International Congress on
Keycivilization and Futurehenge (Kef -2025)

Atatürk University, Erzurum, TURKEY

December 18-20,2025

Proceedings of KEYCIVILIZATION AND FUTUREHENGE-2025

Proceedings of KEYCIVILIZATION AND FUTUREHENGE-2025" INTERNATIONAL CONGRESS ON KEYCIVILIZATION AND FUTUREHENGE (KEF -2025)

Hybrid (Face-to-face and Online)
December 18-20, 2025

Edited by
Neslihan SERÇEOĞLU

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ÖNSÖZ

İnsanlık tarihi boyunca uygarlıklar; sanat, mimarlık, mühendislik ve turizm gibi disiplinlerin etkileşimiyle şekillenmiş, geçmişin birikimi geleceğin inşasında belirleyici olmuştur. Kültürel mirasın korunması, çağdaş yaşam alanlarının yeniden yorumlanması ve teknolojik gelişmelerin sürdürülebilir yaklaşımlarla bütünleştirilmesi, günümüz dünyasının en önemli ortak meseleleri arasında yer almaktadır. Bu anlayıştan hareketle, disiplinlerarası bir bakış açısını temel alan **International Congress on Keycivilization and Futurehenge (KEF-2025)** hayata geçirilmiştir.

KEF-2025, güzel sanatlar, mimarlık, mühendislik ve turizm alanlarını bir araya getirerek; geçmişten geleceğe uzanan çok boyutlu bir düşünce zemini oluşturmayı, kültürel mirası çağdaş yaklaşımlarla ele almayı ve bilimsel bilgi ile sektörel deneyimi ortak bir platformda buluşturmayı amaçlamaktadır. Kongre, akademik dünyayla uygulama alanlarını bir araya getirerek yeni vizyonların geliştirilmesine katkı sunmayı hedeflemektedir.

18–20 Aralık 2025 tarihleri arasında **hibrit (yüz yüze ve çevrim içi)** olarak gerçekleştirilen KEF-2025, farklı ülkelerden akademisyenleri, araştırmacıları ve uygulayıcıları bir araya getirerek disiplinlerarası bilgi paylaşımına olanak sağlamıştır. Kongre kapsamında; kültürel mirasın korunması ve tanıtımına yönelik yenilikçi yaklaşımlar, sürdürülebilir turizm uygulamaları, çağdaş sanat ve mimarlık pratikleri ile mühendislik alanındaki güncel gelişmeler ele alınmıştır.

KEF-2025'in, özellikle genç araştırmacıların desteklenmesine, uluslararası akademik görünürlüğün artırılmasına ve güzel sanatlar, mimarlık, mühendislik ve turizm alanlarında çağdaş yaklaşımların yaygınlaştırılmasına önemli katkılar sunduğuna inanılmaktadır. Ayrıca kongrenin, kamu, özel sektör ve akademi arasında etkileşimli ve kalıcı iş birliklerinin kurulmasına zemin hazırladığı düşünülmektedir.

Kongremize **Kosova, Yunanistan, İran, Lübnan, Pakistan, Fas, Malezya, Suudi Arabistan, Hindistan, Arnavutluk, Çin, İspanya, Azerbaycan, Kırgızistan, Gürcistan, Özbekistan, Romanya ve İtalya** gibi farklı coğrafyalardan geniş bir uluslararası katılım sağlanmıştır. Kongremizde toplam **104 bildiri** sunulmuş olup, bunların **85'i yabancı ülke menşeli (%81,7), 19'u ise yerli (%18,3) bildirilerden** oluşmaktadır. Sunulan bildirilerin **57'si İngilizce tam metin, 28'i İngilizce özet metin, 13'ü Türkçe tam metin ve 6'sı Türkçe özet metin** olarak hazırlanmıştır. Kongremize toplam **225 bilim insanı katılım sağlamış olup, katılımcıların 164'ü yabancı (%72,9), 61'i ise Türk (%27,1) akademisyen ve araştırmacılardan** oluşmaktadır. Ayrıca **kongreye alanında uzman 12 keynote speaker** katkı sağlamıştır. Bu veriler, kongrenin güçlü uluslararası yapısını ve yüksek düzeydeki küresel akademik etkileşimini açıkça ortaya koymaktadır.

Bu kongrenin başarıyla gerçekleştirilmesinde emeği geçen tüm davetli konuşmacılara, oturum başkanlarına, yazar ve katılımcılara, bilim ve düzenleme kurullarına içten teşekkürlerimizi sunarız. KEF-2025'in ortaya koyduğu akademik birikimin, gelecekte gerçekleştirilecek çalışmalara ilham kaynağı olmasını temenni ederiz. Gelecek kongrelerde yeniden bir araya gelmek dileğiyle.

KEF-2025 Kongre Düzenleme Kurulu adına

FOREWORD

Throughout the history of humanity, civilizations have been shaped through the interaction of disciplines such as art, architecture, engineering, and tourism, with the accumulation of the past playing a decisive role in the construction of the future. The preservation of cultural heritage, the reinterpretation of contemporary living spaces, and the integration of technological developments with sustainable approaches are among the most significant shared concerns of today's world. Based on this understanding, the **International Congress on Keycivilization and Futurehenge (KEF-2025)** was established with an interdisciplinary perspective.

KEF-2025 aims to bring together the fields of fine arts, architecture, engineering, and tourism in order to create a multidimensional intellectual platform that bridges the past and the future, addresses cultural heritage through contemporary approaches, and unites scientific knowledge with sectoral experience under a common framework. The congress seeks to contribute to the development of new visions by fostering collaboration between academia and practice-oriented fields.

Held in a **hybrid format (face-to-face and online)** on **December 18–20, 2025**, KEF-2025 brought together academics, researchers, and practitioners from different countries, enabling interdisciplinary knowledge exchange. Within the scope of the congress, innovative approaches to the preservation and promotion of cultural heritage, sustainable tourism practices, contemporary art and architectural discourses, and recent developments in engineering were comprehensively discussed.

KEF-2025 is believed to have made significant contributions particularly to supporting early-career researchers, increasing international academic visibility, and disseminating contemporary approaches in the fields of fine arts, architecture, engineering, and tourism. Moreover, the congress is considered to have provided a strong foundation for establishing interactive and sustainable networks among the public sector, private sector, and academia.

Our congress hosted broad international participation from diverse geographical regions, including **Kosovo, Greece, Iran, Lebanon, Pakistan, Morocco, Malaysia, Saudi Arabia, India, Albania, China, Spain, Azerbaijan, Kyrgyzstan, Georgia, Uzbekistan, Romania, and Italy.** A total of **104 papers** were presented at the congress, of which **85 were from foreign countries (81.7%) and 19 were domestic submissions (18.3%).** Of the presented papers, **57 were prepared as full papers in English, 28 as extended abstracts in English, 13 as full papers in Turkish, and 6 as abstracts in Turkish.** In total, **225 scientists participated in the congress, including 164 international participants (72.9%) and 61 Turkish academics and researchers (27.1%). In addition, 12 keynote speakers** who are experts in their respective fields contributed to the congress. These data clearly demonstrate the strong international structure of the congress and its high level of global academic interaction.

We would like to express our sincere gratitude to all keynote speakers, session chairs, authors, and participants, as well as to the members of the scientific and organizing committees, whose efforts made the successful realization of this congress possible. It is our hope that the academic contributions presented at KEF-2025 will serve as a source of inspiration for future studies.

We look forward to meeting again at future congresses.

On behalf of the KEF-2025 Organizing Committee

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Sayın Prof.Dr. Hasan YILMAZ

Mimarlık ve Tasarım Fakültesi öğretim üyesi Prof.Dr. Hasan YILMAZ'ın, 18-20 Aralık 2025 tarihlerinde düzenlenecek "The First International Congress on Keycivilization&Futurehenge (KEF 18-20 December 2025)" konulu Uluslararası Bilimsel Toplantının Kongre Başkanı ve Akademisyen Temsilcisi olarak görev alması uygun görülmüştür.

Bilgilerini ve gereğini rica ederim.

Doç.Dr. Sait Sinan ATİLGAN
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CONFERENCE PROGRAM

INTERNATIOAL CONGRESS ON KEYCIVILIZATION AND FUTUREHENGE (KEF-2025)

Congress Program

18 DECEMBER 2025-THURSDAY

10:00-11:00 PROTOCOL SPEECHES
11:00-11:30 Keynote Speaker Elmira Jamei
11:30-12:00 Keynote Speaker Md Abdul Maleque
Atatürk University Rectorate Building, Kemal Bıyıkoğlu Hall (Blue Hall)

12:00-13:00 Lunch (Ata Training Hotel - Space Restaurant)

14:00 Keynote Speaker Saaid Zaki
14:30 Keynote Speaker Lionel Constantin Fosso
15:00 Keynote Speaker Rabia Meryem Yılmaz

15:30 Coffee-Break

16:00 Keynote Speaker Heri Puspito Diyah Setiyorini
16:30 Keynote Speaker Osman Cenk Demiroğlu
17:00 Keynote Speaker Resul TUGAY
17:30 Keynote Speaker Khusen Ibragimov

18:00 Coffee-Break

18:30 Keynote Speaker Adeb Qaid
19:00 Keynote Speaker Dilshan Ossen
19:30 Keynote Speaker Sadık Artunç
20:00 Keynote Speaker Cihan Çobanoğlu
(Ata Training Hotel)

19 DECEMBER 2025 FRIDAY - SCIENTIFIC SESSIONS

09.30 10.30

Hall Name: Mimar Sinan Hall		Hall Name: Mevlana Hall		Hall Name: Evliya Çelebi Hall		Hall Name: Cezeri Hall	
Zoom Linki: https://zoom.us/j/94437988350 **(Room 1)**		**Zoom Linki:** https://zoom.us/j/94437988350 **(Room 2)**		**Zoom Linki:** https://zoom.us/j/94437988350 **(Room 3)**		**Zoom Linki:** https://zoom.us/j/94437988350 **(Room 4)**	
Session Chair: Prof. Dr. Abdulkadir Cüneyt AYDIN		**Session Chair:** Prof. Dr. Atila GÜL		**Session Chair:** Assoc. Prof. Dr. Şevki Özer AKÇAY		**Session Chair:** Assistant Professor (Dr.) Şölen KÖSEOĞLU	
Announcements	**Authors**	**Announcements**	**Authors**	**Announcements**	**Authors**	**Announcements**	**Authors**
The Impact of Soil Swelling on Soil-Structure Interaction	**Adrian Kadiri**, Mario Bačić, Kemal Edip	GIS-Based Comparative Analysis of Urban Flood Risk in Mediterranean Cities: A Case Study of İzmir and Naples	**Floriana Zucaro**, Gizem Dinç, Atila Gül	Concerning Sasanian Glyptic Artifacts at the National Museum of Georgia	Ketevan, R. Ramishvili, Helen Giunashvili	An Assessment On Family-Friendly And Single-Friendly Work Culture In Tourism And Hospitality	Esra Katırcıoğlu
Constructions and 3D Imaging of Technological Systems and Geometric Forms of Discovered Inventions, Based on the Classical Greek Philosophy, Geometry, Mathematics and Physics	Panagiotis Stefanides	Determining Spatial Organisation Criteria In Landscape Design	Hatice Eylül Dilek, Hatice Eda Gül, Atila Gül, Gizem Dinç	The Status of the Camel Figurine in Iranian Lustreware Sculpture: A Study of Works from the 6th to 8th Centuries AH	Atefe Fazel,Vajiheh Avav,	Ecological Synthesis of Vernacular Architectural Heritage And Its Integration Into Sustainable Tourism In Cittaslow Uzundere	**Sanaz Davardoust**, Mustafa Özgeriş, Faris Karahan
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10.45-11.45

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Assessment of the Environmental and Radiological Sustainability Challenges of Lignite-Fired Power Plants	Gazmend Nafezi, **Mazllum Kamberi**	Integrating Seismic Hazard Assessment into Urban Landscape Planning: A Framework for Disaster-Resilient Cities	**Shahrokh Pourbeyranvand**, Fatemeh Cheraghzadeh	A Comparative Study of Art Nouveau And Art Deco Jewelry	Negar Sharafsaz, Akram Mohammadizadeh	The Use of Ethnic Motifs In The Design Of Gastronomic Spaces: Cultural Identity And Customer Experience	**Dilnaz Shugurbekova**, Dinara Isakova
The Future Engineer: Sustainability and the New Material World	Md Abdul Maleque, Ahmad Zahirani Ahmad Azhar, İhsan Efeoğlu	Integrating Groundwater-Seismic Interactions into Resilient Urban Landscape Planning	**Shahrokh Pourbeyranvand**, Fatemeh Cheraghzadeh	Identification and Representation of the "Bey" Doll as an Ancestral–Ritual Icon in Iranian Culture	Nahid Jafari Dehkordi	Examining Visitor Satisfaction in Heritage Tourism: Insights from Two Museums in Tashkent	Aziza Ibrokhimova, Dotonbek Eshpulatov
Prospects for creation basalt industry plants in the countries of the world	Sergey P. Osnos, Illia Rozhkov	Heterogeneous Sensibility and The Politics of Housing Adaptation: Syrian Displaced Families in Beirut Vertical Settlement	Goran Ivo MARINOVIC	From Monster to Female Div: The Continuity of the Aja'ib al-Makhluqat Visual Tradition in Qajar Tilework (A Case Study of Louvre Museum Tiles)"	Nahid Jafari Dehkordi	Digital Art Pedagogy: An Examination Of Remote Learning Processes	Hokuma Safarli Aghasov

11:45 – 13:30 Lunch (Ata Training Hotel - Space Restaurant)

13:30 – 14:30

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Cultural and Artistic Connections between Iran and the Ottoman Empire in the Depiction of Layla and Majnun in the Khamsa-ye Tahmasbi and Fazuli in the 16th Century	Marjaneh, Naderi Gorzoddini Nahid Jafari Dehkordi	Pause and Movement: An Anthropological Approach to Embodied Spatial Perception in Intermediary Spaces of Temporary Urban Markets	Seyed Kasra Mirpadyab, Fatemeh Ramazani Pas chapari	Characterization of Euphorbia Milii Flower Extract and its Application on Silk Fabric	**Goutam Bar,** M Hirral, Priyagni	Evaluating Universal Design In Shopping Mall Facilities For Elderlyusers	Fatin Afrini Mohamad Ishak **Syazwani Abdul Kadir** Noorul Nadya Shaharum Hikmah Kamarudin
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16:00-17:00

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17:15-18:15

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Peyzaj Mimarlığı Görsel Kalite Analizinde: Eye Tracking	Sena Nur Angın	El Anatsui'nin Sanatsal Üretim İfade Yöntemi	Mustafa Bulat, Mariya Pınar	Yeşil Hastanelerde "WHO" İlkeleri ve "3R" Stratejileri	Beyza Nur Çalışkan Keleş	Soğuk İklim Estetiği Ve Kamusal Heykeller: Erzurum Kent Merkezinde Mekân, Bellek Ve Kimlik	Mustafa Bulat, Gülümser& Beyaztaş Özlütürk

18:30 – 19:30

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KEYNOTE SPEAKERS

Urban Planning Interventions to Mitigate Urban Overheating and Thermal Distress



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The Future Engineer: Sustainability and the New Material World



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Abstract

This keynote presents a comprehensive outlook on the advancing role of engineering in a rapidly changing global scenery. It starts by reflecting on the past of engineering, where the discipline primarily contributed to the mechanics of materials, infrastructure development, and materials strength, focusing on performance, efficiency, and cost optimization. These foundations established the technical rigour upon which modern engineering continues to build. The talk then moves to the present state of engineering, characterized by rapid digitalisation, automation, and increasing societal expectations. Today's engineers operate in complex, interconnected systems where environmental constraints, resource limitations, and resilience requirements demand solutions that extend beyond traditional engineering practices.

Looking toward the future, the presentation predicts that engineers will be integrators of technology, system thinking, and ethical responsibility. Future engineering practice will require adaptability, interdisciplinary collaboration, and the ability to anticipate long-term societal and environmental impacts rather than responding only to immediate technical challenges. Central to this future is the emergence of a new material world, where advanced materials—such as smart, bio-derived, and circular-economy materials—serve as key enablers of sustainable innovation. Materials are positioned not merely as structural components but as active, multifunctional systems that shape the performance, durability, and environmental footprint of engineered solutions. The presentation then explores the transformative role of artificial intelligence and data-driven engineering, highlighting how AI accelerates materials discovery, enhances performance prediction, optimizes processing parameters, and supports advanced characterization. This shift from trial-and-error experimentation to predictive design fundamentally changes how engineers innovate and make decisions. Building on these technological advances, the presentation emphasizes sustainability as a core engineering necessity. Engineers must adopt lifecycle thinking, integrate circular-economy principles, reduce carbon footprints, and design regenerative systems that balance technological progress with environmental stewardship.

Finally, the presentation highlights the importance of ethics in engineering practice. As engineering solutions grow more powerful and influential, ethical responsibility, social accountability, and environmental justice must guide decision-making. The future engineer is thus expected to abide by ethics with environmental stewardship, social responsibility and professional integrity.

Nanotechnology and Nanomaterials Application in Construction Industry in Egypt



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ABSTRACT

Nanotechnology, introduced almost half century ago, is one of the most active research areas
with both novel science and useful applications that has gradually established itself in the past two decades. The evolution of technology and instrumentation as well as its related scientific areas such as physics and chemistry are making the research on nanotechnology aggressive and evolutional. The Architecture, Engineering, and Construction (A/E/C) industry might accommodate broad applications of nanotechnology and nanaomaterials. It has been demonstrated that nanotechnology generated products have many unique characteristics, and can significantly fix current construction problems, and may change the requirement and organization of construction process. This article shows and documents applicable nanotechnology based products that can improve the overall competitiveness of the construction industry. The areas of applying nanotechnology in construction will be mainly focused on: (1) lighter and stronger structural composites, (2) low maintenance coating, (3) better properties of cementitious materials, (4) reducing the thermal transfer rate of fire retardant and insulation, and (5) construction related nano-sensors. Although currently behind other areas such as water treatment and remediation, the Architecture, Engineering, and Construction (A/E/C) industry might accommodate broad application.

Digital Experience Transformation in Tourism Research Toward 2030: Applications of Augmented, Virtual, and Mixed Reality



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Abstract

The digital transformation experienced in the field of tourism over the past twenty-five years is to be examined by this study from a holistic perspective, and it is intended that the literature will be shaped by experiences based on augmented reality, virtual reality, and mixed reality towards 2030. The aim of the research is to explain how digital tourism applications are being restructured in terms of technological innovations and psychological processes such as user experience, emotional engagement, perceived reality, interaction intensity and behavioural intention. In the study, there was a combination of the titles, abstracts and keyword information of articles obtained from the Web of Science database; there was the application of a comprehensive data preprocessing procedure for the elimination of missing values, the removal of repetitive expressions and the identification of commonly occurring concepts. The analysis revealed co-occurrence relationships between concepts, conceptual network structures, upward trends over time, sudden burst patterns, and thematic clusters. The findings show that the rise of digital concepts in tourism is not linear but takes shape through sudden accelerations, pauses, and turning points. One of the strongest conceptual clusters is the triad of "satisfaction–intention–sense of reality." The fact that these three concepts hold the highest values in both co-occurrence analyses and burst indicators demonstrates that, although new technologies dominate research, theoretical models used to explain behavior in tourism are still structured around these fundamental concepts. In particular, the relationship between satisfaction and intention to use continues to be a key determinant of tourism experience even in digital environments. Another important finding of the research is that the experiential axis formed by concepts such as "sense of presence," "sensory intensity," and "level of interaction" continues to constitute a strong core in tourism studies. The central position of these concepts within the conceptual network analysis indicates that the psychological foundations of digital tourism experience are gaining increasing importance. Examination of thematic clusters shows that the literature converges under three main themes: (1) digital learning, cognitive processes, and motivation based on virtual environments; (2) smart tourism applications, three-dimensional cultural heritage transfer, and digital innovation; (3) user experience, sense of presence, level of interaction, and behavioral response models. These three themes reveal that digital technologies in tourism are not merely tools for promotion but have become essential components of the experience itself. In conclusion, the study demonstrates that tourism research is moving toward a new scientific axis shaped by digital reality, interaction intensity, sensory atmosphere, user engagement, and the sense of connection created by digital environments as we approach 2030. The findings show that although technology evolves, the core of tourism psychology—comprising the unity of "experience–reality–behavioral intention"—continues in the digital age with new forms. In this respect, the study provides a comprehensive framework that can shape the future research agenda of the tourism field.

Homeland Journey: The Impact of Diaspora Tourism Experiences on Cultural Identity and Sustainability



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Abstract

Research Purpose - One of the challenges faced by the global diaspora is losing cultural identity. Diaspora tourism refers to the travel of diaspora communities to their ancestral homelands to reconnect with their cultural roots. Related to these notions, this research aims to explore the connection between diaspora tourism experience and cultural identity by examining the role of souvenir consumption and the implication for sustainability. Souvenirs prolong the tourism experience and often carry cultural values that help individuals to connect with culture.

The literature used in this research adopts social practice theory to analyse the material, competence, and meaning of tourism experience, souvenir purchase behaviour, cultural identity, and sustainability.

A mixed-method approach is employed through two studies. Study 1 involves scoping review to analyse the current literature on diaspora tourism. Specifically, the study aims at exploring key issues related to tourism experiences, souvenir consumption behaviour, and cultural identity. Data is collected through Scopus data base relate to those issues. Thematic analysis is used to identify key patterns and insights from the data using the Voyant Tools. The tools assist in analysing the themes by identifying concepts and themes of the literature automatically. The second study adopts a quantitative approach, utilising a questionnaire-based survey to analyse the relationships between tourism experience, cultural identity, and sustainability variables, that are moderated by souvenir consumption. Data will be analysed using Partial Least Squares (PLS), a statistical method used to test the model's fit and examine the relationships between variables.

Research Result - Study 1 identifies five themes of the connection between diaspora tourism, souvenir consumption, cultural identity, and tourism. The themes are the diaspora tourism experience and cultural identity; place, memory, and practice; emotional and relationship experience; heritage connections; and impacts. Based on this study, Study 2 found that diaspora tourism experience exerted strong direct effects on both cultural identity and souvenir purchase, demonstrating that meaningful diaspora travel experiences enhance cultural attachment while simultaneously encouraging souvenir purchasing behavior. Souvenir purchase also showed a significant positive effect on cultural identity, confirming its role as a form of symbolic cultural consumption. Cultural identity emerged as the strongest predictor of sustainability, emphasising that strengthened cultural awareness and pride drive more sustainable attitudes and behaviors among diaspora tourists. All indirect relationships, including single, dual, and serial mediations, were significant, showing that souvenir purchasing and cultural identity act as important mediating mechanisms that link diaspora tourism experiences to sustainability outcomes.

Research Contribution - This research contributes theoretically by extending social practice theory within the context of diaspora tourism and cultural identity. From a managerial perspective, it offers insights for tourism stakeholders on designing meaningful tourism experiences and souvenirs that reinforce cultural identity and sustainability among diaspora communities.

Keywords: Diaspora tourism, tourism experience, culture identity, sustainability, social practice theory

How Possible is Climate Resilient Development for Sustainable Ski Tourism?



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Abstract

The Intergovernmental Panel on Climate Change (IPCC, 2021) promotes Climate Resilient Development (CRD) as "a process of implementing greenhouse gas mitigation and adaptation options to support sustainable development for all", acknowledging that "climate action and sustainable development are interdependent processes and climate resilient development is possible when this interdependence is leveraged". As such, ski tourism, as a sector enjoyed by millions of enthusiasts worldwide and which brings employment and socioeconomic development opportunities to especially the rural regions in need of progress, is urged to adopt the CRD concept along its development pathways. A CRD perspective is already evident for ski tourism especially in terms of the local adaptation efforts towards the impacts of climate change, but challenges remain especially regarding the decarbonization requirement of the Sustainable Development Goal (SDG) 13 – Climate Action, when the systematic nature of ski tourism is taken into account with its transit space, where most of the greenhouse gas emissions are generated from travel to/from the destinations. In his speech, Demiroglu addresses these challenges with more details and examples, and offers different roadmaps for a truly climate-resilient ski tourism sector.

Engineering in the Age of AI: Insights from Research and Industry



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Abstract

In this seminar, I will discuss three projects from my PhD and my Machine Learning Research Internship at TikTok. These projects encompass entity linking, where I developed advanced methods for connecting entities across datasets; fake engagements, focusing on the detection and prevention of fraudulent activities on social media; and data currency, which involves evaluating and enhancing the value of data in machine learning. I will also introduce my current project, which offers promising opportunities for collaboration and further research.

The Impact of Climate Change on Tourism Demand



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Abstract

Climate change has become a critical determinant of tourism demand, particularly in destinations where climatic conditions play a central role in tourists' destination choice. This study provides one of the first comprehensive empirical investigations into how climate change influences international tourism demand in Kazakhstan, an emerging tourism destination in Central Asia. Using a dynamic panel dataset covering 121 origin countries over the period 2000–2018, the analysis explicitly incorporates time-variant climate variables to capture the evolving effects of temperature on tourism flows.

The study adopts a tourism demand framework grounded in consumer behavior theory and estimates the model using a two-step system generalized method of moments (SYS-GMM) estimator. Unlike earlier studies that treated temperature as time-invariant, this research integrates annual average temperatures of both origin and destination countries, along with their squared terms, to account for potential non-linear effects. Control variables include tourists' income levels, transport costs, relative prices, political stability, visa restrictions, shared borders, and word-of-mouth effects.

The empirical results reveal a significant non-linear relationship between temperature and international tourist arrivals to Kazakhstan. Specifically, an increase in destination temperature initially stimulates tourism demand, but beyond a certain threshold, higher temperatures reduce arrivals. The estimated optimal temperature for international tourists visiting Kazakhstan is approximately 7°C, indicating a preference for moderate climatic conditions. Similarly, temperature conditions in origin countries influence outbound tourism decisions, suggesting that climate variability affects both push and pull factors in tourism flows. These findings imply that climate change has a substantial and measurable impact on tourism demand in Kazakhstan. Rising temperatures may enhance the country's attractiveness up to a point, but extreme climatic conditions could negatively affect its competitiveness as a destination. The results underscore the importance of climate-sensitive tourism planning and environmental policy. Policymakers are encouraged to mitigate environmental degradation, promote low-carbon technologies, and strategically market tourism products during favorable climate seasons to sustain long-term tourism development in Kazakhstan.

The Soul of Sana'a – Ancient Wisdom for a Sustainable Future



Adeb Qaid

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Abstract

The Old City of Sana'a stands as a vibrant, UNESCO-recognized "living textbook" of sustainable design, proving that ancient wisdom is a vital daily practice rather than a forgotten memory. With a history spanning over 2,500 years, the city's dense urban fabric and 6,000 historic tower houses demonstrate a masterful integration of Islamic urbanism and environmental harmony. This enduring legacy is anchored by the tower house, a "vertical village" crafted from rammed earth and baked brick. These materials create breathing structures with high thermal mass, naturally regulating temperatures in a harsh climate. This resilience is bolstered by *Qadad*, a sophisticated natural armor made of lime and volcanic ash, which serves as waterproof skin, a solar reflector, and a canvas for cultural storytelling.

Internally, the tower house functions as a highly organized social and economic ecosystem. The ground floor acts as an economic engine for storage and livestock, while the middle floors preserve family privacy. The structure culminates in the *Mafraj*, a communal room at the highest level designed for dialogue and intellectual exchange. This layout ensures that social connection is treated as a fundamental requirement of home infrastructure. Beyond individual walls, the city operates as an invisible engine of passive design. By utilizing the "stack effect" for natural ventilation and narrow, winding streets for solar shading, Sana'a achieves remarkable thermal comfort without the need for mechanical cooling, fostering a human-scale world where the architecture itself encourages community interaction.

Sustainability in Sana'a is a holistic, circular web where water, food, and community are inextricably linked. The city is an intelligent water-harvesting machine, using rooftop catchments and gravity-fed systems to channel rainwater into shared cisterns. Innovative infrastructure like the *Saylah* manages seasonal floods by transforming thoroughfares into riverbeds, while urban gardens known as *Bustans* and *Maqashim* act as green lungs, using recycled mosque water to produce local food. This "Zero Waste" philosophy turns livestock waste into fertilizer and local earth into building materials, creating a resilient system maintained through shared social responsibility and the transfer of knowledge across generations.

In conclusion, Sana'a offers a powerful counter-narrative to modern, energy-intensive construction. While modern concrete buildings often result in high energy consumption and a "psychology of placelessness," the heritage model of Sana'a provides high thermal comfort and a deep local identity. The path forward lies in "Respectful Innovation," where technologies like 3D-printed earth and AI-optimized design enhance traditional methods rather than replacing them. By embracing the blueprint of Sana'a designing with place, building with local earth, and empowering the community we can move toward a future where modernity and cultural identity thrive as partners.

From Sustainable to Regenerative approach to cultural heritage



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Abstract

The accelerating global climate crisis—marked by more frequent extreme weather events and the looming threat of rapid environmental transformation—reveals the limitations of existing mitigation strategies and the insufficiency of relying solely on technological solutions. As global warming manifests differently across regions, its ripple effects on ecosystems, built environments, and human well-being demand a dual response: decelerating climate change while adapting to current environmental realities. The pursuit of Sustainable Development remains complex, challenged by population growth, evolving human needs, diverse economies, and environmental degradation. This has driven a paradigm shift from sustainability toward regeneration. Regenerative design, particularly within adaptive reuse projects, redefines architectural practice by moving beyond harm reduction to the active restoration of ecological and social systems. Although existing buildings may pose challenges—such as structural constraints and the need to preserve cultural heritage—these limitations inspire innovative, contextually grounded solutions. A regenerative strategy emphasizes the protection of cultural value through refurbishment and reuse, the integration of natural and human systems, the promotion of well-being, the use of local technologies and materials, minimized energy dependence, reduced environmental impact, and active human engagement. This approach is exemplified through a bio-inspired cooling design, demonstrating how regenerative principles can transform heritage into a living, adaptive, and sustainable future.

BEYOND SUSTAINABILITY: A SUSTAINABLE PLANET



Sadık Artunç

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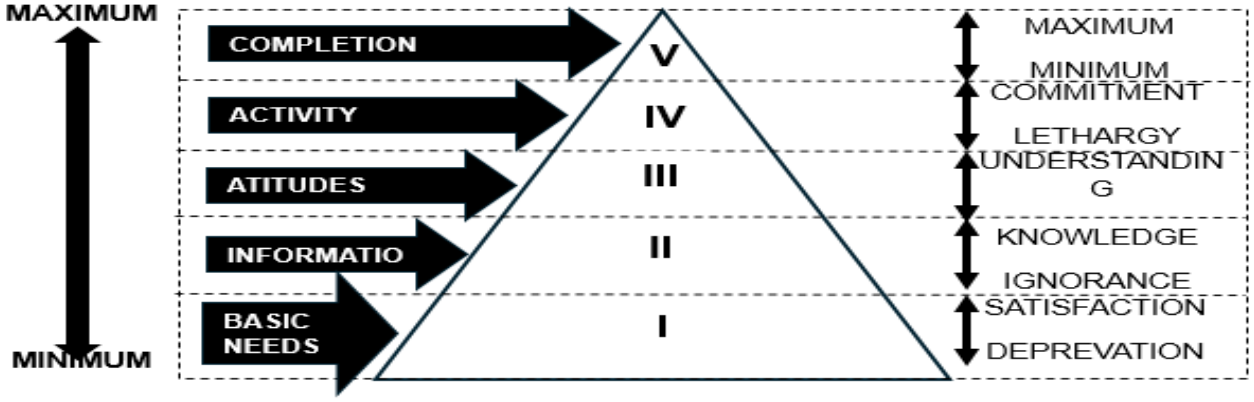
Abstract

This presentation discussed the foundations of sustainability and its relationship to ethics. This relationship demands that ethics and sustainability not be treated as matters we choose only when convenient. Therefore, all professionals must hold paramount the safety, health, and welfare of the public and strive to comply with the principles of sustainable development in the performance of their professional duties. It is important to emphasize that professionals must avoid focusing solely on safety, health, and welfare while ignoring the broader environmental, social, and economic contexts. By ignoring the larger picture in favor of minor details, we shift the risks across space and time. Professionals in planning, design, and construction must develop more creative means of enhancing the quality of life without merely replacing existing habits.

Next, eight characteristics of sustainable communities were presented (EU, 2025, Bristol Accord Annex 1):

- Active, inclusive and safe - Fair, tolerant and cohesive with a strong local culture and other shared community activities.
- Well run – with effective and inclusive participation, representation, and leadership.
- Well connected – with good transportation services and communication linking people to jobs, schools, health, and other services.
- Well served – with public, private, community, and voluntary services that are appropriate to people's needs and accessible to all.
- Environmentally sensitive – providing places for people to live that are considerate of the environment.
- Thriving – with flourishing, diverse, and innovative local economy.
- Well designed and built – featuring quality built and natural environment.
- Fair for everyone - including those in other communities, now and in the future.

Building blocks of sustainability and sustainable development have several levels, and these must be equally satisfied for each component: (1) Environment/Ecology/Planet Dimension, (2) People/Equity Dimension, (3) Economic Prosperity Dimension (©Artunç)



Cihan Çobanoğlu



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PRESENTATIONS

A COMPARATIVE STUDY of ART NOUVEAU and ART DECO JEWELRY[1]

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Abstract

Art Nouveau and Art Deco styles are considered among the most influential movements in jewelry design from the late 19th to the early 20th centuries, reflecting cultural, social, and artistic changes. Art Nouveau, inspired by nature and emphasizing curved lines and fluid forms, represented a return to artistic aesthetics and craftsmanship in response to industrialization. This style, using natural materials such as gold, glass, and shells, displayed symbolic designs in which women, as symbols of nature, held a prominent place. In contrast, Art Deco, coinciding with the rise of modernity and technology, emphasized geometric forms, straight lines, symmetrical volumetric compositions, and the use of diverse materials such as metals and glass, reflecting the influences of Cubism and industrial design. A comparative study of these two artistic styles reveals points of similarity and difference in forms and aesthetic approaches and clarifies the evolution of jewelry art. The primary objective of this research is to compare Art Nouveau and Art Deco jewelry to identify the characteristics of the two styles. The research questions are: "1. What influences have Art Nouveau and Art Deco styles had on jewelry making? 2. In what respects can Art Nouveau and Art Deco jewelry be compared?" This research is fundamental in purpose, descriptive-analytical and comparative in method, and utilizes library research and purposeful sample selection. The conducted examinations conclude that Art Nouveau, with its emphasis on nature and organic designs, and Art Deco, with its focus on modernity and geometric lines, have both played prominent roles in the history of jewelry by reflecting the cultural developments of their respective eras.

Keywords: Art Nouveau jewelry, Art Deco jewelry, natural lines, geometric shapes.

Introduction

Jewelry has always been a manifestation of decorative art, a reflection of the culture and social values of each historical period. Two prominent styles, Art Nouveau and Art Deco, emerged in the late 19th and early 20th centuries and significantly influenced jewelry design. Each, inspired by social, technological, and cultural transformations, offered different interpretations of aesthetics.

Art Nouveau or "New Art" was prevalent between 1890 and 1910. In reaction to industrialization, it emphasized a return to nature and craftsmanship. Jewelry of this style was characterized by fluid, curvilinear lines, drawing inspiration from natural forms and symbols such as the female figure as an embodiment of nature. The use of enamel and natural materials like gold, pearl, glass, and semi-precious stones were among its features. This style began to decline with the rise of Art Deco around 1910, but its influence on the decorative arts endured.

Art Deco, which took shape before World War I at the International Exhibition in Paris, reached its peak in the 1920s and 1930s. Evolving from a French movement into a global trend in architecture, interior design, and jewelry, it emphasized geometric shapes, straight lines, stepped forms, and the use of modern materials such as glass, metal, and plastic. Art Deco was a simpler and more structured continuation of Art Nouveau, transforming its free-flowing curves into more precise circles and ovals. Jewelry from this period, with its geometric and symmetrical designs, showed a clear influence of Cubism[1].

A comparative study of jewelry in the Art Nouveau and Art Deco styles can reveal points of similarity and difference in motifs, forms, designs, and other aspects. The primary objective of the present research is to compare Art Nouveau and Art Deco style jewelry in order to identify the defining characteristics of the two styles.

A comparative study of Art Nouveau and Art Deco style jewelry is essential because these two styles played a foundational role in the evolution of jewelry design aesthetics at the beginning of the 20th century. Despite their importance, coherent comparative research in this field, particularly in Persian sources, is very limited. This research provides a foundation for a more precise understanding of the formal and conceptual differences between these two styles and their informed application in contemporary design. Analyzing their similarities

[1] This article is derived from the Master's thesis of Negar Sharafsaz, titled "Study of Art Deco Style for the Designing and Making Jewelry," supervised by Dr. Akram Mohammadizadeh at the Tabriz Islamic Art University.

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and differences enables a more accurate understanding of historical trends, aesthetic values, and the cultural context of each style. Conducting this research, given the scarcity of comparative studies in this area, can contribute to expanding the scholarly literature on decorative arts and enhancing approaches in contemporary design.

Methodology

This research is fundamental in purpose. The type of research is descriptive, analytical, and comparative. The method of data analysis is qualitative. Data collection is based on library research, and the selection of samples is purposive.

Research Background

Maryam Moazen and Hawa Raeisi (2023), in an article titled "A Study on the Art Nouveau Style and Its Impact on the Art World," investigate the Art Nouveau movement, search for its roots in the depths of history, examine notable works of its artists, the scope of its spread, and its influence on the arts of architecture, painting, graphics and printmaking, glassmaking, and finally, the worlds of fashion, textiles, and accessories.

Soran Shuluf (2014), in an article titled "Art Nouveau Style Jewelry," examines jewelry of this style.

James Grady (2014), in an article titled "Nature and the Art Nouveau Style," explores the Art Nouveau style and its inspiration from nature.

Javad Ahmadi Moghaddam (2014), in an article titled "The Mutual Influence of Islamic Art and Art Nouveau," introduces the Art Nouveau movement and its pioneers, seeking to demonstrate to what extent these approaches in Europe were inspired by the art of Iran and the East.

Melika Kheireddin (2018), in an article titled "Stylistics of Art Nouveau in Iranian Buildings," aims to approach a new stylistics of this Western architectural movement in contemporary Iran through a comparative study of architectural tendencies of Art Nouveau in the West and a principled comparison of them in Iran.

Thesis by Afsaneh Hassannezhad (2023), titled "A Study of Naturalism in Art Nouveau Jewelry and Inspiration from it in the Design and Creation of Contemporary Jewelry," where the researcher investigates how naturalism permeated Art Nouveau jewelry.

Thesis by Maryam Torabian (2022), titled "Design and Creation of Metal Decorations and Embellishments for Women's Clothing Based on Art Nouveau Style Designs," in which the dissertation focuses on recognizing and defining Art Nouveau motifs and designs and using those motifs for decorative purposes on women's clothing.

Thesis by Mahdieh Sadat Hosseini (2023), titled "Design and Creation of Composite Metal and Glass Vessels by Studying the Influence of Islamic Motifs on Art Nouveau Movement Works," where the author examines the influence of Islamic motifs on Art Nouveau movement works in composite metal and glass pieces.

Thesis by Maryam Ghasemi (2018), titled "A Study of the Traces of Islamic Art in Art Nouveau Style Motifs for Designing and Executing Glass Sculptures," where the author, inspired by the motifs of this style, creates modern Islamic artworks.

Penelope Hunter (2015), in an article titled "Art Deco, The Last Presence," where the author speaks about the Art Deco style as the last glorious chapter in the history of French decorative art.

Arman Ghanbari (2014), in an article titled "Art Deco," this research addresses the impacts of Art Deco which transformed modern architectural space.

Zahra Banki (2004), in an article titled "Art Deco," where in this research, the author, with a brief look at some of the influences that non-European and European cultures had on the formation process of Art Deco, ultimately examines the influence of Art Deco art on other arts.

Tarannom Sorkhi (2022), in an article titled "Art Deco Jewelry: A Revolution in Form and Function," where the researcher, while examining the Art Deco style, investigates the influences of this style on jewelry design and creation.

Mark Ebert (1983), in an article titled "Art Deco: The Period, The Jewelry," where the author examines Art Deco both in terms of the era in which the movement was formed and in terms of the distinctive jewelry that represents this design style.

Mahzad Saberi Bigdeli and Zahra Rahbarnia (2009), in an article titled "The Interaction of 'Art Deco' and 'Bauhaus' Ceramics with Social Factors and Indicators for Distinguishing Ceramic Works from Other Samples," by studying and observing the ceramic styles of these two schools, it becomes clear that generally, the differences between the works of these two styles, regarding decoration, pattern, and form, are much greater than their similarities.

Abbas Akbari (2007), in an article titled "A Study of the Evolution of Carpet Design under the Influence of Western Artistic Movements," where the author, by studying the history of carpet emergence in the West, seeks to answer the questions of this article to provide a basis for more comprehensive research on this issue.
Leila Bagheri (2023), in a bachelor's thesis titled "A Study of the Two Styles Art Deco and Cubism for the Design of Contemporary Manteaux," the researcher in this paper has tried to beautifully apply them in manteau design by combining these two artistic styles, which are in some way related to each other and both are used abstractly in different arts.
Shirin Akbarian and Helia Aslani Lahrood (2022), in an article titled "An Analysis of the Factors Transforming Architectural Styles in Europe (Classical to Art Deco) and Its Impact on Contemporary Iranian Architecture," in this research, the researchers seek to identify and analyze the historical roots of European architectural styles, their transformations and changes, and how they entered and interacted with authentic Iranian architecture.
In this research, through a comparative study of the Art Nouveau and Art Deco styles regarding form, motifs, materials, sources of inspiration, colors, and production techniques, an attempt will be made to provide a better understanding of the jewelry design process.

Findings

The Art Nouveau Style

In the last decade of the nineteenth century, artists were searching for new ways that, in line with scientific, industrial, and social transformations, would meet their needs. The search for spiritual values by artists was also part of this effort, which around 1890 led to the creation of a new artistic style. This style quickly became a major, widespread artistic movement in Europe, influencing the artistic taste of the West from the common people to the elite (Shad Ghazvini, 2018: 8).
The Art Nouveau style emerged from a major movement in the decorative arts that first appeared in Western Europe, but its birth was not as spontaneous as is often thought. The traditions and imitations of the past played an overly large role in the creation of this style (Lahor, 2007: 5). Art Nouveau was considered an "anti-historical" movement; however, some of its prominent innovators were influenced by the English Arts and Crafts movement, which drew its inspiration mainly from the Medieval[2] and early Renaissance periods[3]. In France, the movement was heavily influenced by Neo-Gothic[4] and Neo-Rococo styles[5]. This period was the beginning of a century of great changes, when the Industrial Revolution and the machine age were in full swing. For many of the artists and designers who created Art Nouveau, this style was seen as a symbolic moment at the end of a century of change and the beginning of another (Sternau, 1996: 5).
After the first half of the nineteenth century, a movement to reform the applied arts emerged, starting in England, the place where the drawbacks of numerous identical industrial products were noticed earlier and more acutely (Zumbach, 2018: 10). This style began as a reaction against the horrors of mass production and revived dying craft skills and arts (Copplestone, 1998: 7). This style influenced all arts, from painting and sculpture to book design, poster art, illustration, book arts, architecture, interior decoration, crafts, textiles, as well as music, theater, and literature (Shad Ghazvini, 2018: 9). It was particularly effective in the fields of architecture and handicrafts, and influential in the visual arts; most major artists of the early twentieth century either participated in this movement or were influenced by it in the first years of their artistic activity (Gardner, 1986: 646).
Although artists following Art Nouveau tried to distance themselves from the traditions dominating European art, they practically could not completely avoid the influence of past styles. Their main effort was to find abstract patterns based on the balance of lines that had manifested in various forms in Islamic art and Japanese art. Initially, linear surfaces and ornamental plant-based abstract motifs, based on Japanese decorative patterns and motifs, appeared in all arts of this style, and Japanese art[6] had an almost profound influence on various aspects of this art (Shad Ghazvini, 2018: 9).
The essence of Art Nouveau lies in a line; a long, sinuous curve found in all designs of this style. Art Nouveau rejected the order of straight lines and right angles, preferring a more natural movement instead (Copplestone, 1998: 7). This style, known for its sinuous lines, natural and organic ornamentation, and use of plant and animal forms, countered the excesses of Victorian[7] ornamentation and the simple ornamentation of Modernism[8] (Sternau, 1996: 6).
The curved forms characteristic of Art Nouveau first appeared in England but quickly spread across Europe, taking on unique interpretations in different cities: Paris and Nancy in France, Munich, Berlin, Brussels, Barcelona, Glasgow, and Vienna all became centers for this style, which soon became ubiquitous throughout

Europe and, with centers in New York and Chicago, had a similar influence in America (Copplestone, 1998: 7). The obsolescence of the Art Nouveau style and its replacement by Art Deco was the result of a gradual but profound change in the social, economic, technological, and cultural structures of the world. Art Nouveau, as a style dependent on nature, sentiment, and handcrafted ornamentation, no longer met the needs of the industrial and modern age; in contrast, Art Deco, with features such as geometricity, order, functionalism, and compatibility with technology, could claim the dominant position in art and architecture of the 1920s and 1930s. When Art Nouveau gave way to the simple, clean geometry of Art Deco motifs, the ornate curves of Art Nouveau were considered old-fashioned and obsolete, and many Art Nouveau products were scornfully discarded, neglected, or destroyed. In Belgium and elsewhere, some Art Nouveau buildings were demolished to make way for the "new" style, without regard for the fact that Art Nouveau may have contributed to the emergence of the modern movement (Sternau, 1996: 6).

Art Nouveau Style Jewelry

The art of jewelry-making experienced something akin to a revolution during the period of change and revival that occurred in the late nineteenth and early twentieth centuries; a period known as the Belle Époque (Beautiful Era). At the heart of this change was a new approach to the materials available to the jeweler (Bedoyere, 2007: 174). For many designers in the late nineteenth century, metal provided the best opportunity for expressing the fluid lines of Art Nouveau. Metals such as iron and silver[9], which were both malleable and ductile, could be shaped into the long lines and sinuous curves that belonged to this movement (Bedoyere, 2005: 32).

In this period, there was a tendency to use very expensive stones in jewelry designs with opulent settings. Jewelry designers at the dawn of the new century opposed this sometimes highly ostentatious style and instead emphasized the artistic-aesthetic value of design and skilled craftsmanship more than the material value of raw materials. René Lalique was one of the first to follow this principle in Paris from 1890; he chose more affordable materials but gave them innovative expressive possibilities. The technique of enameling was particularly compatible with this approach and was almost entirely suitable for creating the colors typically favored in Art Nouveau (Wolf, 2015: 80). Among the famous jewelers of this period were Louis Comfort Tiffany and René Lalique, who drew inspiration from nature and curved lines for their designs. Louis Comfort Tiffany was aware of the changes Art Nouveau had brought to the cultural world. Therefore, these jewels included semi-precious stones alongside precious stones, glass, pearl, the use of soft colors and artistic color combinations, and the use of metals with stronger sculptural elements than before (Bedoyere, 2007: 173).

In Image No. 1, the "Dragonfly" corsage ornament created by René Lalique around 1897-1898, made of gold, enamel, moonstone, and diamonds, where the dragonfly's head ends in a woman's bust with a helmet, while its legs are the claws of a wild beast (Wolf, 2015: 81).



Image 1: Dragonfly Woman Corsage Ornament, René Lalique, France, c. 1897-1898 (Wolf, 2015: 81).

Philippe Wolfers, a Belgian silversmith, paid less attention to the abstract designs that captivated many of his contemporaries and focused more on designs that utilized natural motifs such as iris and lily (Image 2). The natural form of these elongated flowers harmonized well with curved lines. Japanese art had a significant influence on Wolfers' style, and he often used exotic materials such as ivory[10] to decorate his jewelry (Bedoyere, 2005: 32).



Image 2: Wisteria Choker Necklace, Philippe Wolfers, 1898 (Bedoyere, 2005: 33).

The enameling of jewelry has been used for decoration for centuries. The cloisonné enameling technique[11] is particularly suitable for jewelry work because it allows for precise details and a variety of colors. Lalique found this technique well-suited for his nature-based designs (Image 3). He used gold to create cloisons(cells) that could represent the veins of leaves, the delicate pattern of a dragonfly's wings, or the hair like veins spreading across violet petals (Bedoyere, 2005: 140).



Image 3: Petunia Corsage Ornament, René Lalique, c. 1900 (Bedoyere, 2005: 141).

Although Mucha Alphonse is best known for his highly individual style of illustration, he was also active in the field of jewelry design. A brooch (Image 4), designed by Mucha for Sarah Bernhardt and executed by Fouquet, was entirely decorated with enamel, ivory, and turquoise[12] (Bedoyere, 2005: 318).



Image 4: Sarah Bernhardt Brooch, Alphonse Mucha, France, c. 1900 (Bedoyere, 2005: 319).

Although René Lalique was trained and skilled in using precious materials such as gold, silver, and diamonds[13], he did not limit himself to these. For this great artist, the integrity and vision of a piece demanded that materials, techniques, and design be harmonized to create an authentic work of art. This serpent pendant (Image 5) was made using the enameling technique and pearls (Bedoyere, 2005: 344).



Image 5: Serpent Pendant, René Lalique, c. 1898-1899(Bedoyere, 2005: 345).

From the early 1850s, insects had been recognized as a source of inspiration for Gothic Revival designers and especially jewelers. By the 1890s, technology had advanced to a stage where the fine, delicate structures of insect wings or the iridescent colors of beetles' shells could be depicted using enamel, metals, and stones. Dragonflies, in particular, enjoyed great popularity among Art Nouveau jewelers. The beauty of their glossy, metallic bodies (Image 6), with their brilliant green and blue hues, could only be matched by Lalique's masterful simulations in enamel and semi-precious stones (Bedoyere, 2005: 346).

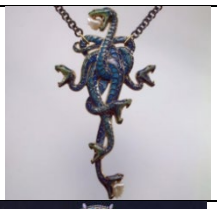


Image 6: Brooch with Two Dragonflies, René Lalique, c. 1900 (Bedoyere, 2005: 347).

From the perspective of visual elements, Art Nouveau jewelry is shaped by the fluidity of line, the organic nature of form, the diversity of color, and the delicacy of texture. The curved line, as the dominant visual element, plays an essential role in conveying movement, rhythm, and dynamism, representing a reflection of living nature. The forms are often derived from plants, flowers, insects, serpents, and the female figure, recreated with a symbolic and poetic vision. The colors, through the extensive use of translucent enamels and colorful semi-precious stones, acquire a soft and emotional effect. Furthermore, texture in these works, by combining polished and matte surfaces, creates a distinctive visual and tactile quality. Consequently, the visual elements in Art Nouveau jewelry (Table No. 1) elevate the status of the jewel from a mere decorative object to an independent work of art.

Table No. 1: Analysis of Art Nouveau Jewelry in Terms of Visual Elements. (The Authors)

Row	Visual Elements	Art Nouveau Style Jewelry	Picture
1	Form	Curved, fluid, organic, inspired by nature and undulating lines	

2	Line	Soft, flowing, unbroken, dynamic	
3	Color	Delicate and soft; use of natural colors such as green, blue, purple	
4	Texture	Delicate, natural, sometimes with painterly subtleties on colored enamel	
5	Surface	Dynamic, curved, with fine decorative details	
6	Ornamentation	Plant, animal, and human motifs with symbolic significance	

The Art Deco Style

Art Deco is recognized as a symbol of luxury, modernity, and the grandeur of the post-World War I era. The term "Art Deco" is derived from the Exposition Internationale des Arts Décoratifs et Industriels Modernes (International Exhibition of Modern Decorative and Industrial Arts), a comprehensive exhibition of applied arts held in Paris in 1925. The aim of this exhibition was to reconcile art and industry, employing them together in a beautiful and artistic manner. Art Deco permeated modern life in the interwar years (Sternau, 2006: 4). World War I is generally considered the dividing line between the Art Nouveau and Art Deco periods, but the Art Deco style actually took shape between 1908 and 1912, a period typically regarded as transitional (Duncan, 1988: 7), and reached its peak between 1925 and 1935 (Sternau, 2006: 4).

Although Art Deco learned from Art Nouveau, it achieved its goals using different techniques and stylistic devices. Art Deco was a fusion of various styles and movements that had influenced early 20th-century art; including Bauhaus[14], Futurism[15], Neoclassicism[16], Constructivism[17], Cubism, Modernism, and also Art Nouveau. The result was that good design became accessible to the general public for the first time and was no longer the exclusive domain of the wealthy, although Art Deco also offered them luxuriously designed goods (Kerr, 2008: 6).

At the same time, the materials used in Art Deco were often exotic and original. Art Deco designers set aside traditional materials and instead worked with more exotic and original materials. The use of materials such as sharkskin, ivory, marble, glass, precious woods, and velvet fabrics was common to create a luxurious and aristocratic ambiance in interior decoration (Kerr, 2008: 9). The primary materials in delicate Art Deco jewelry were platinum[18] and diamonds (Ebert, 1983: 7). Platinum became popular due to its strength, enduring shine, and malleability, and by the early 1920s, it had replaced gold (Miller, 2005: 155). Color also played an important role in Art Deco jewelry (Ebert, 1983: 5). In the early 1920s, the use of soft colors, black and white contrast (black onyx and diamonds) was common (Sternau, 2006: 36), and by the late 1920s, the use of black and red color combinations, influenced by Aztec[19] and Inca[20] cultures, became popular (Miller, 2005: 159).

Artists drew inspiration from Edwardian styles[21] (Ebert, 1983: 6), avant-garde paintings[22] (Sternau, 2006: 36), African art[23] (Miller, 2005: 150), Japanese jewelry (Miller, 2005: 151), Aztec and Inca cultures (Miller, 2005:

159), the Egyptian style[24] (Miller, 2005: 170), as well as Baroque[25] and Byzantine[26] art (Miller, 2005: 153). New forms such as dress clips, decorative chains, and long pendant necklaces emerged (Miller, 2005: 149), and during the Depression, multi-functional and convertible jewelry was designed to meet consumer needs (Sternau, 2006: 36).

Art Deco moved from floral ornamentation towards geometric decoration (Sternau, 2006: 39). The geometric approach seen in many Art Deco works has its roots in Neoclassicism and restrained decoration, which was a reaction to Victorian excesses (Miller, 2005: 13). The use of pure geometry was considered a reaction to the ornate Art Nouveau (Miller, 2005: 158). Just as the Art Deco style replaced Art Nouveau, Art Deco in France was ultimately succeeded by Modernism. Its decline began at the height of its triumph, at the 1925 International Exposition in Paris (Duncan, 1988: 8).

Art Deco Style Jewelry

Art Deco jewelry encompasses a range from luxurious pieces to inexpensive plastic examples (Miller, 2005: 149). The Art Deco style in jewelry of the 1920s and 1930s traces its roots back to the pre-World War I period. Art Deco jewelry primarily drew inspiration for its decorative vocabulary from avant-garde painting movements of the first decade of the 20th century (Duncan, 1988: 162-166). Its production center was France, but native styles also developed in America, Scandinavia, and Mexico. Fine Art Deco jewelry is divided into two types: gemstone and Modernist (Miller, 2005: 149), and it continued into the 1950s, when geometry gave way to organic designs (Miller, 2005: 150).

The list of French jewelry designers and houses that were both innovative and prolific in the Art Deco style includes important names such as: Georges and Jean Fouquet, Gérard Sandoz, Jean Dunand, Raymond Templier, Jean Després, Sibyl Dunlop, Emanuel Götl, Osterlag, René Lalique (Miller, 2005: 151), and the companies Boucheron[27], Van Cleef & Arpels[28], the Lacloche family[29], Coco Chanel[30], and Cartier[31] (specialists in wall and wristwatches which made them popular) (Ebert, 1983: 11).

The main motifs in jewelry design included stepped patterns and simple geometric shapes such as squares, circles, and triangles (Duncan, 1988: 167). The Depression era created an opportunity for inexpensive and costume jewelry (Sternau, 2006: 36). Costume jewelry differs from precious jewelry as it is made from base metals or silver decorated with glass or synthetic stones. In the 1920s, the introduction of synthetic materials brought the price of costume jewelry to a level accessible to the general public (Duncan, 1988: 167). The style of Art Deco gemstone jewelry continued into the 1950s, when geometric arrangements gave way to organic patterns and larger colored stones (Miller, 2005: 150).

Image 7, with its bold yet delicate design, is an example of the French Art Deco jewelry design movement. Here, strong geometric patterns take advantage of the contrast between materials, subtly adorned with gleaming gold (Sternau, 2006: 36).



Image 7: Yellow and White Gold Bracelet with Onyx, Jean Fouquet, 1925(Sternau, 2006: 36).

The discovery of the treasures of Tutankhamun's tomb in 1922 created a wave of interest in Egyptian artifacts. Here, animal and divine motifs directly inspired by ancient Egyptian art (Image 8) have created captivating designs, decorated with brilliant gemstones, diamonds, emeralds[32], sapphires and rubies[33], and onyx[34] carved on platinum (Sternau, 2006: 115).



Image 8:Two bracelets with Egyptian motifs, Van Cleef & Arpels, circa 1925; Van Cleef & Arpels Collection Museum, Paris.
(www.the-collection.vancleefarpels.com)

Image 9 shows a collection of designs by the Cartier company from the 1920s. This collection includes a luxurious bracelet, a pair of clips decorated with diamonds and sapphires, a diamond brooch, and an Art Deco ring (Zaczek, 2001: 95).



Image 9: A collection of Art Deco jewelry, Louis Cartier, c. 1920 (Zaczek, 2001: 95).

The Boucheron hinged bangle bracelet (Image 10) is crafted from gold and platinum, with two strap-like ends pavé-set with brilliant-cut[35] diamonds and framing four rows of baguette[36] and square-cut sapphires. These stones are set using the invisible setting method. The interior circumference of this bracelet is 19 centimeters (equivalent to 7.5 inches) (Miller, 2005: 155).



Image 10: Hinged Bangle Bracelet, Boucheron, 1930s (Miller, 2005: 155).

A silver bracelet by the French designer (Image 11), Gérard Sandoz. The geometric design of this bracelet is achieved using black, gray, and red enamel alongside white eggshell lacquer. Sandoz's geometric designs often have a machine-like quality, while many of his other works are inspired by the fine art of Cubism (Miller, 2005: 151).



Image 11: Silver Bracelet, Gérard Sandoz, circa 1925 (Miller, 2005: 151).

A bracelet by Templier (Image 12), designed in the late 1920s as a jewel combining a bracelet and brooch. On a wide band, he placed a brooch of geometric plates and a ring of black onyx[37], both adorned with numerous diamonds. Templier always used diamonds in a calculated manner and even developed an innovative method to enhance their brilliance. He polished the metal surfaces into curved shapes to act like mirrors, reflecting the light from the diamonds and crystals (Duncan, 1988: 173).

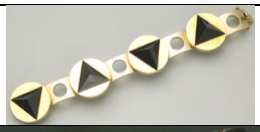


Image 12: Combination Bracelet-Brooch, Raymond Templier, 1925 (Duncan, 1988: 173).

From the perspective of visual elements, Art Deco jewelry is formed based on geometric order, symmetry, straight lines, and strong visual contrasts. The line in this style is predominantly straight, angular, and broken, emphasizing strength, rigidity, and order—unlike the fluidity of Art Nouveau. Forms are often designed as squares, rectangles, circles, triangles, and stepped or radial combinations, inspired by 20th-century modern architecture and machine aesthetic. Colors acquire a brilliant and powerful effect through the strong contrast between precious stones such as diamonds, rubies, emeralds, and dark stones like onyx. Texture is primarily polished, shiny, and precise, emphasizing the industrial refinement and luxury of this style. Overall, the visual elements in Art Deco jewelry (Table No. 2) express the spirit of modernity, industrial progress, and the opulent splendor of the interwar period.

Table No. 2: Analysis of Art Deco Jewelry in Terms of Visual Elements. (The Authors)

Row	Visual Elements	Art Deco Style Jewelry	Picture
1	Form	Geometric, angular, symmetrical, inspired by technology and architecture	

2	Line	Straight, broken, prominent, and often incorporating geometric rhythms	
3	Color	Strong, contrasting, and brilliant; black-white, red, gold, and silver combinations	
4	Texture	Polished, glossy, industrial, often with a uniform and smooth surface	
5	Surface	Flatter, simpler, emphasizing clarity and geometric order	
6	Ornamentation	Geometric, stepped, solar, Egyptian art patterns	

Art Nouveau jewelry, relying on curved lines, organic forms, and direct inspiration from nature, expresses an emotional and poetic approach to design. In contrast, Art Deco jewelry is based on organized geometry, symmetry, straight lines, and an opulent effect. In terms of color and materials, Art Nouveau predominantly utilizes enamel and semi-precious stones with soft colors, whereas Art Deco relies on diamonds, precious stones, and gleaming metals to emphasize power, modernity, and visual grandeur. These two styles clearly illustrate the transition from romantic naturalism to the industrial and modern order of the twentieth century (Table No. 3).

Table No. 3: Comparative Analysis of Art Nouveau and Art Deco Style Jewelry. (The Authors)

Row	Characteristic	Art Nouveau	Art Deco
1	Time Period	Approximately 1890 to 1910 (pre-World War I)	Approximately 1920 to the late 1930s (between the two World Wars)
2	Geographical Origin	France, Belgium, Britain, Germany; then throughout Europe and America	France and America (especially Paris and New York), then globally
3	Artistic Approach	Return to nature, organic lines, and a poetic spirit; each piece like an independent work of art	Celebration of modernity, machinery, order, and symmetry; focus on luxury and geometry
4	Forms and Lines	Soft, undulating, and fluid curves; inspiration from plants, women, insects	Straight, angular lines, perfect symmetry, zigzag, stepped, and radial patterns
5	Common Motifs	Flowers, leaves, women with flowing hair, butterflies, dragonflies, serpents, nature, and mythology	Sunbursts, sun rays, architectural forms, technological motifs, geometric patterns
6	Materials and Metals	Gold, silver, copper, colored enamel, pâte de verre (glass paste)	Platinum, yellow and white gold, polished silver, black enamel, chrome, and diamonds

7	Techniques	Transparent and opaque enameling, meticulous craftsmanship, engraving, and organic construction	Precise geometric cuts, machine-set stones, industrial fabrication with high precision
8	Gemstones	Agate, opal, tourmaline, coral, pearl, colored glass	Diamonds, rubies, emeralds, sapphires, onyx, red coral
9	Gemstone Cuts	Irregular, more natural and soft; often custom-cut	Standard cuts (brilliant, emerald, baguette, square, triangular)
10	Scale and Volume	Delicate and poetic; emphasis on form and color over brilliance	Often large and showy; emphasis on order and ostentatious display
11	Distinctive Feature	A sense of movement and living nature in the forms	Geometric order, metallic brilliance, and strong color contrast
12	Prominent Artists	René Lalique, Georges Fouquet, Henri Vever, Alphonse Mucha, Philippe Wolfers	Cartier, Van Cleef & Arpels, Boucheron, Raymond Templier, Jean and Georges Fouquet, Gérard Sandoz, Emanuel Gattle, Arnold Ostertag

Conclusion and Recommendations

The Art Nouveau and Art Deco styles were each influenced by their significant historical and cultural periods and played a unique role in the history of jewelry design. Art Nouveau, with its emphasis on nature and organic forms, imbued jewelry with a poetic and artistic spirit. This style, through the use of curved lines, intricate details, and inspiration from natural elements such as flowers, animals, and human figures, created a rich and emotional visual experience. Furthermore, by reflecting the aesthetic and philosophical values of the late nineteenth century, Art Nouveau brought a sense of delicacy and harmony with nature to jewelry design.
In contrast, the Art Deco style represented a major shift towards modernity and industrialization. This style, employing geometric lines, symmetry, and abstract patterns, reinforced a sense of progress and futurism in jewelry design. Art Deco, by using new materials like platinum and synthetic stones, along with bright colors and high contrast, focused on simplicity and modern aesthetics. These differences illustrate the cultural and technological transformations of their respective eras. Each style has, in its own unique way, managed to transform jewelry into artistic and historical works through its aesthetic and philosophical expression.

Endnotes

1. The Cubism style is one that depicts reality through geometric shapes and multiple perspectives (Gardner, 2019: 622).
2. The Middle Ages is a historical period between antiquity and the Renaissance (approximately the 5th to the 15th century AD), known for the dominance of feudalism, church influence, and scientific and cultural limitations (Gardner, 2019: 266).
3. The Early Renaissance was a period in the 14th and 15th centuries AD that began with the revival of classical Greek and Roman art, science, and thought in Italy, paving the way for the High Renaissance (Gardner, 2019: 354).
4. Neo-Gothic (or Gothic Revival) is a revival of the medieval Gothic style that regained popularity in the 18th and 19th centuries, particularly in Europe, and was used in architecture, art, and design (Gardner, 2019: 544).
5. Neo-Rococo is a revivalist style of the 19th century, inspired by 18th-century Rococo, emphasizing refinement, detailed ornamentation, and aristocratic splendor (Marzban, 2016: 177).
6. Japanese art reflects a minimalist aesthetic, harmony with nature, and a balance between simplicity and symbolism, evident in painting, architecture, calligraphy, and design (Marzban, 2016: 52).
7. The Victorian style is known for its detailed ornamentation, ostentation, combination of historical styles, and use of rich colors and textures in 19th-century British art and design (Kingsley, 1999: 7).
8. The Modern style (Art Moderne) is an artistic movement that took shape in the early 20th century and, with an emphasis on innovation, simplicity, form, and the use of new materials like metal and glass, created a revolution in design and architecture (Gardner, 2019: 614).

9. Silver is a precious, soft metal with a white luster, widely used in jewelry and decorative objects due to its high malleability and suitable resistance (Hall, 2011: 50).
10. Ivory is the use of a natural, hard material from the teeth or tusks of elephants and some other animals for making or decorating jewelry pieces, valued in the past for its bright color, delicate texture, and fine carving potential for its high artistic and luxury value.
11. The Cloisonné enamel technique is a decorative method in which metal wires are placed on a metal surface to create cells, which are then filled with colored enamel and fired to create a smooth, colorful surface (Pakbaz, 2016: 564).
12. Turquoise is a semi-precious stone ranging in color from blue to green, formed from a combination of copper and aluminum, valued in jewelry for its distinctive color and symbolic properties.
13. Diamond, composed of carbon, is formed under heat of three to four thousand degrees and under immense pressure in many layers without air (Moradi-Eghbal, 2021: 100).
14. Bauhaus was an avant-garde movement in design and architecture that promoted minimalist and functional principles by combining art, industry, and technology (Lambert, 2007: 41).
15. Futurism was an artistic and literary movement in the early 20th century that rejected past traditions, celebrated dynamism, speed, technology, and modernity, and emphasized the raw energy of industrial life (Shad Ghazvini, 2018: 33).
16. Neoclassicism was an artistic movement that revived the simplicity and proportion of classical Greek and Roman aesthetics in the 18th and 19th centuries (Marzban, 2016: 192).
17. Constructivism was a modern movement in art and architecture that emerged in early 20th century Russia, emphasizing geometric structure, industrial materials, and functionalism (Gardner, 2019: 637).
18. Platinum is a white-gray-silver, lustrous metal, rarer and more expensive than gold and silver, heavy, and highly resistant to corrosion and tarnishing (Hall, 2011: 52).
19. The Aztec civilization (1300-1521 AD) was a powerful empire in central Mexico known for its magnificent architecture, complex religious rituals, and advanced agricultural system (Gardner, 2019: 748).
20. The Inca civilization (1438–1533 AD) is known for its powerful rule, advanced stone architecture, mountain roads, and terraced agricultural system in the Andes mountains (Marzban, 2016: 338).
21. The Edwardian style (1901-1910) was a refined and luxurious period, inspired by Art Nouveau and distanced from the Victorian style (Milford, 2014: 5).
22. The Avant-garde movement is known for breaking traditional rules and presenting radical, experimental, and innovative ideas in form and content, such as the works of artists like Picasso and Matisse who shifted artistic boundaries (Shad Ghazvini, 2018: 7).
23. African art is a reflection of spiritual beliefs, ethnic identities, and a deep connection between humans and nature, manifested in symbolic forms, sculpture, painting, and textiles (Marzban, 2016: 289).
24. Ancient Egyptian art was symbolic, religious, and ritualistic, created for the immortality of the soul and the worship of gods in a geometric, orderly, and eternal form (Marzban, 2016: 17).
25. The Baroque style (17th to early 18th century) is known for its exaggerated display of emotion, dynamic movement, sumptuous ornamentation, and the use of dramatic lighting in art, architecture, and music (Marzban, 2016: 173).
26. The Byzantine style (4th to 15th century) is known for its religious art, golden mosaics, domed architecture, and flat, symbolic images of sacred figures (Marzban, 2016: 106).
27. Boucheron, this historic French company founded by Frédéric Boucheron in 1858, continued to operate on the Place Vendôme, the center of luxury commerce in Paris. Boucheron set standards of style and quality for generations of jewelers from its inception. The company has always specialized in precious gemstones, and its pieces are often clearly hallmarked. After World War I, demand for bracelets and brooches increased, which Boucheron met with brilliant success. By the early 1920s, platinum had replaced gold as the primary metal. Diamonds were predominantly used in baguette or rectangular step cuts, often combined with sapphires. The introduction of "white jewelry" combining diamonds and platinum was one of the company's achievements (Miller, 2005: 155).
28. Van Cleef & Arpels was founded in Paris in 1906 and began operations in New York from 1929. Founded by Alfred Van Cleef and his brother-in-law Charles Arpels, this luxury company continued to operate on the Place Vendôme in Paris alongside its great rival, Boucheron. Van Cleef has always offered simpler and more modern designs than Boucheron and created some of the best Art Deco jewelry designs. In the 1920s, Van Cleef introduced the invisible setting technique, where stones were precisely cut to fit into a parallel framework, creating a seamless, bezel-less appearance. Colored stones from Southeast Asia, particularly

rubies, sapphires, and emeralds, along with Chinese jade and black onyx elements, were especially popular during this period. The company expanded its operations to New York from 1939 (Miller, 2005: 157).
29. The Lacloche family, by founding a company in Paris in 1892, became one of the prominent names in Art Deco jewelry in the early twentieth century. This family business expanded through the collaboration of sisters and brothers in Paris, Madrid, and other cities. Notable works include the "Petit Point" bracelets, gold accessories with animal motifs, and Art Deco jewelry in Chinoiserie and Egyptian Revival styles. Despite its success, the company went bankrupt in 1931. Afterwards, Jacques Lacloche continued the business alone, gaining fame for his modern jewelry designs and later entering the fields of furniture and decorative arts. Today, the Lacloche legacy is being revisited through exhibitions, books, and the presence of their works in auctions such as Sotheby's, inspiring collectors (collection.vam.ac.uk).
30. Coco Chanel: Few have been able to inject fantasy and taste into modern culture to the extent of Coco Chanel; a legacy that still guides the policies of the company she founded in 1912. Gabrielle "Coco" Chanel began her brilliant professional career as a milliner before World War I and had established her signature style of simple, comfortable fashion by the early 1920s. Chanel's jewelry always deliberately remained in the realm of costume jewelry; a concept credited to her invention and popularization. Chanel became interested in jewelry design from 1911, influenced by Paul Iribe (designer for Jeanne Lanvin and others). Her jewelry was introduced in the late 1920s and remains an important part of the modern Chanel empire. By then, Chanel moved in artistic circles with Pablo Picasso, Salvador Dalí, and Jean Cocteau (for whom she designed film costumes). Her jewelry depicted the surreal world of these artists, inspired by Baroque and Byzantine pasts (Miller, 2005: 153).
31. Cartier, dubbed the "King of Jewelers" by Edward VII, one of his favorite clients and collectors, Alfred Cartier founded a company that established itself as the premier luxury purveyor of Art Deco, relying on generations of excellence and prestige. By the time of Alfred Cartier's death in 1925, Cartier boutiques operated throughout the affluent world, including the Persian Gulf states. The Paris headquarters was run by Louis Cartier, the New York store by Pierre, and the London branch by the youngest brother, Jacques. The family and company union led to unified styles and standards designed to attract the wealthiest clients with modernist taste. Cartier used a variety of innovative materials including black onyx, Chinese jade, and enamel. The designers were largely anonymous. However, Cartier Art Deco has few rivals in terms of quality of execution and boldness of design and is easily recognizable. All pieces are marked with the company's hallmarks and French assay marks. The original boxes also add value to any Cartier jewel (Miller, 2005: 152).
32. Emerald is a green, brilliant stone from the beryl family, valued highly for its beauty and rarity.
33. Red Ruby and Blue Sapphire: Both are very hard and brilliant stones whose colors differ due to their mineral content: one red and the other blue.
34. Onyx is a layered stone, usually dark in color, known for its linear patterns and glossy appearance.
35. The Brilliant cut is a method of shaping a diamond with precise facets to create maximum brilliance and sparkle (Adib, 2013: 148).
36. The Baguette cut in diamonds is a rectangular cut style with parallel edges and a flat surface, typically used to enhance brilliance and linear display in ring stones (Staller, 2020: 49).
37. Black Agate is a semi-precious, dark-colored stone known for its glossy surface and perceived protective quality.

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STUDY OF THE INFLUENCE OF TRADITIONAL (IRANIAN–ISLAMIC) MOTIFS ON THE WORKS OF SAQQAKHANEH ARTISTS

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Abstract
The Saqqakhaneh school is one of the most important movements in contemporary Iranian art, first named by Karim Emami, and is known for its creative revival of traditional Iranian–Islamic motifs in a modern context. Artists of this school, in their effort to create a new connection between tradition and contemporary expression, employed a range of visual elements such as abstract arabesque and khatai patterns, motifs derived from Iranian miniature painting, calligraphy and calligraphic painting (Naqashi-Khat), as well as religious and mythological elements. This study, using a descriptive-analytical method and based on library sources, examines the presence and function of these motifs in the works of artists such as Hossein Zenderoudi, Faramarz Pilaram, Reza Mafi, and Sadegh Tabrizi. The main research questions are: "Which traditional, religious, and mythological motifs appear in the works of Saqqakhaneh artists?" and "What role do these elements play in the visual structure of these works?" The findings indicate that symbols such as the lock, hand (panjé), flag, talismans, cypress, boteh-jeqqé, horses, arabesque patterns, khatai designs, motifs from miniature painting, and calligraphy in Nastaʿlīq and Shekasteh scripts are widely and commonly used in the works of these artists. The results also show that religious elements are the most prevalent, and many of the motifs present in Saqqakhaneh spaces appear consistently across the works of most artists of this school. This study demonstrates that the Saqqakhaneh school, relying on rooted Iranian–Islamic motifs, has created a fresh and distinctive visual language in contemporary Iranian art.
Keywords: Saqqa-khane School, Traditional Iranian-Islamic Motifs, Contemporary Iranian Art

1. Introduction

The Sakakhane School is one of the prominent and influential movements in contemporary Iranian art, which, relying on Iranian-Islamic traditional motifs, succeeded in creating a fresh and distinctive expression in Iranian modern art. This approach, first named "Sakakhane" by Karim Emami, emerged in a context where efforts were being made to revive national arts at the School of Old Industries and later in the educational programs of the Faculty of Decorative Arts. These efforts focused on preserving Iran's visual heritage and utilizing it within the structure of contemporary art. In this environment, Sakakhane artists sought to combine deeply rooted visual elements from miniature painting, calligraphy, and traditional arts with modern expression, thereby establishing an independent identity for Iranian art in the contemporary period (Khoshzab, 2012:22).
Since art has always served as a medium to reflect beliefs, symbols, and cultural motifs, Sakakhane artists also creatively reinterpreted traditional elements by referring to past visual sources. In this context, motifs such as the lock, paw, flag, talismans, cypress, boteh-jeghah, horse, Seljuk and Chinese patterns, and designs derived from Iranian miniature painting and Nastaʿlīq and Shekaste calligraphy are widely observed in the works of artists such as Hossein Zenderoudi, Faramarz Pilaram, Reza Mafi, and Sadegh Tabrizi. These elements not only carry a deep connection with the Iranian visual tradition but also constitute the main sources shaping the aesthetic structure and composition of this movement's works.
The importance of studying the Sakakhane School lies in its ability to create a fundamental transformation in contemporary Iranian art by relying on Iranian-Islamic motifs and to open a new path for subsequent artists. Particularly, the extensive use of religious and traditional motifs has made Sakakhane one of the most distinctive artistic trends in the second half of the 14th century (solar calendar).
This study aims to examine the traditional motifs in the works of Sakakhane School artists and seeks to answer the following questions:
Which traditional, religious, and mythological motifs are present in the works of Sakakhane artists?
What role do these elements play in the visual structure of these works?
The research methodology is descriptive-analytical and based on library sources. In the first section, the historical and educational contexts of the formation of the Sakakhane School are examined. In the second section, the traditional motifs and their presence in the artists' works are analyzed. In the third section, the

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place of these motifs in the visual structure of the works and their influence on the formation of the visual identity of the Sakakhane School are evaluated.

2.Methodology

Although studies conducted on the Sakakhane School are rich in describing and presenting examples of works by the prominent artists of this movement, they have mostly paid little attention to comparative analysis or systematic examination of motifs and the visual structure of the works. A review of the existing literature shows that most studies adopt a historical and descriptive approach, while precise analysis of the presence of traditional, religious, and mythological motifs in Sakakhane artists' works has been largely neglected.

Khoshzab (2012) in her thesis examined the position of Iranian symbols and emblematic motifs in Sakakhane-style painting. She analyzed motifs such as Seljuk designs, boteh-jeghah, Kufi scripts, and ritual elements, demonstrating that these motifs are not only decorative but also carry cultural and identity-related meanings. However, her research focused primarily on identifying and classifying motifs, with less attention given to comparative analysis or examining how these motifs are reproduced in the visual structure and composition of the works.

Pakbaz and Emdadian (2001–2002), in their collection *Pioneers of Modern Iranian Art*, introduced the works of artists such as Hossein Zenderoudi and Parviz Tanavoli, highlighting their role in shaping the Sakakhane movement. These studies clarified the historical and artistic background of the Sakakhane School's formation, but their focus was on presenting artists and notable works rather than conceptually or comparatively analyzing motifs and traditional designs.

Hosseini (2016) and Seif (2016) approached the Sakakhane movement from a cross-period perspective, examining its development within the framework of contemporary Iranian art. Mo'arknejad (2016) provided an overview analyzing the emergence and formation of the Sakakhane School. While these studies provide valuable historical and descriptive data, the systematic analysis of motifs and identification of common visual patterns in Sakakhane artists' works remain lacking.

Furthermore, Hoshyar and Mobini (2023), focusing on contemporary calligraphic painting and adopting an intertextual approach, examined mythological, traditional, and religious motifs in Sakakhane artists' works. Their study shows that visual elements such as locks, paws, flags, talismans, cypresses, boteh-jeghah, horses, Seljuk and Chinese motifs, and designs derived from miniature painting and Nastaʿlīq and Shekaste calligraphy are prominently present and play a fundamental role in the visual structure and artistic identity of the Sakakhane movement. However, this research has paid less attention to comparative analysis among different artists and the role of these motifs in the compositional structure and visual perception of the movement.

Based on previous studies, it can be concluded that despite valuable research, a comparative and systematic study of traditional, religious, and mythological motifs in Sakakhane artists' works is still needed. The present study, focusing on the most representative works of this movement, aims to fill this gap and provide a comprehensive analysis of the role, position, and function of traditional motifs in the visual structure and artistic identity of the Sakakhane School.

3.The Saqqakhaneh School

The Saqqakhaneh School was named by Karim Emami in 1962 for a group of artists and their works. Emami, a translator, critic, and journalist who analyzed artistic events in the press during those years, wrote that the emergence of writing in painting in the early 1960s reminded many of the atmosphere of the traditional saqqakhaneh niches. He used this term to describe the works of this group of artists, and over time, the term expanded to include all painters and sculptors who used traditional Iranian artistic forms as their point of departure (Pakbaz, 2008: 307).

Some artists—such as Ghandriz—in the evolution of their personal style, simplified human figures and objects to reach forms close to surrealism. Their works moved from drawing to motif, and from motif to the fusion of patterns, consistently focusing on skies, the sun, clouds, and wind, representing the ethereal essence of nature.

Another major characteristic of Saqqakhaneh works is the use of Persian calligraphy. Iranian calligraphy, which developed a unique form throughout history and became intertwined with Iranian culture, was used as an identity-bearing visual element in their paintings (Hosseini, 2016). For these artists, writing had primarily a visual function; its textual meaning was not emphasized. This widespread use of script can be observed in the works of almost all members of the group.

Hossein Zenderoudi was a pioneer in this direction; his early works began with simple geometric surfaces and were later covered with bright colors and inscriptions. This approach was later continued by Faramarz Pilaram, who strengthened the visual composition of the work by adding textual elements (Seif, 2016: 22).
Zenderoudi gradually moved away from restrictive geometric forms and turned to the element of script. He used writing not in the traditional sense of calligraphy but as compositions of letters and words, regardless of their literal meaning. This style was inspired by talismanic writings and shrine inscriptions. Although some critics did not accept this approach, its influence on shaping contemporary Iranian calligraphic painting is undeniable (Hoshyar & Mobini, 2023: 138).
Reza Mafi also brought calligraphy onto the canvas while adhering to its traditional rules, merging the art of calligraphy with modern painting (ibid., 139).
During the second decade after the Islamic Revolution, the debate on the identity crisis and status of contemporary Iranian painting resurfaced. Themes such as religious art, non-religious art, artistic traditions, and spirituality became prominent. The influential presence of religious modernists in cultural and administrative fields paved the way for a return to tradition and renewed interest in the Saqqakhaneh School. Modern Iranian artists such as Jafar Rouhbakhsh, Parviz Kalantari, Mansoureh Hosseini, Rahim Nezhafer, Shahla Habibi, Mohammad Ali Taraghi-Jah, and Zahra Rahnavard adopted this orientation (Mo'arknejad, 2016: 145).
Karim Emami noted that the name "Saqqakhaneh" is neither complete nor fully comprehensive, but it serves as a useful marker for distinguishing and recalling this artistic movement (Emami, 1977: 44). Saqqakhaneh painters sought to recreate the artistic identity of their works by drawing upon historical and traditional Iranian motifs. They aimed to create works that aligned with global artistic trends while remaining connected to Iran's ancient cultural heritage. Texture and background were also two key elements in forming the visual identity of their works (Hoshyar & Mobini, 2023: 140).
The Saqqakhaneh Group is considered the first true artistic group in modern Iranian painting, where each artist—driven by personal interests and characteristics—moved along a path of national artistic exploration. The members traveled extensively, studied Western artistic movements, and combined Iran's old visual signs with modern experiences such as Cubism through extensive research. They believed that using decorative motifs of the past could express the artist's emotions while simultaneously connecting with the history of Iranian art (Emami, 1966: 44–48).
The use of Qajar-era motifs and earlier elements, and imagery such as horses, female faces, and legendary characters like Div and Khorshid Khanum, are among the distinctive features of this group's works, seen clearly in the works of Oveyssi, Ghandriz, Tabrizi, and Jazeh Tabatabai (Pakbaz, 2008).

4. Members of the Saqqakhaneh School

The Saqqakhaneh School can be traced back to Hossein Zenderoudi as its starting point, followed by artists such as Mansour Ghandriz, Massoud Arabshahi, Faramarz Pilaram, Sadegh Tabrizi, Reza Mafi, and Parviz Tanavoli who later joined the movement. Some researchers also include Jaze Tabatabai and Nasser Ovissi in this group due to their use of Iranian decorative elements and their studies on folk and traditional arts, although these artists themselves were not particularly inclined to be associated with the movement.
Karim Emami stated in an interview that Parviz Tanavoli and Hossein Zenderoudi, during a trip to the city of Rey, encountered religious posters whose simple forms, repeated motifs, and vibrant colors inspired them. These posters became the foundation for the early works of the Saqqakhaneh movement, and the first designs produced by Zenderoudi after this experience are considered the origins of the school.
These artists represented the second generation of Iranian modern painters after the early pioneers. Parviz Tanavoli recounts that around 1960, he and Zenderoudi visited the Shah Abdolazim shrine, where they sought local materials for their works and were inspired by printed religious images. The simplicity of forms, repetition of motifs, and striking colors in these images became the initial inspirations for the Saqqakhaneh style.
Hossein Zenderoudi employed religious texts, prayers, talismans, and references to the events of Ashura in his works. In some of his later works, these texts appeared as humorous or meaningless phrases, used simply to fill space on the canvas (Eskandari, 1999: 192). His approach to color, script, and composition reveals the influence of modern art, where imagery dominates over text—contrary to traditional Iranian art, in which text usually holds precedence (ibid, 192–197).
Parviz Tanavoli, in series such as Shirin and Farhad, created numerous sculptures and locks using religious and national symbols. His goal was to form a personal style that was both modern and distinctly Iranian;

therefore, he employed national and local motifs through a geometric mindset, highlighting Iranian-Islamic identity (ibid, 152).
Overall, the artists of the Saqqakhaneh School may be regarded as the heirs of traditional Iranian craftsmen—illuminators, metalworkers, and calligraphers—who adorned functional objects with delicate motifs and elegant scripts. This was precisely the intention of Saqqakhaneh artists, although many critics of the time accused them of imitation and repetition (Saqqakhaneh Exhibition Brochure).

5. Elements of Interest in the Saqqakhaneh School

In order to connect modernity with Iranian tradition, the artists of the Saqqakhaneh School employed ancient and traditional symbols, distinguishing their works from other modern styles. These elements can be semiotically categorized into several groups:
Geometric motifs and shapes: Used either as decorative elements or as the primary structural components of the artwork.
Floral motifs: Long present in Iranian art, symbolizing a connection with nature and tradition.
Animal motifs: In some works they are highly abstracted, showing only a general silhouette; in others they appear in symbolic or ornamental forms.
Human motifs: Like floral and animal forms, these figures are often symbolic and stylized. In the works of Massoud Arabshahi, Faramarz Pilaram, and Hossein Zenderoudi, such motifs are entirely symbolic and not precisely describable. In contrast, in the works of Sadegh Tabrizi and Nasser Ovissi, they appear with Iranianized features reminiscent of miniature illustration.
Magical and ritual objects: Amulets, talismans, prayers, numbers, and symbols associated with traditional Iranian rituals are commonly found, reflecting the historical and religious beliefs of society.
Islamic religious symbols: From prayers and Qur'anic verses to Ashura-related motifs and ceremonial symbols, these elements appear with innovative compositions in Saqqakhaneh artworks.
In addition, traditional elements such as doors, locks and keys, shrines, ring stones, bowls, and devotional plaques are frequently used. These ancient motifs are reinterpreted through a creative visual approach, acquiring new forms and structures. Persian calligraphy, whether as an independent visual component or engraved on objects, becomes central to many Saqqakhaneh works. Kufic script, through its historical evolution, emerges as a new expressive language that harmonizes with the overall spirit of the movement.
The common feature among Saqqakhaneh artists is their use of calligraphy, religious symbols, and elements of folk and Shi'a culture. Traditional color palettes, combined with Ashura motifs such as the hand emblem, the *alam*, shrine-like forms, votive ribbons, talismans, astrolabes, and the "forty-key cup," create an atmosphere that is at once new and intimately familiar, reminiscent of *hosseiniyehs* and Muharram mourning rituals.
Among the prominent artists, Parviz Tanavoli reinterpreted traditional elements in sculpture using carpets, vessels, kilims, iron, mosque doors and windows, locks and keys, and Saqqakhaneh shrines. Tanavoli consistently emphasized Eastern and Iranian culture, stating that he no longer looked to the West and that Eastern art had become his priority (Aflaki, 2003: 55–56).
The artists of the Saqqakhaneh School can be regarded as heirs to the master craftsmen of the past—illuminators, metalworkers, and calligraphers—who adorned functional objects with intricate patterns and elegant scripts. The goal of Saqqakhaneh artists was to revive the same historical aesthetic of Iran, although some critics of the time accused them of insincerity or imitation (Saqqakhaneh Exhibition Brochure).

6. Introduction of Artists and the Motifs Featured in Their Works

Hossein Zenderoudi: Born in 1937 in Tehran, he began his artistic education at the Tehran School of Fine Arts, where he created his earliest paintings. At the age of 22, he moved to Paris, and after winning a prize in one of the biennales, he received a scholarship and continued his university studies in art. Upon returning to Iran, he held an exhibition at the Kaboud Atelier and became recognized as one of the most prominent figures of the Saqqakhaneh School, although he personally rejected the association of this movement with his works. In 1972, he created an exquisite Qur'an with colored designs which received an award from UNESCO. His works, characterized by repeated numbers and letters and a focus on the four elements—water, wind, earth, and fire—create rich, energetic, and detailed compositions and are preserved in international museums and exhibitions.In Zenderoudi's works, there is a profound connection between calligraphy and painting. His intelligent use of Iranian motifs and elements of popular culture—such as invocations, talismans, ritual symbols, and magical objects—is clearly evident. Religious themes like Ashura scenes, calligraphic lines, texts of invocations, and talismans also appear frequently, creating a mystical and nostalgic atmosphere. Through abstract and geometric expressions and innovative compositions, Zenderoudi produces multilayered and distinctive paintings that can appear poetic, musical, or reflective of the mysteries of existence. With this approach, his works offer a unique and enriching artistic experience to both Iranian and international audiences. (Fig.1)
Figure 1: Works by Hossein Zenderoudi (Tehran Auction Magazine)
Masoud Arabshahi:Born in 1935 in Tehran, Arabshahi developed an early interest in painting and traditional Iranian arts. He explored ancient motifs and archaeological remains from Iran and Mesopotamia, and by



blending ancient mythologies, Marlik and Ziwiye ceramics, and modern art principles, he created distinctive and coherent works. His travels to the United States brought him new experiences while strengthening his connection to Eastern traditions. Arabshahi's works reflect a thoughtful fusion of ancient heritage with a modern artistic mindset, offering an abstract and contemporary interpretation shaped by archaeological elements. Contrary to some claims, his works do not fully align with the Saqqakhaneh style, and the association is mostly due to historical simultaneity rather than stylistic consistency.
As a prominent Iranian artist, Arabshahi employed numerous motifs in his works, most of which are abstract and include ancient symbols, geometric forms, and scientific or architectural signs. He drew inspiration from ancient Iranian and Mesopotamian symbols such as the lotus, the sun wheel, and the tree of life, using them mainly as decorative elements in his early works. After around 1976, his focus shifted toward spatial composition and geometric or linear signs, contributing to the creation of a modern and enigmatic atmosphere. Unlike other Saqqakhaneh artists, Arabshahi did not use calligraphy or religious symbols, and his works lack direct narrative representation. His travels to Europe and exposure to Western modern art played an important role in shaping his unique geometric and spatial style. (Fig.2)



Figure 2: Works by Massoud Arabshahi (Shahrivar Monthly, Issue 9)

Sadegh Tabrizi: Born in 1938 in Tehran, he began his artistic path in childhood under the supervision of his father and traditional *coffeehouse painters*. He completed his studies in interior architecture and later focused on *calligraphy-painting (naqashi-khat)*, becoming one of its pioneers in Iran. His works feature figures from the coffeehouse painting tradition, seals, letters, and words—sometimes appearing as textured forms and sometimes in relief. The aesthetics of the Qajar era and coffeehouse painting are clearly reflected in his oeuvre. Tabrizi also created collages on pottery and leather, incorporating traditional motifs and elements of Persian miniature to express his personal vision of nature and culture.

In the book *The Shining Peaks of Iranian Art*, Ehsan Yarshater introduces Tabrizi as an artist who revives the visual heritage of the past by focusing on traditional and cultural objects. His works include *kharmohreh* beads, old locks and keys, torn pages of manuscripts, practice sheets, seals, and metal bowls with firm rims—elements reminiscent of the Saqqakhaneh atmosphere. Through the rhythmic repetition of motifs, Tabrizi harmonizes diverse elements and infuses them with renewed vitality. Abstract and symbolic motifs also appear in his works, contributing to the re-creation of Iran's cultural identity. This style showcases the harmony between tradition and the artist's individual creativity, which forms a defining feature of his art. (Figure 3)

Figure 3: Works by Sadegh Tabrizi (Pish Negah Monthly)



Mansour Qandriz (born 1935, Tabriz) was a graduate of the Tehran College of Decorative Arts and one of the active figures of the Saqqakhaneh movement. In 1964, together with a group of artists, he founded the Iran Hall, which became known as Qandriz Hall after his death. Although Qandriz's works were associated with the Saqqakhaneh movement, they did not rely on Qajar motifs or religious decorations and instead reflected his personal and independent style. He drew upon primitive and universal motifs, with geometric forms such as squares and circles forming the foundation of his structured compositions. His approach to art was primarily personal, introspective, and abstract, relying little on religious or ceremonial culture.

Despite a limited number of figurative works, Qandriz successfully demonstrated his creativity, innovation, and expressionist style within modern Iranian art. After initial academic experiences and imitations of Impressionism and Post-Impressionism, he developed his personal style influenced by Iranian miniature painting and artists such as Matisse. His works are a fusion of Iranian tradition and Western modernism, featuring vivid colors, soft lines, and elongated or small figures that gradually take on a mythical and mysterious quality.

The Saqqakhaneh period and its artistic transformations provided the background for the development of Qandriz's style and the emergence of his primitive character and motifs. His early motifs included humans, birds, the sun, and swords with repetitive geometries, which gradually became simpler and more abstract. Additionally, Qandriz's interest in religious and national roots is evident in his works through symbols and religious elements such as minarets, candlesticks, and lattice patterns. (Figure 4)



Figure 4: Works of Mansour Qandriz (Niavaran Private Library Museum)

Farshid Pilaram (1937–1983) was a painter, calligrapher, and one of the pioneers of the Saqqakhaneh school. After studying at the Boys' Fine Arts School and the Tehran College of Decorative Arts, he traveled to France to learn lithography and printing. His early works, by enlarging traditional stamps and combining religious symbols such as *alam* (banner) and *panjeh* (hand symbol) with geometric shapes, created a calligraphic inscription-like background. Pilaram, relying on traditional art and integrating Persian calligraphy, especially *Nastaliq*, into painting, developed the *calligraphic painting* style in Iran. He believed that repetition of forms and integration of linear elements in artworks led to artistic unity and a connection with reality, aiming to promote authentic Iranian art.

Farshid Pilaram consistently sought to depict authentic Iranian symbols, and in his early works, he enlarged traditional stamps and combined them with religious symbols such as banners, hands, eyes, and horseshoes. By utilizing traditional Iranian arts, such as tile work, and integrating Persian calligraphy, especially *Nastaliq*, into painting, he advanced the calligraphic painting style. The lines in his works possess rhythmic and harmonious movement, and through repetition and the blending of thick and thin strokes, they create visual



unity. His paintings are often large, with form dominating content, featuring strong color contrasts and thick, heavy application of color. Together with a group of Saqqakhaneh artists, Pilaram established an authentic approach in painting and sculpture based on Iranian beliefs and religious symbols. (Figure 5)

Figure 5: Works of Farshid Pilaram (Iranian Visual Arts Magazine)

Jazeh Tabatabai was born in 1930 in Tehran and was a multifaceted artist—painter, sculptor, and poet—who also founded Iran's first art gallery, *Honar-e Jadid* ("New Art"). He signed his works as "Tabatabai," and his gallery soon became one of the major cultural centers of its time. Tabatabai passed away on February 9, 2008, at the age of 77, shortly before a major exhibition of his works was scheduled to be held at the Tehran Museum of Contemporary Art. The Iranian Academy of Arts had also planned to hold a commemoration and exhibition of his works in May 2008. Despite these plans, the exhibitions were never actually realized.

Jazeh Tabatabai was an independent and free painter who initially depicted the events of Ashura using traditional and religious elements, and later turned to sculpture. His works reflect rural folk life, ritual symbols, and religious forms such as talismans, often aiming to critique magical thinking and object fetishism. Tabatabai preserved Iranian traditions and culture, and he became widely known for his inventive figures and metal sculptures. He created these sculptures using industrial machinery parts and the assemblage technique. His style is closely associated with the Saqqakhaneh school, and recurring themes such as lions, women, and the sun frequently appear in his works. (Figure 6)



Figure 6: Works of Jazeh Tabatabai (Art Exhibition)

Nasser Ovissi (born 1934 in Tehran) is an Iranian painter and ceramist who formally studied law but never abandoned art. He received diplomas in fine arts, painting, ceramics, lithography, and gilding from Rome, Italy. His works are characterized by narrative qualities and a consistently personal and creative approach to imagery. His participation in the 1958 Tehran Painting Biennial became a turning point that introduced his work to the art community. From that time on, his paintings gained attention, were purchased, and established his professional artistic path.

Nasser Ovissi creates poetic and figurative paintings that hover between painting and calligraphy. Iranian women, powerful horses, *khatā'ī* motifs, and bright colors are key features of his works. Inspired by Seljuk



and Qajar imagery as well as coffee-house painting, he brought a significant transformation to the history of Iranian painting through his creative vision. His works have a unique rhythm and continuity, and even in dynamic scenes, they portray time as still, conveying a world filled with love and vitality. Calligraphy and *khatā'ī* patterns play an aesthetic and structural role in his compositions, while flowers and the eyes of his figures express emotion and the sorrow of uncertainty about the future. Through horses, human figures, and *khatā'ī* motifs, Ovissi depicts the deep bond of Iranians with their nature and culture. (Figure 7)
Figure 7: Works of Nasser Ovissi (Ayrik Gallery)

7. Examination of Elements Used in the Artworks
In order to examine the works of artists associated with the Saqqakhaneh School, the visual and conceptual elements employed in their artworks have been identified and categorized. These elements include abstract arabesque (eslimi) and khataei motifs, motifs derived from Iranian miniature painting, calligraphy and calligraphic painting, religious and mythological elements, human and animal figures, as well as geometric and abstract forms. Analyzing these components allows for a clearer understanding of the similarities and differences in each artist's approach to reinterpreting tradition and integrating it with modern artistic expression. Table 1 presents a concise and comparative overview of the principal elements used in the works of the artists under study.
Table 1: Visual Elements Used in the Works of Saqqakhaneh School Artists

Artist	Traditional Miniature Motifs	Arabesque (Esleme)	Khatai	Calligraphy & Painting-Calligraphy	Religious Elements	Human & Mythological Figures	Geometric & Abstract Forms
Hossein Zenderoudi	-	-	-	Nastaʿlīq & Shekasteh	Talismans, Flags, Panjah	Mythological beings, humans & animals	Curved lines, geometric textures
Masoud Arabshahi	Ancient Mesopotamian & Iranian motifs used from miniature painting	-	-	-	-	Mythological beings	Circles, squares, curves, geometric lines
Sadegh Tabrizi	Used miniature motifs	Used Arabesque	-	Nastaʿlīq	Religious symbols	Coffeehouse figures	Balanced and harmonic compositions
Mansour Qandriz	Primitive motifs & locks from miniature painting	-	-	-	Limited religious symbols	Simple figures & horses	Squares, circles, geometric forms
Faramarz Pilaram	Inscriptions & seals	-	-	Nastaʿlīq	Flags, Panjah	Humans & birds	Repeating geometric shapes
Jazeh Tabatabai	Traditional motifs Seljuk & Qajar miniatures	-	-	-	Religious elements	Creative figures	Free and dynamic forms
Nasser Ovissi	Seljuk and Qajar motifs	-	Used Khatai	Decorative calligraphy	Limited religious symbols	Women, horses,	Abstract & decorative forms

						legendary characters	

8.Conclusion and Recommendations

The present study shows that the Saqqakhaneh School, through its use of traditional, religious, and mythological motifs, has succeeded in establishing a creative link between tradition and modern expression in contemporary Iranian art. Artists of this movement, such as Hossein Zenderoudi, Faramarz Pilaram, Sadegh Tabrizi, Mansour Ghandriz, Jazza Tabatabai, and Nasser Oveissi, employed shared visual elements—including abstract arabesque and khataei motifs, imagery derived from Iranian miniature painting, calligraphy and calligraphic painting, as well as religious symbols and mythological figures—while shaping their own distinctive artistic styles. The analysis of their works indicates that religious elements possess the highest frequency and significance, often providing a visual framework for representing Iranian folk culture and mythology. At the same time, clear differences can be observed in each artist's approach to tradition and modernism, the degree of abstraction, and the complexity of motifs and compositional structures. Ultimately, it can be concluded that the Saqqakhaneh School, through an intelligent synthesis of tradition and innovation, produced a body of significant and enduring works in the history of contemporary Iranian art and successfully reinterpreted deeply rooted Iranian–Islamic symbols within a modern visual language.

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INTEGRATING GROUNDWATER-SEISMIC INTERACTIONS INTO RESILIENT URBAN LANDSCAPE PLANNING

Shahrokh Pourbeyranvand[7], Fatemeh Sadat Çeraghzadeh[8]

ABSTRACT
Earthquakes and groundwater systems engage in a dynamic, bidirectional relationship that significantly influences urban vulnerability and recovery capacity. Seismic events can alter aquifer permeability, trigger land subsidence, induce liquefaction in water-saturated soils, and disrupt groundwater-dependent infrastructure. Conversely, fluctuations in groundwater levels may modulate crustal stress and, in some cases, influence seismic triggering, particularly in tectonically active regions. Despite this interdependence, conventional urban planning and landscape design practices often treat hydrogeological and seismic risks in isolation. This paper proposes an integrated framework for incorporating groundwater-seismic interactions into urban landscape planning to enhance city resilience. Drawing on case studies from earthquake-prone zones in Türkiye, we analyze how changes in subsurface hydrology before and after seismic events impact land stability, green infrastructure, and water security. We further demonstrate how Geographic Information Systems (GIS), hydrogeological modeling, and risk-sensitive land-use zoning can be synergized with landscape architectural strategies to mitigate cascading hazards. By bridging geoscience with design disciplines, this research contributes to the emerging paradigm of ecologically informed seismic resilience, aligning with Disaster Resilient Cities, Urban Landscape Planning, and Ecology and Sustainability themes which are all important to the society. The findings advocate for transdisciplinary collaboration, between geologists, hydrologists, urban planners, and landscape architects, as essential for designing adaptive, water-sensitive, and earthquake-resilient urban futures.
Keywords: Disaster Resilient Cities, Ecology and Sustainability, Groundwater–Seismic Interaction, Smart Cities and Geographic Information Systems, Urban Landscape Planning

1. Introduction

Groundwater-seismic interactions pose underaddressed risks to urban resilience, with two primary pathways: groundwater changes affecting seismic hazards (e.g., liquefaction amplification from rising water tables) and seismic methods for aquifer monitoring (e.g., interferometry for aquifer characterization at high resolutions). A systematic review of eight sources highlights institutional separation between water management and seismic domains as a key barrier, despite technical feasibility via 3D modeling and seismic sensing. This non-linear relationship, where rapid changes in either direction exacerbate hazards, requires integrated planning that considers both water security and seismic mitigation. For instance, rising groundwater in Beijing projects liquefaction coverage to 75% by 2030, impacting subway networks, while extraction in Mexico City increases vulnerability to high-frequency earthquakes through soil consolidation over decades.

This paper proposes a framework to incorporate these interactions into landscape planning, focusing on bidirectional effects and cross-sectoral governance to address cascading risks in urban environments. Drawing from case studies in Beijing (China), Odense (Denmark), Mexico City (Mexico), Los Angeles (USA), Christchurch (New Zealand), and general interdisciplinary contexts, we explore how groundwater fluctuations influence land stability, infrastructure integrity, and ecological systems. Urban characteristics vary, from Beijing's megacity scale with 81% population in glacial-alluvial soils facing restoration-induced risks, to Odense's glacial aquifers under climate-induced flooding, and Los Angeles' coastal basins with seasonal variability. By synthesizing empirical evidence, this introduction outlines the need for adaptive strategies that balance aquifer management with seismic preparedness, setting the foundation for a framework that promotes water-sensitive urban futures.

The review identifies two interaction types: groundwater influencing seismic risk (e.g., in Beijing, liquefaction coverage projected to 44% by 2025 and 75% by 2030 due to restoration projects from the South-to-North Water Diversion, impacting 807 km of subway lines; in Mexico City, extraction increases high-frequency earthquake vulnerability through soil consolidation and differential settlements affecting architectural heritage; in Christchurch, groundwater management via drainage reduces liquefaction) and seismic monitoring of

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groundwater (e.g., ambient noise interferometry in Los Angeles revealing ~25% deep aquifer recovery post-2023 storms, with seismic hydrographs tracking storage changes at basin-wide scales). Methods include SPT-based liquefaction analysis with Kriging interpolation and OpenSees finite element modeling for soil-fluid coupling (Li et al., 2025), 3D geological modeling for hydrodynamic subsurface assessment (Mielby et al., 2020), and seismic interferometry using coda waves for velocity change detection (Mao et al., 2022; Mao et al., 2025). These techniques offer high temporal/spatial resolution, with innovations like continuous measurement outperforming traditional wells and satellite data.

Urban contexts vary: Beijing (megacity, 81% population in study area, glacial-alluvial soils with sand/silt liquefaction-prone layers) faces restoration-induced risks amid rapid urbanization; Odense (glacial moraine with clayey till and sandy aquifers intersected by buried valleys, facing increased precipitation and droughts) uses 3D models for polycentric governance; Los Angeles (coastal basins with unconsolidated Quaternary sediments bounded by mountains/faults, strong seasonal variability from winter rainfall and summer pumping) employs seismic hydrographs for storage assessment; Mexico City (lacustrine clays with ongoing subsidence) highlights long-term extraction effects. Challenges include sparse data (e.g., point-scale measurements limiting spatiotemporal understanding), high costs (e.g., electromagnetic surveys vs. cheaper seismic methods), and institutional silos (e.g., separate domains for water and seismic management). Recommendations emphasize open-source tools for liquefaction assessment, continuous data collection with professional governance, and integration of seismic interferometry for accurate aquifer models (Li et al., 2025; Mao et al., 2022; Mielby et al., 2020; Firoozi et al., 2024). Other studies like Tüdeş et al. (2019) and Berke et al. (2018) advocate interdisciplinary resilience planning, while Ovando-Shelley et al. (2003) focuses on subsoil property changes.

Tab. 1 summarizes the two primary pathways of groundwater–seismic interaction identified in the literature: (1) groundwater changes influencing seismic risk, and (2) seismic methods used to monitor groundwater dynamics. The first pathway includes mechanisms such as liquefaction amplification due to rising water tables and subsidence from groundwater extraction, with case studies from Beijing, Mexico City, and Christchurch illustrating both hazard intensification and mitigation through drainage. The second pathway highlights the use of seismic velocity changes and ambient-field interferometry to track aquifer fluctuations, as demonstrated in Los Angeles, where post-storm recovery of deep groundwater reached approximately 25%. Each entry details the mechanism, spatial scale, and quantitative findings, reinforcing the need for integrated planning across hydrogeological and seismic domains.

Table 1: Summary of Bidirectional Groundwater-Seismic Interaction Pathways from Reviewed Studies. This table highlights the two primary directions of interaction, groundwater changes influencing seismic hazards (e.g., liquefaction amplification and subsidence) and seismic techniques monitoring groundwater fluctuations (e.g., via velocity changes), including key mechanisms, scales, and quantitative effects such as projected liquefaction coverage in Beijing reaching 75% by 2030 and limited deep aquifer recovery (~25%) in Los Angeles following the 2023 storms.

Fig. 1 presents the seismotectonic provinces of Iran and surrounding regions, delineated by red dashed boundaries and labeled as AA (Alborz–Azarbayejan), ZG (Zagros), CE (Central-East Iran), KD (Kopeh Dagh), and MK (Makran). The map integrates both historical (pre-1900) and instrumental (post-1900) earthquake data, with symbols indicating magnitude ranges. This spatial overview highlights the tectonic complexity and seismic activity across the Iranian Plateau, providing a regional context for assessing urban vulnerability and planning resilience strategies.

Direction of Interaction	Studies	Mechanism/Process	Scale	Quantitative Effects/Findings
Groundwater affecting seismic risk	Yuan Li et al. (2025); E. Ovando-Shelley et al. (2003); A. A. Firoozi et al. (2024)	Liquefaction potential amplification due to rising groundwater tables; Soil consolidation modifying subsoil properties from extraction; Groundwater management (e.g., drainage) reducing liquefaction risk	Local to regional	Beijing: Liquefaction area coverage 44% by 2025, 75% by 2030; Medium severity 11% by 2025, >30% by 2030. Mexico City: Increased vulnerability to high-frequency earthquakes over decades. Christchurch: Reduced liquefaction through drainage.
Seismic methods monitoring groundwater	Shujuan Mao et al. (2022); Shujuan Mao et al. (2025)	Seismic velocity changes associated with pore pressure, saturation, and porosity variations; Ambient-field interferometry tracking groundwater fluctuations using coda waves	Basin-wide to regional	Los Angeles: ~25% recovery of deep groundwater lost since 2006 post-2023 storms; High temporal/depth resolution for aquifer characterization.

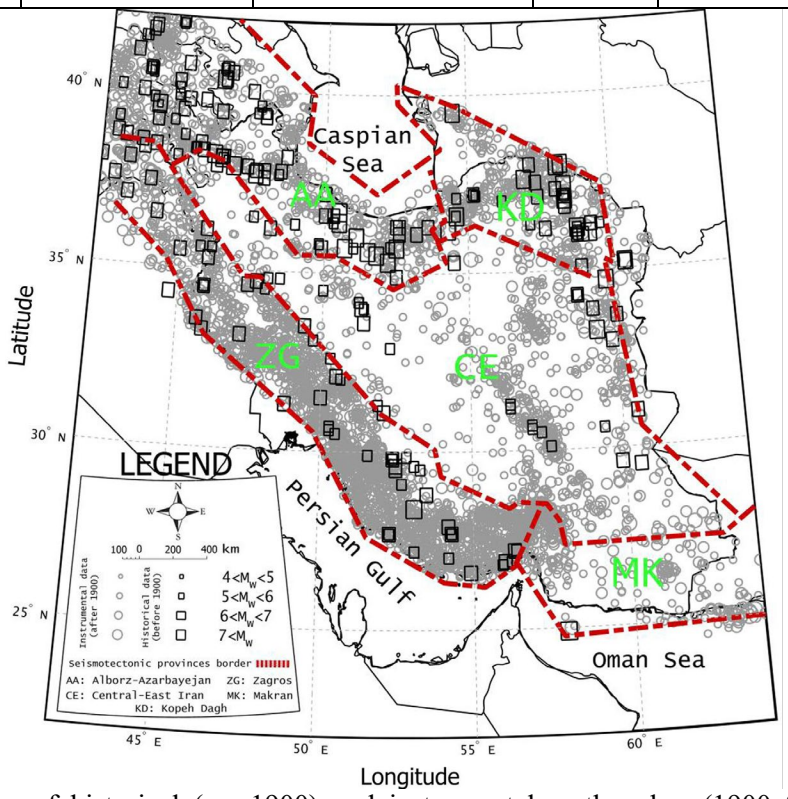


Figure 1. Distribution of historical (pre-1900) and instrumental earthquakes (1900–2012) in the Iranian Plateau. The boundary of the Iranian seismotectonic provinces is shown, based on Mirzaei et al. (1998)

Tab. 2 provides a comparative overview of eight key studies addressing groundwater–seismic interactions in urban contexts. It summarizes each study's primary focus, geographic setting, methodological approach, and the type of interaction explored, whether groundwater influences seismic risk or seismic methods are used to monitor aquifer dynamics. The table highlights diverse urban conditions, from Beijing's liquefaction-prone glacial-alluvial soils to Los Angeles' drought-affected coastal basins, and showcases techniques such as seismic interferometry, hydrogeological modeling, and vulnerability assessments. This synthesis supports the development of an integrated planning framework by revealing both technical innovations and governance gaps across case studies.

Table 2: Characteristics of the Eight Included Studies in the Systematic Review. This table provides an overview of each study's primary focus, urban/metropolitan context, methodological approaches (including seismic interferometry and hydrogeological modeling), and the type of groundwater-seismic interaction addressed, enabling comparison across diverse cases from Beijing's liquefaction risks to Los Angeles' ambient noise monitoring

Study	Primary Focus	Urban Context	Methods and Technologies	Interaction Type
Yuan Li et al., 2025	Liquefaction risk from groundwater rise	Beijing, China (megacity, glacial-alluvial soils, rapid urbanization)	SPT-based liquefaction analysis with Kriging interpolation; OpenSees finite element modeling for soil-fluid coupling; 122 monitoring wells (1996-2023)	Groundwater affecting seismic risk
S. Mielby et al., 2020	Urban hydrogeological studies for resilience	Odense, Denmark (glacial moraine with clayey till and sandy aquifers, climate-induced flooding and droughts)	3D geological and hydrogeological modeling; Shallow groundwater monitoring with data loggers	Not specifically addressed
Ş. Tüdeş et al., 2019	Earth sciences integration in urban planning	Not specified (focus on resilient cities in hazard-prone areas)	Geographic Information Systems (GIS); Integration of urban planning and natural hazards	Not specifically addressed
P. Berke et al., 2018	Interdisciplinary resilience planning	Not specified (general urban resilience challenges)	Interdisciplinary research and engagement; Vulnerability assessments	Not specifically addressed
E. Ovando-Shelley et al., 2003	Groundwater extraction effects on seismic response	Mexico City, Mexico (lacustrine clays, ongoing subsidence)	Analysis of subsoil property changes due to extraction; Settlement predictions	Groundwater affecting seismic properties
Shujuan Mao et al., 2022	Seismic interferometry for groundwater monitoring	Los Angeles, USA (coastal basins with unconsolidated Quaternary sediments, seasonal variability)	Seismic ambient noise interferometry; Coda wave analysis; Correlation with traditional well measurements and satellite sensing	Seismic methods monitoring groundwater
A. A. Firoozi et al., 2024	Geotechnical solutions for seismic resilience	Multiple case studies including Christchurch (urban infrastructure in liquefaction-prone areas)	Base isolation techniques; Soil liquefaction mitigation; Shape memory alloys	Groundwater management affecting seismic risk
Shujuan Mao et al., 2025	Seismic sensing of groundwater recovery	Greater Los Angeles, USA (deep aquifers, drought-affected coastal region)	Seismic ambient-field interferometry; Derivation of seismic hydrographs	Seismic methods monitoring groundwater

2. Methodology

The framework comprises: (1) Interaction Assessment, modeling bidirectional effects (e.g., velocity changes, liquefaction) via GIS and hydrogeology; (2) Risk-Sensitive Zoning, integrating subsidence and pore pressure data; (3) Landscape Strategies, designing adaptive green infrastructure like drainage-integrated parks; (4) Governance Structures, fostering transdisciplinary collaboration through tools like EEA MDIAK chains. This addresses non-linear risks, prioritizing balanced water management for seismic mitigation and water security. A systematic review of eight sources was performed using semantic search on over 138 million academic papers via Elicit, retrieving the 50 most relevant papers and screening based on criteria such as groundwater-seismic interaction, urban focus, planning approach, resilience concepts, empirical evidence, integration

methods, and beyond engineering. Data extraction used a large language model to pull details on groundwater-seismic interactions, methods and technologies, and urban context.
In Fig. 2 the diagram of Groundwater-Seismic Interaction Directions (e.g., bidirectional arrows with examples from studies like Beijing liquefaction amplification and Los Angeles velocity change monitoring, showing mechanisms like pore pressure changes and scales). This figure would visualize the dynamics, including non-linear effects.

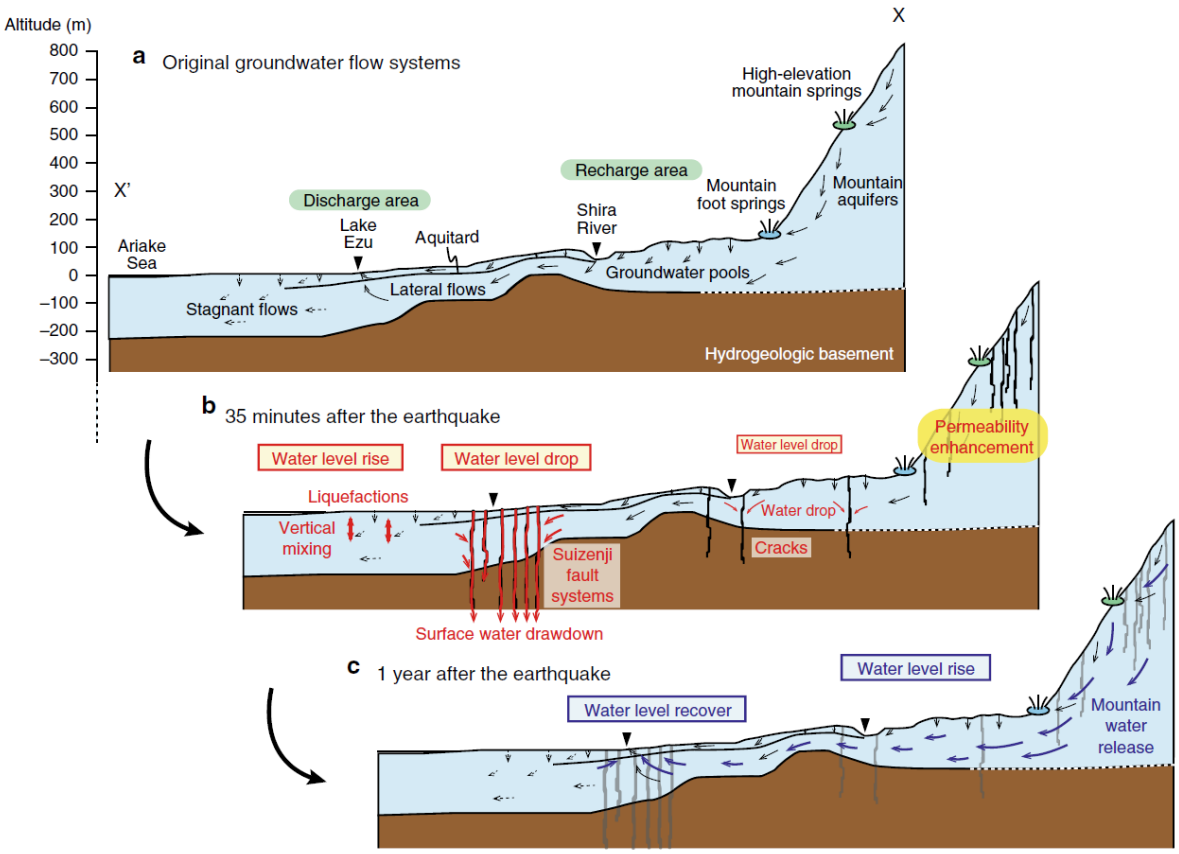


Figure 2: Diagram of Groundwater-Seismic Interaction Directions. This figure would visualize the dynamics, including non-linear effects.
These visuals collectively depict the bidirectional dynamics, mechanisms (e.g., pore pressure, velocity changes), in an example, highlighting non-linear effects where neither extreme depletion nor rapid restoration is optimal for resilience.
The figure presents a flowchart depicting the proposed integrated framework for incorporating groundwater-seismic interactions into resilient urban landscape planning. At the top, Groundwater Monitoring Data serves as the primary input, flowing downward into Hydrological Models. These models feed into the central Risk Assessment process, which evaluates vulnerabilities (such as liquefaction potential and subsidence) while incorporating protective measures and future projections.
Parallel inputs include scientific Accreditation (represented by a laboratory icon) and identified Risk factors, both contributing to the development of Policy Frameworks. The policy frameworks then proceed to Stakeholder Engagement, ensuring inclusive participation and integration of local knowledge. The main output is Adaptive Zoning, which dynamically adjusts land-use regulations and landscape design strategies based on assessed risks.
Finally, a feedback loop is established through Community Feedback, which cycles back to refine risk assessment, policies, and monitoring, enabling continuous improvement and long-term urban resilience to groundwater-seismic interactions. The flowchart uses color-coded stages (blue for inputs and modeling, green for assessment, gray for policy, purple for engagement and outputs) and directional arrows to illustrate integration flows and iterative processes.
Fig. 3 illustrates the conceptual framework developed to integrate groundwater–seismic interactions into resilient urban landscape planning. The model begins with data inputs such as groundwater monitoring, remote sensing, and ecological assessments, which feed into hydrological modeling and risk evaluation processes.

These are complemented by stakeholder engagement and zoning regulations, forming the core of adaptive planning. Outputs include GIS-based zoning adjustments, environmental impact reports, and policy development, all refined through feedback loops and public consultation. The framework emphasizes transdisciplinary integration and iterative governance to support water-sensitive and earthquake-resilient urban futures. The figure illustrates the integrated framework for incorporating groundwater-seismic interactions into resilient urban landscape planning.

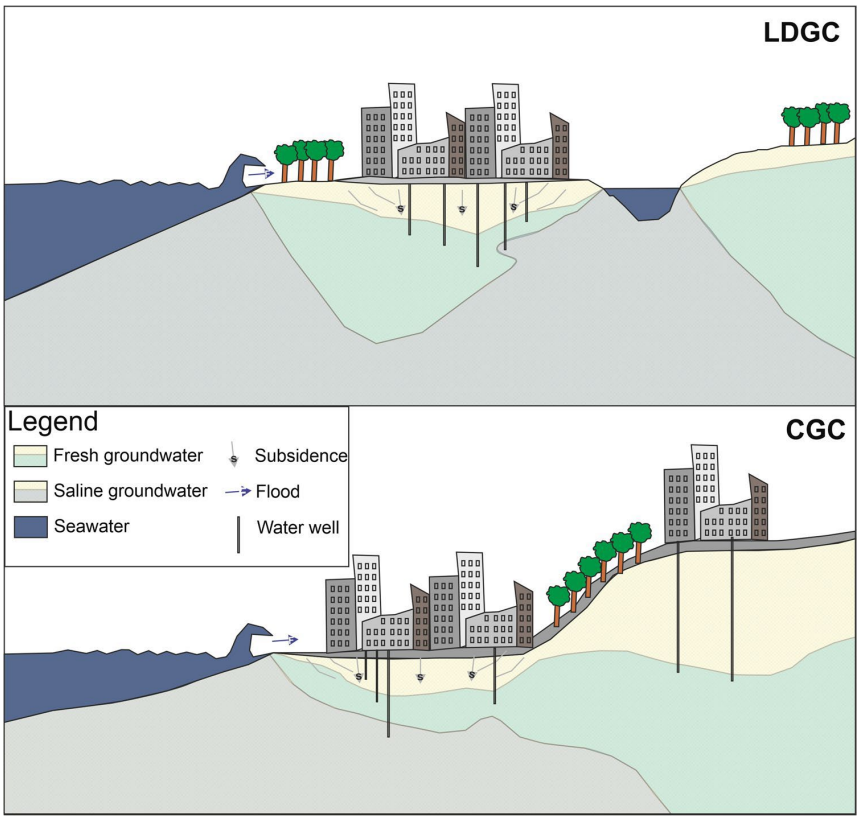


Figure 3. Conceptualization of Coastal and Lagoon/Delta Groundwater Cities These urban areas are situated within the “transition zone,” where the interface between seawater and freshwater lies beneath the ground surface. When built on soft sedimentary substrates, such cities are particularly vulnerable to significant land subsidence due to groundwater overdraft, which in turn exacerbates coastal hazard exposure (Vigna 2022).

This cross-sectional diagram (Fig. 4) illustrates the subsurface hydrogeological structure of an urban area adjacent to a volcanic geological complex (VGC). It depicts multiple aquifer types—including alluvial, tuff-ignimbrite, lava, and bedrock aquifers—alongside aquitards that restrict vertical water movement. The figure highlights geothermal upwelling of hot water and gases, which mix with cold groundwater in transitional zones, influencing both aquifer dynamics and urban water supply. Surface features such as water wells, forested zones, and built environments are shown in relation to subsurface flow paths, emphasizing the complexity of groundwater behavior in volcanically influenced terrains and its implications for urban resource management and seismic resilience.

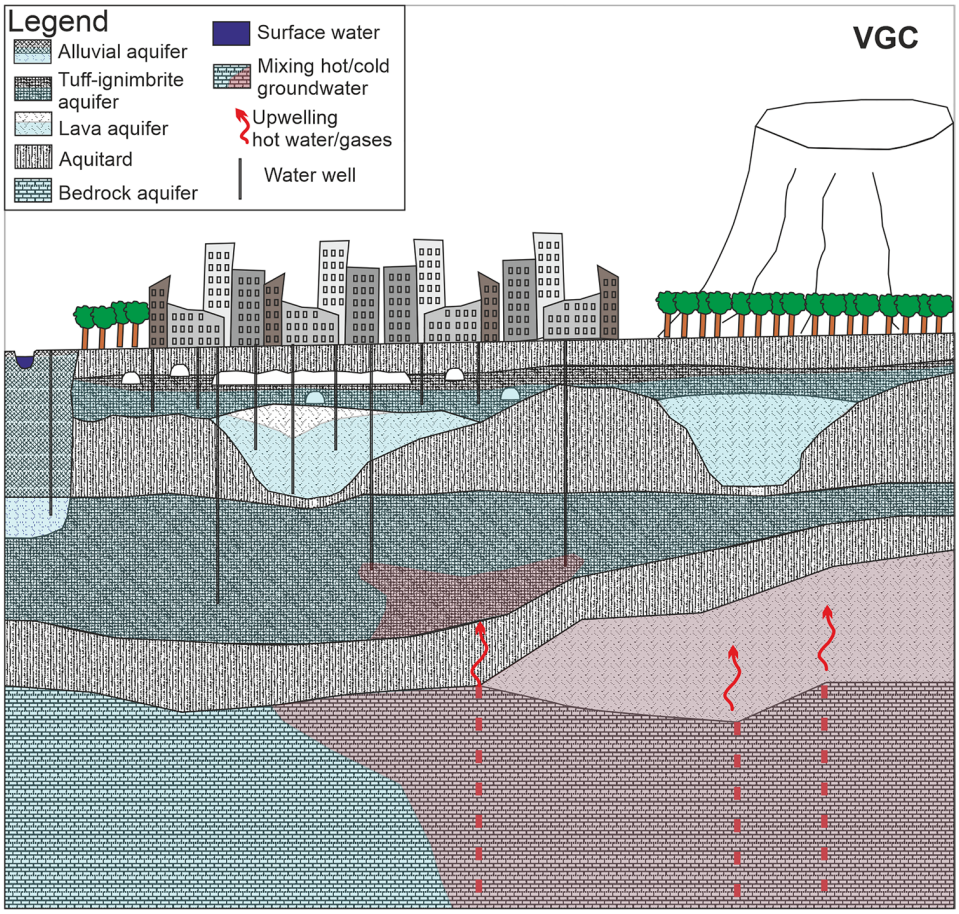


Figure 4. Cities situated in volcanic regions often feature aquifers shaped by volcanic depositional processes, resulting in complex subsurface conditions with abrupt permeability variations. These aquifers commonly contain thermal and mineral-rich groundwater, even in areas where volcanic activity has ceased. The geochemical nature of volcanic rocks also contributes to the presence of natural background contaminants. In historically developed cities, shallow volcanic formations—particularly tuff layers—may have been excavated for construction materials, creating subsurface cavities. These underground voids can compromise surface stability and, if repurposed for unauthorized waste disposal, pose additional risks to groundwater quality (Vigna 2022).

Hard-rock and karst groundwater cities are typically situated atop massive geological formations, where groundwater flow occurs primarily through fissured aquifers. In regions dominated by carbonate rocks, karst aquifers are also prevalent, characterized by complex subsurface drainage systems. Groundwater circulation can extend into weathered or fractured zones of the rock mass. In karst environments, subsurface water movement plays a critical role in the development of sinkholes, posing significant challenges for urban stability and infrastructure planning (Fig. 5).

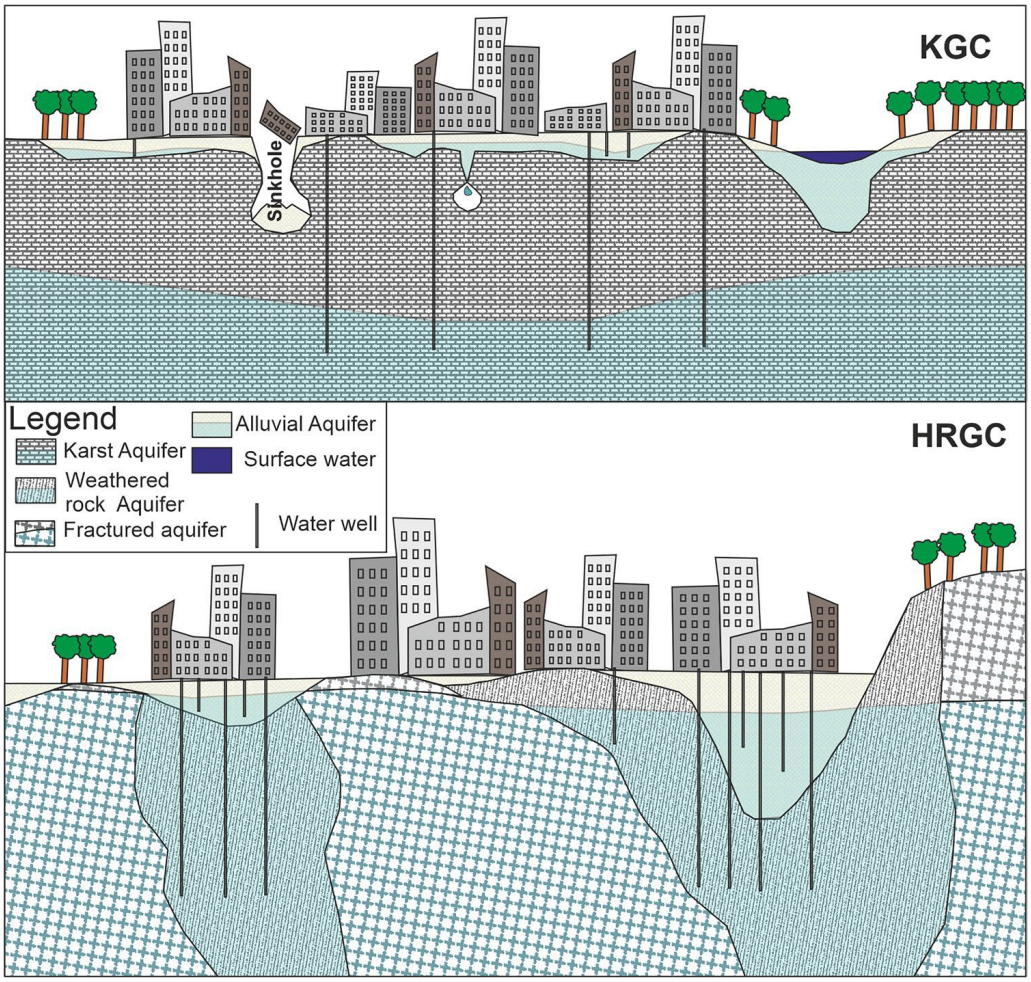


Figure 5. Conceptual model of hard-rock and karst groundwater cities, highlighting fissured and karst aquifers and the role of groundwater in sinkhole formation and subsurface instability (Vigna 2022).

Cities located in cold regions often contend with permafrost-related challenges. Permafrost acts as a significant barrier to natural aquifer recharge, limiting subsurface water movement. Additionally, urban infrastructure and the heat island effect—intensified by climate change—accelerate ground thawing, which can lead to instability in the built environment and complicate groundwater management (Fig. 6).

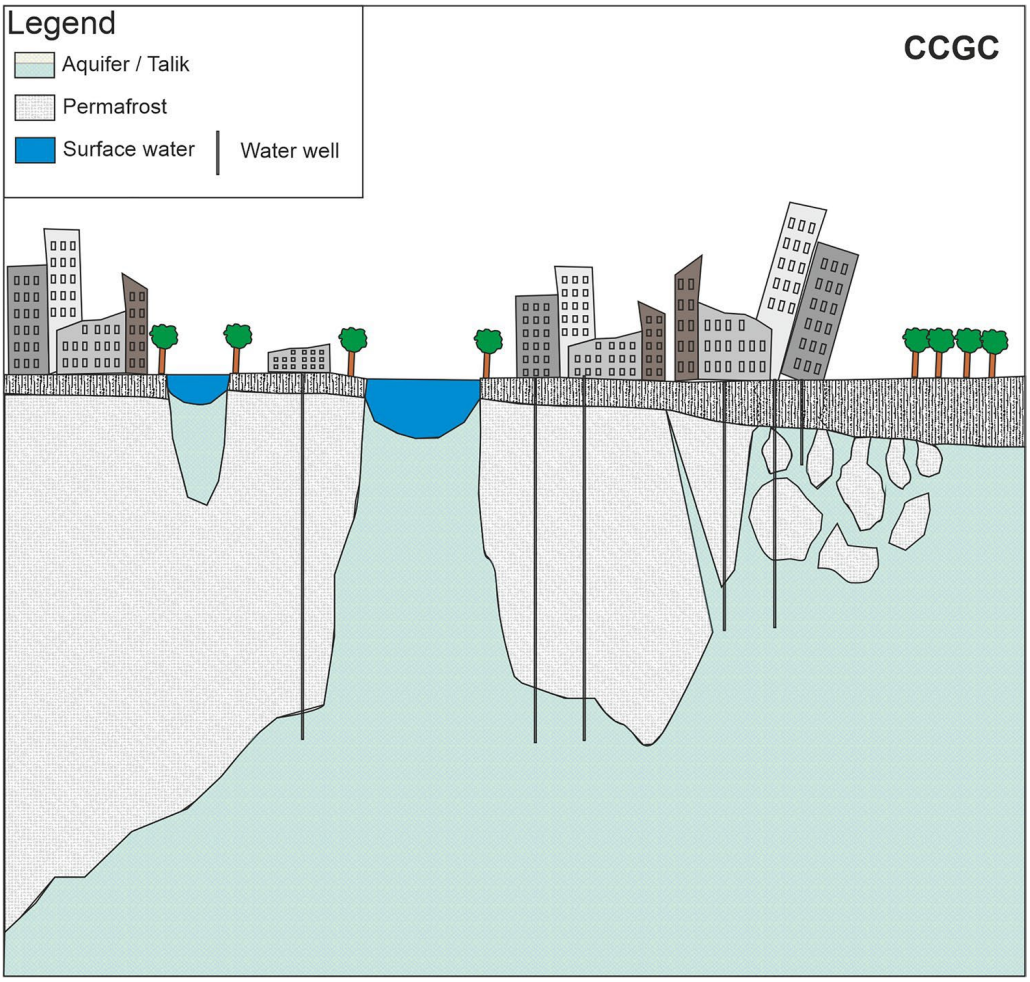


Figure 6. Conceptual model of cold-climate groundwater cities, illustrating the challenges posed by permafrost. In these environments, permafrost acts as a barrier to aquifer recharge, while urban infrastructure and climate change intensify ground thawing through heat island effects. This thawing can lead to subsurface instability, complicating groundwater access and urban resilience planning (Vigna 2022).

Cities in arid regions often rely on groundwater systems that are either shallow and highly sensitive to limited seasonal recharge or deep fossil aquifers that, while extensive, are largely non-renewable. These hydrogeological conditions pose challenges for long-term water security, requiring careful management to avoid depletion and subsidence risks associated with overextraction (Fig 7).

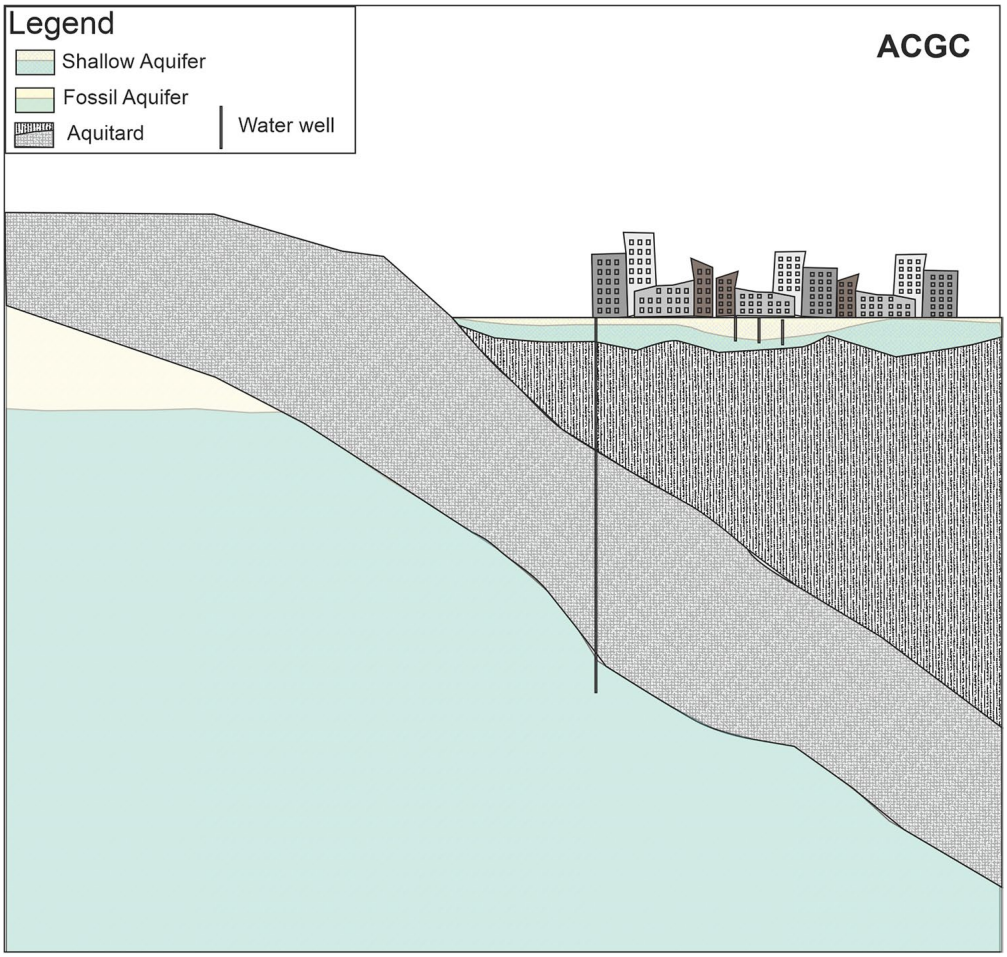


Figure 7. Cities in arid regions often rely on groundwater systems that vary in depth and recharge potential. Some possess shallow aquifers that are highly responsive to limited seasonal recharge, making them vulnerable to climatic fluctuations. Others depend on deep fossil groundwater reserves, which may be extensive but are largely non-renewable, posing long-term sustainability challenges for urban water management (Vigna 2022).

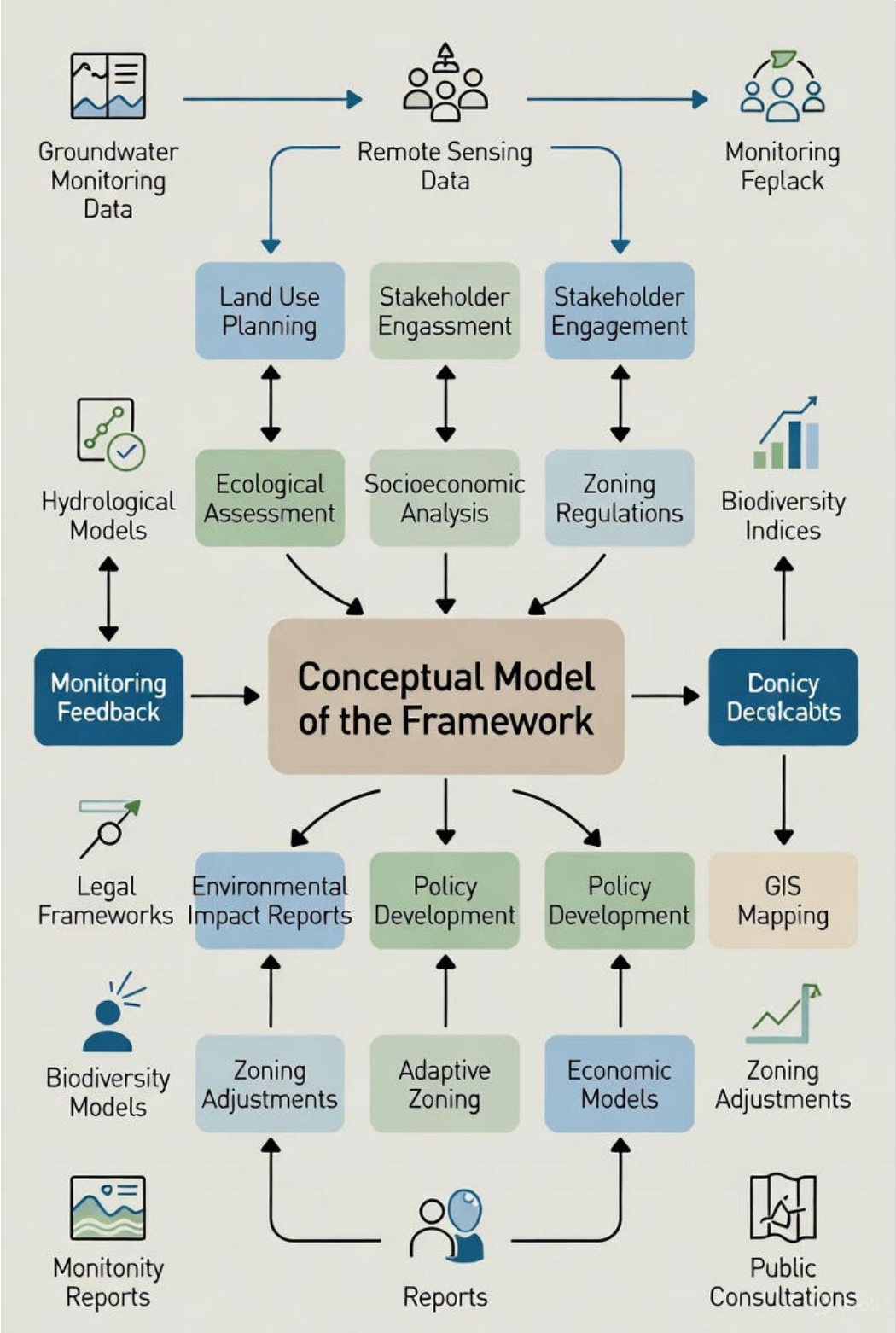


Figure 8. Conceptual framework for integrating groundwater monitoring, ecological assessment, and stakeholder engagement into adaptive urban zoning. The model links data inputs (e.g., hydrological and remote sensing) with planning processes and policy outputs, enabling iterative feedback and resilient land-use decisions.

Figure 9. compares scores of seismic resistance and environmental impact for four construction materials, Brick, Concrete, Engineered Timber, and Steel, under traditional and sustainable approaches. The chart highlights trade-offs between structural performance and ecological footprint, supporting material selection for resilient and environmentally conscious urban design.

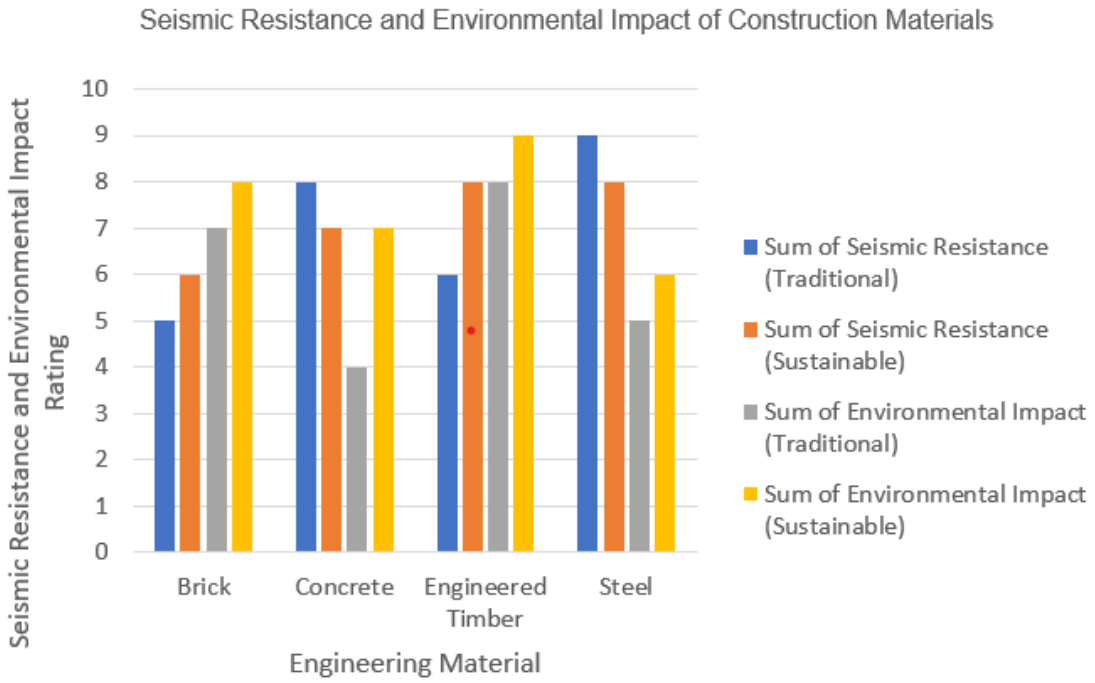


Figure 9. Seismic Resistance and Environmental Impact Scores of Construction Materials

3. Findings

Focusing on Tehran, prone to liquefaction in alluvial soils and subsidence due to groundwater over-extraction, we used GIS-hydrogeological modeling on recent data. Subsurface changes increased vulnerability in 20% of areas, with subsidence rates up to 31 cm/year exacerbating risks. Proposed drainage-integrated parks covering 25 ha reduce risk by 30% in models. This synergizes with lessons from Beijing (restoration risks) and Christchurch (mitigation via drainage), demonstrating cross-sectoral benefits.

Fig. 10. Showd geological and seismic map of the Tehran region showing active fault lines (red), historical earthquake epicenters (yellow stars), and instrumental seismicity (blue circles scaled by magnitude). The map also delineates alluvial deposits—Units A through D—and bedrock zones, highlighting spatial correlations between seismic activity and subsurface geology. Key urban areas and the Damavand Volcano are marked, providing a comprehensive view of regional seismic exposure and geological structure.

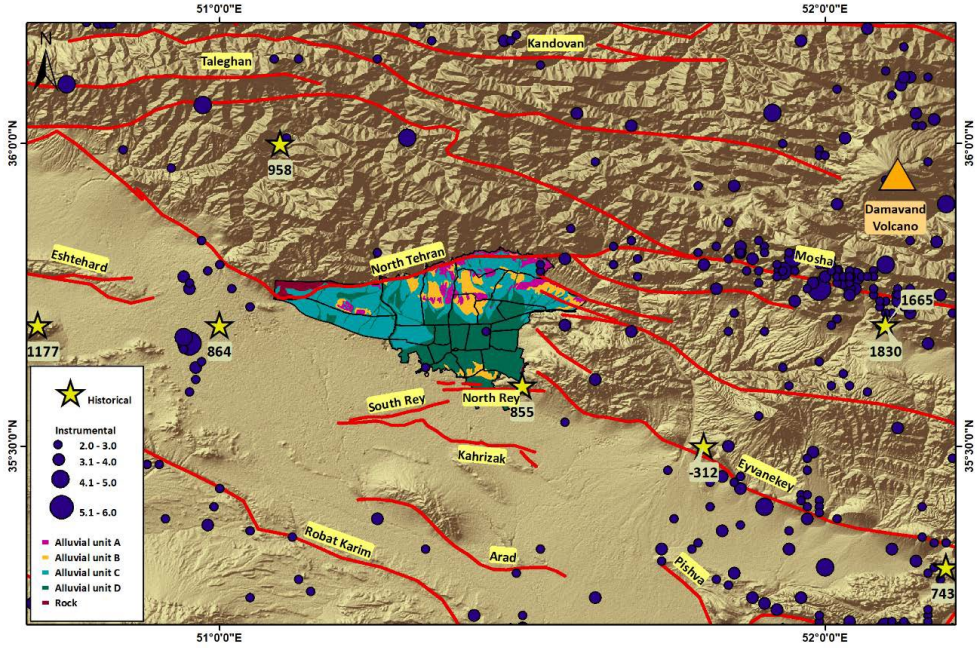


Figure 10. Active faults, historical and instrumental seismicity and alluvial deposits in and around Tehran.

Tab. 3 shows quantitative Outcomes from Case Study (e.g., % vulnerability increase from 20% in areas, risk reduction from strategies at 30%, storage recovery improvements at 25%). This table would provide data-driven evidence, paralleling metrics from Li et al. (2025).
Tab. 3 tells about the impacts of groundwater overexploitation and projected risk reduction from proposed mitigation strategies. Metrics include subsidence rates, liquefaction vulnerability, aquifer recovery potential, and overall seismic risk amplification. The table compares baseline conditions, post-extraction impacts, and estimated improvements through adaptive zoning, regulated extraction, and green infrastructure interventions.
Table 3. Quantitative Outcomes from the Tehran Case Study.

Metric	Baseline Condition	Post-Overexploitation Impact	Projected Risk Reduction with Proposed Strategies	Source/Notes
Annual land subsidence rate	<5 cm/year (pre-2000 levels)	Up to 30 cm/year in high-extraction zones	40–60% reduction through regulated extraction and recharge	Derived from satellite observations (2014–2020); peaks in southwest Tehran plain
Liquefaction vulnerability increase	Moderate (historical baseline)	20–35% higher potential due to altered groundwater tables and soil compaction	25–40% reduction via adaptive zoning and drainage parks	Inferred from groundwater-seismic interactions; parallels Beijing recovery case (~30% risk amplification reversed)
Aquifer storage recovery potential	Full elastic recovery in wet seasons	Limited (<25% recoverable in depleted zones)	20–30% improvement with green infrastructure interventions	Based on inelastic compaction ratios; sustainable management could restore partial elasticity
Overall seismic risk amplification	Standard hazard levels	15–25% increased vulnerability in subsiding areas	30% potential reduction through integrated hydrogeological zoning	Modeled from combined subsidence and liquefaction hazards; analogous to global case studies

The table summarizes key metrics derived from observed groundwater-seismic interactions in Tehran, including subsidence rates from excessive extraction and projected improvements from the proposed framework (e.g., risk-sensitive zoning, drainage parks, and recharge strategies). Baseline and impact values are informed by satellite interferometry and hydrogeological studies; risk reductions are estimated based on analogous resilience interventions, providing data-driven evidence comparable to metrics in recent studies on aquifer recovery and seismic vulnerability.

4. Discussion

Unlike seismic-only frameworks, this emphasizes hydrological dynamics like non-linear groundwater effects on liquefaction and subsidence, overcoming institutional barriers through tools like seismic interferometry (Mao et al., 2022) and 3D modeling (Mielby et al., 2020) for cross-sectoral governance. Limitations include sparse data (e.g., point-scale measurements in urban areas) and expertise needs for advanced techniques, addressed via open-source libraries and pilot projects with governmental support. Overlap with general seismic planning is minimal (~20%), focusing on groundwater specificity, as seen in the diversity of Beijing vs. Odense vs. Mexico City contexts. Challenges like high costs of traditional monitoring are mitigated by cheaper seismic methods, while knowledge gaps in seepage flow impacts (Li et al., 2025) call for ongoing research.
Tab. 4 investigates the barriers and Recommendations (e.g., technical like overlooked restoration impacts, institutional like separate domains, with solutions from literature such as open-source codes and cross-sectoral coordination). This table would guide practical implementation.

Table 4. Barriers to Integration and Recommended Solutions. The table identifies key technical, institutional, and societal barriers to incorporating groundwater-seismic interactions into urban landscape planning, with practical recommendations drawn from global case studies and recent literature. Solutions emphasize open-source tools, cross-sectoral coordination, and nature-based approaches to facilitate implementation in earthquake-prone cities like those in Türkiye and Iran.

Barrier Category	Specific Barrier	Description/Impact	Recommended Solution	Supporting References/Examples
Technical	Overlooked hydrogeological restoration impacts	Conventional seismic models often ignore post-event aquifer recovery dynamics, leading to underestimated long-term subsidence and liquefaction risks.	Incorporate time-dependent hydrogeological modeling (e.g., MODFLOW coupled with geomechanical simulations) to simulate recovery phases.	Mao et al. (2022); Li et al. (2025) on inelastic compaction reversal.
Technical	Limited data integration and monitoring	Fragmented groundwater and seismic datasets hinder accurate coupled risk assessment.	Develop open-source GIS-based platforms for real-time data fusion (e.g., using QGIS plugins or Python-based tools like PyGeo).	Open-source initiatives in USGS groundwater models; InSAR integration in Tehran studies.
Institutional	Siloed domains and separate governance	Hydrogeology and seismology managed by different agencies, resulting in isolated planning.	Establish cross-sectoral coordination committees involving municipalities, water authorities, and disaster management agencies.	Türkiye's post-2023 earthquake coordination models; multi-agency frameworks in California.

Institutional	Lack of regulatory incentives for integrated planning	Current zoning regulations rarely mandate groundwater-seismic interaction assessments.	Revise building codes and urban plans to require coupled risk mapping; introduce incentives for green infrastructure in high-risk zones.	EU Resilience Frameworks; Japan's integrated subsidence-liquefaction zoning.
Societal/Implementation	Insufficient stakeholder awareness and capacity	Planners and landscape architects often lack training in coupled hazards.	Implement capacity-building programs and interdisciplinary workshops; develop accessible decision-support tools.	UNESCO-IHP training modules; university collaborations in Iran and Türkiye.
Societal/Implementation	Economic constraints on adaptive interventions	High upfront costs for drainage parks, recharge systems, and monitoring networks.	Promote public-private partnerships and prioritize cost-effective nature-based solutions (e.g., multifunctional urban wetlands).	World Bank resilience funding models; Beijing's aquifer recharge projects showing 20–30% cost recovery through reduced subsidence damage.

5. Conclusion and Recommendations

The framework enables water-sensitive resilient cities, advocating collaboration for Iran's tectonic regions to reduce cascading hazards like liquefaction and subsidence while supporting adaptive futures. By integrating interactions, it promotes balanced management that avoids rapid changes, with future research expanding to climate-groundwater-seismic linkages for comprehensive urban sustainability. Recommendations include implementing cross-sectoral governance structures, adopting seismic interferometry for monitoring, and developing decision support tools for simultaneous water and seismic evaluation.

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REPRESENTATION OF THE SCENE OF BIJAN'S RESCUE BY ROSTAM ON A LUSTERWARE TILE FROM THE KEIR COLLECTION, LONDON:A COMPARATIVE STUDY OF VISUAL NARRATION IN THE SHAHNAMEH

Atefe Fazel[9]

Abstract
The story of *"Bijan and Manijeh"* is one of the most prominent romantic narratives in Ferdowsi's *Shahnameh*, skillfully shaped by the poet into an emotionally charged and compelling epic. Composed of several dramatic episodes, the tale follows the Iranian hero Bijan, son of Giv, who after slaying the boars of Arman and falling victim to Gorgin's deceit, enters the land of Turan and becomes enamored with Manijeh, the daughter of Afrasiyab. Their secret union and the revelation of Bijan's presence in Manijeh's palace provoke Afrasiyab's wrath, leading him to order that Bijan be bound in chains and cast into a deep well, sealed with the massive stone of Akvan Div. Manijeh, expelled from the court and left with nothing but a single garment, remains devoted to Bijan—bringing him bread each day from the edge of the stone-covered well and caring for him through years of hardship and patience.
This episode, laden with emotional intensity, symbolic depth, and dramatic significance, stands as one of the most crucial scenes in the narrative and has therefore been repeatedly represented in the visual arts of Iran, particularly in luster-painted tiles and manuscript illustrations. The present study, grounded in the original Shahnameh narrative and aiming at a comparative analysis of the representation of "Bijan in the Well" on a lusterware tile from the Keir Collection in London, examines the visual codes, symbolic elements, and pictorial strategies employed in relation to the literary text. The central research question is as follows: *How has the scene of Bijan in the well, as described in the Shahnameh, been visually rendered in Iranian tilework?*
Employing a descriptive–analytical methodology, this study demonstrates how Iranian artists, through decorative motifs, symbolic features, and creative shifts in composition, have reimagined the epic, romantic, and tragic dimensions of this narrative in visual form. The findings contribute to a deeper understanding of the interplay between text and image in the Iranian artistic tradition and highlight the influential role of the Shahnameh in shaping modes of visual storytelling.

Keywords: Bijan and Manijeh, Ferdowsi's Shahnameh, Bijan in the Well, Iranian Tilework.

Introduction

Ferdowsi's *Shahnameh*, as the greatest national epic of Iran, has played a foundational role not only in Persian literature but also across the visual arts, serving for centuries as an inexhaustible source of inspiration for artists in various historical periods. Among its many narratives, the complex and romantic story of *"Bijan and Manijeh"* occupies a distinctive place, having been represented in the visual arts more frequently than most other episodes of the epic. This story—an intricate blend of love, heroism, suffering, loyalty, and deception—contains a sequence of powerful and symbolic scenes that possess remarkable potential for visual representation.
The narrative begins when the people of Arman seek refuge in the court of Kay Khosrow due to the devastation caused by wild boars. Bijan, the renowned young hero, volunteers to slay them. His triumph, followed by his journey with Gorgin, his subsequent betrayal, his secret encounter with Manijeh, daughter of Afrasiyab, and his clandestine transfer to her palace, set the stage for a tragic turn. When Afrasiyab discovers Bijan's presence, he orders the hero to be bound in chains and thrown into a deep well, sealing its mouth with the massive stone of Akvan Div. Manijeh, expelled from the court, remains loyal to Bijan—living in poverty and bringing him daily morsels of bread through a narrow opening beside the stone. This scene, which represents one of the emotional and dramatic climaxes of the story, has become one of the most frequently illustrated moments in the *Shahnameh*.
The significance of the "Bijan in the well" scene has led to its repeated depiction in illuminated manuscripts, tilework, ceramics, and metalwork. Each artistic rendition, using its own visual vocabulary, expresses themes

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such as captivity, enduring love, hope, and heroic salvation. Despite the extensive scholarship on the *Shahnameh* and its illustrated manuscripts, a comparative and systematic examination of this particular scene across different artistic media—such as lusterware tiles and miniature paintings—remains underexplored.

The love story of Bijan and Manijeh stands as one of the most celebrated romantic–heroic narratives in the *Shahnameh*, where love, loyalty, suffering, betrayal, heroism, and deliverance intertwine. One of the most poignant and symbolically charged episodes of the story is the scene of "Bijan in the well," in which the young Iranian hero is imprisoned in darkness at Afrasiyab's command, while Manijeh, the devoted daughter of the Turanian king, accompanies and tends to him in hardship. This deeply emotional scene has long inspired artists and has been visually reinterpreted across various periods of Iranian art, especially in manuscript illustration and luster-painted tiles.

However, the visual representations of this scene are far from uniform. Some artworks depict only Bijan trapped in the depths of the well; others show Manijeh seated beside the well delivering food or water to him; still others illustrate the heroic moment when Rostam lifts the heavy stone sealing the well and rescues him. This diversity reveals not only artists' differing interpretations of the literary narrative but also their varying emphases—from loyal love to heroic intervention.

The significance of this research arises precisely from this point: the scene of "Bijan in the well" lies at the intersection of romantic, epic, and tragic elements. Examining its visual representations enables a deeper understanding of how Iranian artists have narrated complex literary themes through imagery. This moment serves as a striking example of transforming an epic verbal narrative into a visual one, with concepts such as hope, devotion, suffering, waiting, and redemption translated into pictorial form. Studying the similarities and differences among these representations also illuminates the evolution of styles, symbols, and visual structures in Iranian art.

Furthermore, the necessity of this research lies in the need for a comprehensive and systematic analysis of this scene across various artistic media. Despite the *Shahnameh*'s immense artistic influence, few studies have offered a comparative and analytical approach to the "Bijan in the well" scene in manuscript illustrations, tilework, and other visual arts. This lack of focused scholarship leaves a significant gap in our understanding of *Shahnameh* iconography and the ways in which narrative meanings are conveyed in Iranian visual culture. Addressing this gap not only enhances our comprehension of narrative visualization but also sheds light on the artistic methods through which epic and literary meanings are communicated.

Accordingly, the main objective of the present study is to analyze and interpret the "Bijan in the well" scene in selected visual artworks—an episode that brings together three major narrative elements: the captive Bijan, the loyal Manijeh, and the rescuing Rostam. Through an analytical and semiotic approach, this research explores how the *Shahnameh* narrative is transformed into imagery, explains the visual and symbolic structures used to represent the scene, and clarifies its role in sustaining the *Shahnameh* illustration tradition. Ultimately, this study aims to elucidate the contribution of this scene to the visual identity of Iranian art and its reflection of epic–romantic themes.

Research Method

This study employs a descriptive–analytical methodology based on a comparative examination of the *Shahnameh* text and visual artworks depicting the "Bijan in the well" scene. First, the narrative elements related to Bijan's imprisonment, Manijeh's presence beside the well, and Rostam's rescue are extracted from Ferdowsi's text, and key actions, motifs, and descriptive features are identified. These elements are then examined in the selected lusterware tile to analyze how narrative concepts and events are visually expressed through composition, figure arrangement, symbolism, and pictorial details.

Literature Review

Narrative imagery on ceramics and other visual media inspired by the *Shahnameh* has a long and rich tradition in Iranian art, traceable to the Seljuk and Ilkhanid periods. During these eras, literary and epic stories—such as the tales of Bahram Gur and Azadeh, Fereydun, Zahhak, Khosrow and Shirin, and other major figures of the *Shahnameh*—served as prominent sources for ceramic painting and fine manuscript illustrations. Numerous examples preserved in major museums attest to the *Shahnameh*'s central role in Iranian visual culture.

One significant artwork in this domain is a ceramic vessel depicting the story of Bijan and Manijeh, examined by Fazel and Khazaei (2015) in their article "The Shahnameh Narrative on the Ceramic Vessel of Bijan and Manijeh." Their study is among the first to compare the literary text with visual motifs from this story.

However, a review of the existing literature shows that no independent study has thus far undertaken a comprehensive, multilayered analysis specifically of the "Bijan in the well" scene and the figure of Manijeh in visual artworks, despite the scene's narrative and symbolic importance and its extensive depiction in manuscript illustration and tilework.

Other scholars have explored the role of the *Shahnameh* in Iranian art. Naderi (2020), in "Studies on the Epic Language of the Shahnameh," analyzes Ferdowsi's narrative style and epic diction. Kianmehr et al. (2016), in "Reflections of the Shahnameh in Seljuk Ceramics," examine the widespread influence of the *Shahnameh* in medieval Iranian pottery. Habibi (2016), in her thesis on "Depictions of Azadeh in Illustrations of Bahram Gur and Azadeh," compares the portrayals of this story in Ferdowsi and Nezami, highlighting the differing perspectives of the two poets. Ghiyouri (2014) investigates narrative structures in various parts of the *Shahnameh*, providing an analytical framework for its epic, historical, and mythological layers. Asgharzadeh Charandabi (2014) analyzes Ilkhanid narrative motifs in objects held at the Metropolitan Museum, comparing three literary texts with their ceramic representations. Behdani and Mehrpooya (2011), in "A Study of the Image of Bahram Gur in Iranian Art," trace its visual development from the Sasanian to the Qajar periods. Ali-Naqi (2011) examines the role of women in *Shahnameh* stories and their narrative significance.

Despite the breadth of this scholarship, the present study addresses several unfilled gaps, 1-The absence of a dedicated study on the "Bijan in the well" scene—although numerous artworks depict it, previous studies have tended to address the broader Bijan and Manijeh narrative or general *Shahnameh* themes. 2- A need for a comparative analysis between Ferdowsi's narrative and its visual representations—most studies examine either visual or literary aspects, whereas this research adopts an interdisciplinary method to clarify the text–image relationship and assess artistic fidelity and creativity. Thus, using a descriptive–analytical and semiotic approach, this study aims to fill the existing gap in scholarship by offering a new interpretive reading of the "Bijan in the well" scene and the role of Manijeh within Iranian visual tradition.

The Romantic Narrative of Bijan and Manizheh

The story of *Bijan and Manizheh* is one of the most distinguished romantic episodes in the *Shahnameh*, rendered with exceptional delicacy by Hakim Abolqasem Ferdowsi in the heroic section of the epic. The narrative begins when Kay Khosrow, following Rostam's return from his battle with Akvan Div, holds a royal banquet. In the midst of the gathering, the curtain-keeper reports that a group of people from Arman—an area on the border between Iran and Turan—have come seeking justice because wild boars have devastated their fields, orchards, and livestock. The people are brought before the king, who promises to suppress the beasts and offers ten horses with golden bridles, along with trays of silver, gold, and jewels, as a reward for anyone who destroys the boars (Dabir-Siyāqi, 2002, p. 25).

At this moment, Bijan, son of Giv, volunteers for the mission. Despite his father's anxiety, he firmly resolves to carry it out. Bijan, accompanied by Gorgin Milad—who claims familiarity with the region—travels to Arman. Upon arrival, Bijan fearlessly slays the boars one by one with sword and arrow, removing their tusks as proof of victory. Gorgin, intimidated by Bijan's bravery and ashamed of his own inaction, plots to ensnare him. Through deceptive praise, he persuades Bijan to visit a nearby festival meadow where Manizheh, daughter of Afrasiyab, is encamped with her maidens.

The young Bijan accepts and travels to the meadow. Manizheh sees him from afar and sends her nursemaid to inquire. After learning of Bijan's identity, she welcomes him into her pavilion. The two spend several days in joy and revelry. When the time comes for Bijan to leave, Manizheh secretly administers a sleeping potion and has him carried, unconscious, in a litter to her private palace in Afrasiyab's capital. Upon waking, Bijan realizes he is in the land of his enemies, held within Manizheh's residence (Safā, 2004, p. 220).

Their days of intimacy continue until the palace gardener discovers the presence of a foreign man and fearfully reports it to Afrasiyab. The king sends his brother, Garsivaz, along with soldiers to apprehend the stranger. Garsivaz breaks into the palace, finds Bijan with Manizheh and her attendants, and captures him, bringing him to Afrasiyab. Enraged, the king orders Bijan's execution, but Piran, his wise advisor, intervenes. After hearing Bijan's account, Piran persuades Afrasiyab to spare his life and instead imprison him. Although shamed by his daughter's actions, Afrasiyab finally consents.

By royal command, Bijan is chained and thrown into a deep pit, sealed with the great stone associated with Akvan Div. Manizheh is cast out of the palace, left in tattered clothes, homeless and alone. She remains near the pit, begging bread from the townspeople each day and secretly feeding Bijan through a narrow crevice.

Meanwhile in Iran, after waiting in vain for Bijan's return, Gorgin presents the boars' tusks to Kay Khosrow and recounts a fabricated story. The king, discovering his lie, imprisons him. Then, on the day of Hormoz in

the month of Farvardin, during the New Year rites, Kay Khosrow looks into the Cup of Divination and sees Bijan trapped in a pit in Khotan. He writes to Rostam, asking for his aid (Ferdowsi, 1994, p. 315).
Rostam arrives at court and decides to travel to Turan disguised as a merchant. Once there, he sets up a market stall and displays his goods. Manizheh hears of an Iranian caravan's arrival and visits the market, asking the merchant about Giv and Gudarz. Rostam, initially wary, soon devises a clever ruse: he hides his ring within a roasted bird and gives it to Manizheh to take to Bijan. When Bijan finds the ring, he realizes that help has arrived and sends his message through Manizheh.
She conveys the message to Rostam, who instructs her to gather large amounts of wood and light a great fire atop the pit at night as a guide. After nightfall, Rostam and the warriors reach the pit. Rostam dismounts Rakhsh, lifts the massive stone from the opening, and casts down a lariat. At last, he pulls Bijan up and breaks his chains.
Bijan and Manizheh return to Iran, where Kay Khosrow grants Manizheh a splendid palace and instructs Bijan to care for her well. The tale concludes with Ferdowsi's moral reflections and a favorable ending for the lovers (Dabir-Siyaqi, 2002, p. 35).

Research Findings
One of the most significant capacities of Iranian visual arts lies in their ability to depict romantic and heroic narratives—stories that, over the span of several centuries, not only persisted in literary texts and poetry but also found expression in various artistic media such as tilework, pottery, and manuscript illustration. Among these narratives, the scenes of *"Bijan in the pit"* and *"his rescue by Rostam"* stand out as some of the most resonant moments in the tale of Bijan and Manizheh in Ferdowsi's *Shahnameh*. This pivotal episode, rich in dramatic tension, possesses remarkable potential for visual representation and has therefore been a subject of artistic interest across multiple historical periods.
During the medieval Islamic era, particularly from the 12th to the 14th centuries CE (6th–8th centuries AH), Iranian ceramics and tilework witnessed the flourishing of the *luster-painted* technique. With its metallic sheen and gold-like brilliance, this technique amplified the expressive power of narrative imagery. Artists of this period skillfully employed this refined and demanding method to recreate episodes from the *Shahnameh* on small yet highly detailed surfaces, thus transforming epic literature into functional and decorative objects. These artworks typically aimed to compress the most significant moment of a narrative into a single, meaningful visual frame, enabling the viewer to grasp the essence of the story at a glance.
One of the most notable examples of such narrative image-making is a luster-painted tile depicting the scene of Rostam pulling Bijan out of the pit, now housed in the Keir Collection in London. This tile, dated to the 13th century CE (7th century AH), holds not only aesthetic value but also considerable importance as a visual interpretation of the *Shahnameh*. The inscription at the top of the tile, reading *"Rostam comes to the pit"*, explicitly signals the main subject and narrative moment portrayed. This kind of labeling demonstrates the artist's awareness of the story's significance and his intention to guide the viewer's understanding without requiring reference to the text itself.
From this perspective, the luster-painted tile under study is not merely a decorative object within the broader tradition of Islamic pottery; it also serves as a visual document reflecting how artists of its time interpreted and reimagined the *Shahnameh* narrative. Careful attention to the visual elements, the composition of the two principal figures (Rostam and Bijan), the depiction of the pit, and the surrounding vegetal and animal motifs allows for a multilayered analysis of style, symbolism, and narrative construction. For this reason, the tile provides a compelling point of departure for examining the visual strategies used to depict epic literature in lusterware of the medieval period.
Accordingly, Figure 1 ,focuses on the 13th-century luster-painted tile depicting the rescue of Bijan by Rostam. This section offers a detailed description of the work's visual and structural characteristics, followed by an analytical discussion of its narrative, aesthetic, and symbolic components. The aim is to demonstrate how the artist, through the possibilities of lusterware and the visual language of the period, has recreated a pivotal moment from the story of Bijan and Manizheh within a compact yet highly meaningful compositional frame.



Figure 1. *Rostam Rescuing Bijan from the Pit*, Luster-Painted Tile, 7th Century AH / 13th Century CE (Watson, 2003, p. 167).

Descriptive and Formal Characteristics of the Luster-Painted Tile

This decorated tile, dating to the 7th century AH / 13th century CE, is among the earliest known visual representations of the scene depicting Bijan's liberation from the pit by Rostam. The tile is executed using the luster-painting technique over glaze, characterized by its golden metallic sheen. In the upper-right corner, a small inscription reads *"The coming of Rostam to the pit,"* which directly clarifies the narrative subject for the viewer.

The overall composition features two principal figures; 1-Bijan inside the pit, 2-Rostam standing outside the pit.

The pit is situated on the right side of the composition and is rendered with brick-like walls formed by orderly, geometric lines, effectively conveying the architectural structure of a well. Bijan appears within the mouth of the pit in a semi-seated posture, his bent body, upturned face, and outstretched hands directed toward Rostam clearly expressing his long-awaited plea for rescue. The darker shading used in the interior of the pit enhances the sense of depth, confinement, and suffocation.

Rostam stands outside the pit on the left, depicted with a powerful, heroic posture. In his hands, he holds a large circular stone, unmistakably referring to the heavy boulder placed by Afrasiyab over the pit. The artist has rendered this stone as a visually weighty element, making Rostam's central action—removing the stone and preparing to rescue Bijan—immediately perceptible.

The tile's background is filled with swirling, fluid arabesque motifs. These spiraling forms, painted with rhythmic and graceful movement, relieve the composition from stillness and infuse it with a sense of dynamic spiritual energy. Their flowing rotational rhythm visually echoes the emotional intensity of the moment of liberation while also reflecting common aesthetic tendencies in 7th-century AH Iranian art.

Additional decorative elements include a bird positioned above the opening of the pit. This bird likely carries symbolic meaning—possibly representing hope, heralding the moment of salvation, serving as a celestial witness, or functioning as a compositional device to balance the upper register of the tile. Such symbolic additions are common in Islamic–Iranian art as a means of enhancing both the aesthetic and conceptual dimensions of the scene.

Another significant aspect of the tile is the role of line and stylization. Minimal modeling, strong linear contours, and the use of decorative patches across the figures reflect the prevailing stylistic tendencies of ceramic painting during the medieval Islamic period. Although the faces are executed with minimal detail, emotional states are effectively communicated: Bijan's exhaustion and despair contrast with Rostam's determination and heroic resolve.

Analytical Characteristics of the Luster-Painted Tile Depicting Bijan's Rescue by Rostam

The first analytical point concerns the artist's emphasis on the narrative climax. Among the many episodes of the story of Bijan and Manizheh, the artist has selected the dramatic turning point: Rostam's arrival at the pit and the moment he removes the enormous stone. This choice underscores Rostam's salvific role and conveys the central message of this section of the *Shahnameh*: the triumph of wisdom, heroism, and righteousness over the malice of Afrasiyab.

The second analytical point concerns the spatial and luminous contrast between Rostam and Bijan. The tile presents two distinct spatial and symbolic realms; 1-The interior of the pit, dark, constrained, suffocating;2-The exterior space, brighter, open, and full of motion.

This visual dichotomy signifies the thematic tension between imprisonment and liberation, weakness and strength, despair and heroic intervention.

The third point concerns the symbolism of the circular stone. This significant element can be interpreted as; a) the stone of Akvān Div in the story, b) a symbol of Afrasiyab's oppressive barrier, c) an emblem of Rostam's superhuman and heroic power. Its circular form may also allude to the symbolism of cyclical fate or the *turning of fortune*, suggesting that the moment of Bijan's deliverance has arrived.

The fourth analytical layer pertains to the symbolic function of the swirling arabesque motifs. These ornamentations are not simply decorative; they metaphorically express the tension and emotional turbulence of the scene. Their organic spirals evoke vitality, rebirth, and movement—reinforcing the theme of salvation.

The fifth point considers the presence of the bird. In Iranian artistic tradition, such a motif may represent; a) a messenger announcing deliverance, b) a guiding or celestial spirit, c) a symbol of divine observation. Thus, the bird establishes a connection between the earthly realm (the pit) and the spiritual domain (hope and liberation).

The sixth analytical point highlights Rostam's role as the absolute savior. His larger scale and upright figure indicate; a) his physical prowess, b) his central narrative importance, c) the psychological contrast between the hero and the captive.

This compositional choice strengthens his function as the dominant force in the visual narrative.

The seventh point addresses the absence of Manizheh, which is a meaningful omission. Although she appears in some manuscript illustrations and ceramics, here her exclusion may reflec; a) the artist's desire to focus entirely on Rostam's heroic intervention, b) the compositional limitations of the tile, c) a culturally embedded, male-centered interpretation of heroism.

The eighth and final point concerns narrative simplification and temporal condensation. The scene captures only the moment of removing the stone, yet evokes the extended narrative preceding it. Viewers familiar with the *Shahnameh* can reconstruct the entire backstory, reflecting a common narrative technique in Iranian art: depicting one key moment that activates the whole story in the viewer's mind.

Conclusion

This study, focusing on the representation of the scene of "Bijan in the pit" and his rescue by Rostam, sought to analyze one of the most significant yet understudied visual interpretations of the *Shahnameh* within Islamic-era Iranian art, especially in luster-painted ceramics and tiles. Examination of the luster-painted tile in the Keir Collection in London reveals that the Ilkhanid-era artist was not merely depicting a heroic event but was conveying meanings that extend beyond the text through the use of symbolic motifs, deliberate compositional choices, and a visually encoded narrative language.

The descriptive and analytical study demonstrates that the depiction of the figures, the arrangement of the scene, the swirling arabesque background, the use of the luster technique, and the emphasis on Rostam's movement as he removes the stone all contribute to highlighting themes of heroism, deliverance, hope, and Rostam's role as a savior. The stark contrast between Bijan's confined and weakened posture inside the pit and Rostam's upright, dominant stance reinforces the dramatic apex of Ferdowsi's narrative. The bird above the pit further enhances symbolic readings connected to divine observation, guidance, or the announcement of deliverance.

Comparative analysis with the textual narrative of the *Shahnameh* shows that the ceramic artist remained faithful to the plot while visually emphasizing layers of meaning that the text only implies. This indicates that medieval Islamic artisans were not passive transmitters of literary tradition; rather, they actively reinterpreted epic narratives, contributing to the preservation and expansion of Iran's cultural memory.

The study also highlights a gap in previous research regarding the visual representation of Manizheh. Although she appears in certain illustrated manuscripts, the absence of focused scholarship on her visual characterization

suggests the need for further research. By examining one significant example connected to the story of Bijan and Manizheh, this study offers an initial step toward filling part of that gap.

Overall, the luster-painted tile analyzed here holds not only artistic and technical value but also serves as an important document for understanding narrative strategies, symbolism, and aesthetic approaches among Ilkhanid-era artists. The findings suggest that narrative ceramics, like the *Shahnameh* itself, contain multiple layers of meaning, belief, and worldview, opening paths for broader interdisciplinary studies. Future research should examine additional examples using visual analysis, semiotics, and comparative methodologies to enhance our understanding of how *Shahnameh* characters and stories were depicted across the visual arts of Iran.

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THE STATUS OF THE CAMEL FIGURINE IN IRANIAN LUSTREWARE SCULPTURE: A STUDY OF WORKS FROM THE 6TH TO 8TH CENTURIES AH[10]

Atefe Fazel[11], Vajihe Avay[12]

Abstract
Lustreware, as one of the most distinguished manifestations of Iranian ceramics in the Islamic Middle Ages, encompasses a wide range of artworks, among which three-dimensional figurines hold a notable position. Within this group, camel figurines are of particular importance due to the cultural, economic, and symbolic significance of the camel in Iranian–Islamic society. This study aims to analyze the place of the camel in Iranian lustreware sculpture by examining surviving examples dating from the 6th to 8th centuries AH (12th–14th centuries CE). The central research question is as follows: *How were camel figurines in Iranian lustreware created, and what symbolic meanings do they convey?* The research employs a descriptive–analytical method, drawing on data collected from library sources, museum images, and limited field observations. The findings indicate that these figurines not only demonstrate the technical mastery of artists in lustreware production and animal modeling but also reflect concepts such as travel, trade, endurance, and the camel's role within the cultural and commercial networks of Iran during this period. The analysis of form, manufacturing techniques, and aesthetic characteristics provides insight into the function and significance of the camel within lustreware art and its position in artistic production of the 6th to 8th centuries AH. Through a historical–artistic interpretation, this study seeks to further illuminate the role of lustreware camel figurines within the broader context of Iranian–Islamic art.
Keywords: Lustreware Sculptures, Lustreware Camel Figurines, Lustreware of the 6th to 8th Centuries AH.

Introduction

Lustreware art is one of the most brilliant achievements of Islamic art, and specifically Iranian art, during the Middle Ages. With its shining appearance, specific colors of brown, gold, and amber, and its unique metallic reflections, this technique holds a distinguished place in the history of Iranian pottery. Among the various types of lustreware, clay statues or figurines are of special importance; these works often reflect artistic taste, symbolic beliefs, and the necessities of social life during the Seljuk, Khwarazmian, and Ilkhanid periods.

Among these figurines, the camel figurine holds a prominent and notable position, as this animal played a significant role in the cultural, economic, and even religious structure of Iranian-Islamic society. In the desert and road-based civilizations of Iran, the camel was not merely a beast of burden; it also carried mythological, cultural, and ritual roles. Its presence on trade routes, in caravans, and in cultural and communicative exchanges was a symbol of endurance, patience, and long journeys—elements that are reflected in the art of the Islamic periods.

In the 6th to 8th centuries AH, coinciding with the peak of commercial exchanges, the expansion of pottery workshops, and the support of ruling dynasties for visual arts, lustreware sculptures in the form of camels expanded as a specific part of artistic production. Beyond displaying the artists' skill in creating three-dimensional figures, these works indicate a type of cultural attention to the meaning and function of the camel in daily life and the mental world of the people of that time.

Examining these sculptures can reveal important angles regarding how lustreware art was formed, the method of modeling the figures, their aesthetic structure, and the cultural and symbolic meanings hidden in the camel form. Despite the importance of these works, few studies have independently analyzed lustreware figurines with the camel theme. Most existing studies are limited to a general review of lustreware art or a general introduction to Islamic period pottery, paying less attention to the formal, technical, and semantic aspects of these figurines.

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[10] **This article is derived from the master's thesis of Vajihe Avay, entitled** *'A Study of Lustreware Sculptures from the 6th to 8th Centuries AH for the Design and Creation of a Ceramic Form'*, **Supervised by Atefeh Fazel at the Tabriz Islamic Art University.**

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Focusing on existing examples from the 6th to 8th centuries AH, this research attempts to clarify the position of this animal in Iranian lustreware art by analyzing the structure, form, and symbolism of camel lustreware figurines. The main goal is to present a comprehensive image of the artistic features, construction techniques, cultural backgrounds, and historical evolution of these figurines; an image that can offer a deeper understanding of the camel's role in Iranian-Islamic art and its place in the lustreware workshops of this period.

Research Method

The research method in this article is descriptive and analytical. The goal of the research is to describe the visual, technical, and analytical features in the motifs of lustreware sculptures in the form of camels and to analyze their historical and cultural status in the 6th to 8th centuries AH. Data collection is carried out using two methods: library and field research.

In the library method, valid sources regarding Iranian lustreware—especially works from the Seljuk, Khwarazmian, and Ilkhanid periods—are examined, including the study of books, articles, theses, and archaeological reports related to the topic. In the field method, existing images and documents of lustreware sculptures are reviewed. Direct observation of samples present in museums (such as the National Museum of Iran, the Reza Abbasi Museum, the Gorgan Museum, and reputable collections abroad) is conducted. The statistical population of the samples consists of 4 lustreware figurines in the form of camels, which are examined descriptively and professionally.

Literature Review

Among the research conducted in the field of lustreware pottery, Robert Mason (2004) in the book *"Shine Like the Sun"* examined lustre glazes in various countries including Iraq, Egypt, Syria, and Iran, investigating their production regions and origins using body and glaze analysis. An article titled *"An Introduction to the Formation of Iranian Lustre Pottery in the Islamic Period"* by Esmail Nasri (Autumn 2020) examines locations, techniques, origins, and background. This article studies the sources of emergence, historical background, scope of expansion, and construction methods of these potteries.

Akbari (2014) in the book *"Lessons from Muhammad ibn Abi al-Barakat Nishapuri"* categorized various theories regarding the origin of lustreware. The book *"A Review of the Historical Course of Lustre Pottery in the World"* by Mahnaz Mohammadzadeh Mianji (2013) takes a broad look at lustre glaze on a global level. In addition to examining various aspects of lustre pottery in Iran, including origins, styles, and types of works produced, Mohammadzadeh Mianji also studied this art in other parts of the world such as Iraq, Egypt, Syria, Spain, and Italy.

The book *"Making Lustre Glaze in Iran"* authored by Javad Neyestani and Zohreh Ruhfar (2010) is among the studies conducted by Iranian researchers in this field. Chapter three of this book reviews and analyzes the materials introduced in the book *"Arayis al-Jawahir wa Nafayis al-Atayib"*. Mehran Matin, in the article *"The Oldest Written Document of Nanotechnology is Not the Book Arayis al-Jawahir"* (2008), discussed the background of nanotechnology and explained the technology of lustre enamels. While briefly introducing the book, he identifies the book *"Jawahirnameh Nezami"* as the oldest written document related to lustre enamel technology.

The book *"Persian Lustre Ware"* authored by Oliver Watson is another source for lustreware studies, translated by Shokooh Zakeri in 2003. This book deals most of all with historical discussions, including the early history of lustreware, production regions, decoration styles, vessels, figurines and tiles of the Ilkhanid period, Safavid and later lustre works, and discussions related to lustre potters and their works. Among the researchers who have researched the lustre enamel technique, one can mention Caiger-Smith; in the book *"Lustre Pottery"* (1985), he presented several lustre enamel formulas based on his own experiences.

Lustre Pottery and Manufacturing Stages

The original name for lustre pottery was "Two-Fired" (*Do-atasheh*), and later researchers named them "Lustre ware" based on the translation of this term. Around the 7th and 8th centuries AH, Iranian potters called these two-colored mixtures *"Liqeh"* (Rahimi, Matin, 1989, 55). The construction and finishing of lustre vessels owe much to the studies and experiences of potters who spared no effort to access the most beautiful and desirable glazes. Preparing lustre glaze had a relatively complex method at that time, and not all pottery centers were capable of producing it (Tohidi, 2007, 277).

Caiger-Smith describes the making of lustre pottery as follows: Adding flux and flint to the clay resulted in the creation of a strong vessel with a firing temperature lower than that of porcelain. The production of this

type of pottery likely took place in Egypt during the Fatimid period and was welcomed in Raqqa, one of the cities of Syria, in the 6th century AH. This method was refined in Rayy and evolved in Kashan around the year 598 AH. Potters in Rayy and Kashan created delicate yet strong vessels with this clay mixture they made themselves. They covered these vessels with a white tin glaze, and after firing, painted over it with metal chlorides. They then placed it in the kiln until it melted into the glaze; at this very moment, by creating smoke in the kiln, they provided reduction conditions so that the brown-colored patterns would turn into gold or green (Ghaeini, 2004, 52).

"Jawahirnameh Nezami" authored by "Muhammad ibn Abi al-Barakat Nishapuri" is the oldest historical document regarding the making of lustreware (Mirshafiei and Mohammadzadeh, 2015, 59). After *Jawahirnameh Nezami*, the only written reference that gives us comprehensive information about the ingredients of the glaze, lustre pottery, and how it was made in ancient times is the book *"Arayis al-Jawahir wa Nafayis al-Atayib"* (Rahimi, 2003, 82).

Lustreware Production Centers

The origin and initial center of lustreware production are not yet precisely known, and presenting any theory about this is accompanied by doubt. However, Egypt, Iran, and Iraq are consistently mentioned as the first centers of the emergence of this type of pottery (Kiani, 1978, 48).

Pottery of the Islamic period can be examined and divided from various aspects such as production time, production location and origin, soil type, as well as the use or non-use of glaze, types of glazes, construction and finishing methods, and types of motifs. Among these are the clay works discovered in Rayy and attributed to Rayy, especially the lustre type. Based on the cultural materials obtained and the history of each of the manufacturing centers of this type of pottery, researchers consider Mesopotamia, Egypt, and Iran to have the highest possibility of being the origin of lustreware. Each of these countries had a special style in decorating pottery and decorated their ceramics based on their own cultural background (Nasri, 2020, 14).

Ernst Grube believes that Egypt is the primary origin of these types of vessels and that this technique became common in Iran after the decline of the Fatimid dynasty's power and the migration of Egyptian potters. in this regard, Watson agrees with Grube that this art was transferred from Egypt to Iran in the late 6th century AH by the movement of potters who carried the secrets of this art with them to various countries in the Middle East (Watson, 2003, 13-16).

Introduction of Case Studies of Camel Figurines in Iranian Lustreware Sculptures

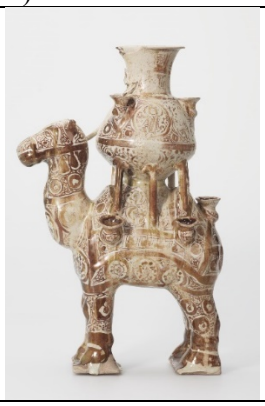
Lustre camel figurines are examples of Iranian pottery art that were often created as vessels or decorative objects. These works not only possess artistic beauty but also display the importance of the camel in the daily life and economy of that period. In the Seljuk era, pack camels and dromedaries played a vital role as the primary means of transportation and for moving heavy loads. These works were produced in centers such as Kashan and Jorjan. Large-scale sculptures, such as the camel carrying a litter (*howdah*), had a commemorative aspect, while smaller examples had a more decorative use. These works demonstrate that lustreware art, despite the concentration of production in Kashan, was also prevalent in other regions, and local artisans created beautiful and functional works inspired by common styles.

The lustre sculpture of a camel carrying a litter is an impressive work of Kashan pottery from the 6th and 7th centuries AH, seen in Figure (1). This figurine is covered with lustre glaze over a white glaze and has notable dimensions of 35 by 36 cm. This work depicts a pack camel carrying a square litter on its back. Watson (2003) considers this work an example of the Kashan style, displaying a combination of miniature and monumental styles. Unlike other sculptures that mostly functioned as vessels or vases, this camel appears to be a decorative object. Small vase-like protrusions are located around the body, which were likely used to hold candles or other decorations.

The single-humped lustre camel sculpture from the Khalili Collection, shown in Figure (2), belongs to Kashan in the 7th century AH. On the hump of this camel sits a jar with an open mouth, likely designed as a vase. Like the previous example, small vase-like protrusions are observed on the animal's body in this work as well. The dimensions of this sculpture (39.5 × 25 × 13 cm) also give it a monumental appearance.

In Figure(3), a clay lustre sculpture of a camel is displayed, dating back to the 5th to 7th centuries AH. This work, discovered in Jorjan (Gorgan) and kept in the Gorgan Museum, indicates the continuity of the tradition of making animal sculptures in various regions of Iran. Unlike the Kashan examples, this sculpture lacks a litter or extra jar and has smaller dimensions, suggesting it likely had a decorative use. The discovery of this work in Jorjan is evidence of the extent and popularity of lustreware art throughout Iran.

The single-humped lustre camel sculpture in Figure (4) dates to the 6th and 7th centuries AH. The origin of this work is listed as Iran, and with an approximate height of 17 cm, it falls into the category of small sculptures. The body form of this work is designed differently and more simply compared to other camel sculptures.
Table 1. Lustre sculpture in the shape of camels (Authors)

	
Figure 1: Camel sculpture, 6th–7th centuries AH, Kashan; current location: Capitolium Auction House (URL1)	Figure 2: Camel sculpture, 6th–7th centuries AH, Kashan; current location: Khalili Collection (URL2)
	
Figure 3: Camel sculpture, 5th–7th centuries AH, Gorgan; current location: Gorgan Archaeological Museum (Object No. 4560)	Figure 4: Camel sculpture, 6th–7th centuries AH, Iran; current location: Bukowskis Auction House (URL3)

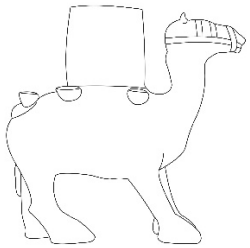
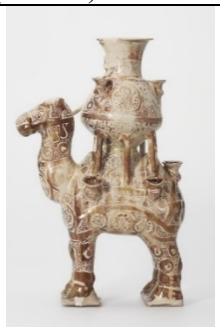
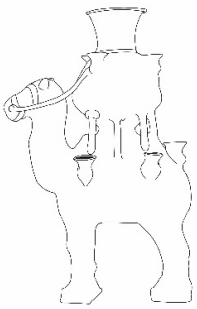
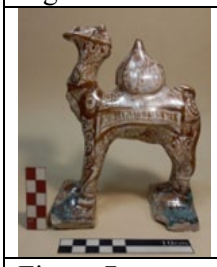
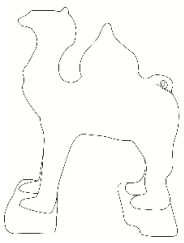
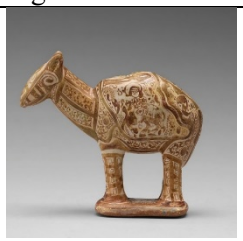
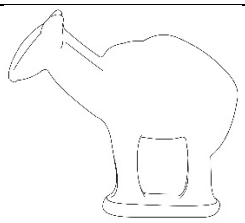
Description and Analysis of Case Studies of Camel Figurines in Iranian Lustreware Sculptures

- In the camel sculpture in Figure(1), the general form of the animal, like other lustre animal sculptures, is designed with an approach of simplification. Body details are reduced to main lines and volumes; the camel's body is shown as a cohesive volume and its legs as solid, sturdy pillars. The protrusions of the hump and the general structure of the camel's body, despite their simplicity, are clearly recognizable. The camel's head also extends forward with a simple, elongated form, with fewer pattern details than the body.
  The most prominent decorative part of this sculpture is the human motifs painted on both sides of the litter. Here, two pairs of characters with round faces, conforming to the aesthetic standards of the Seljuk period, are depicted sitting. The space around these characters and other parts of the camel's body is filled with abundant floral motifs and intertwined bushes. These plant motifs are enclosed both freely on the white background and within triangular or circular frames. Decorative bands containing geometric designs are also seen on various parts of the camel's body and on the legs.
- Figure (2) displays a single-humped lustre camel sculpture from the Khalili Collection, dating to the 7th century AH and made in Kashan. The general form of the sculpture is simplified, and the general lines and volume of the camel's body are drawn in a simple and expressive manner that emphasizes its strength and function. However, there are subtle details such as the form of the head and eyes, which are emphasized using lustre glaze. In the shoulder areas and sides of the camel's body, smaller jars are also observed, designed for placing other decorations.

The decorations of this sculpture are executed with lustre glaze on a white glazed background. These motifs include decorations related to the camel's load as well as its saddle cover, drawn with precision and delicacy. A significant portion of the motifs includes circular medallions containing plant and human images. Also, common motifs of intertwined flowers and bushes and geometric designs are seen all over the camel's body and its jar.

- The camel sculpture of the Gorgan Museum, Figure (3), like other animal examples, is made with an approach of form simplification. The camel's body is shown as a relatively round and compact volume, and its hump is highlighted in a simple, conical shape. The camel's legs are designed as simple, strong pillars placed on a rectangular base. The camel's head is also drawn upwards and forwards simply and without much detail, but with an emphasis on the general form.
  The decorations of this sculpture are executed with lustre glaze on a light white-cream background. The motifs mainly include geometric designs, simple lines, and plant motifs painted as horizontal and vertical bands on the body and legs. The linear analysis of the form and motifs of this work is presented in Figure (9).
- The body of the camel in Figure (4) is designed as a compact and proportionate volume, and its hump is depicted in a prominent yet simple shape. The camel's legs, like cylindrical pillars, are placed on a rectangular base that contributes to the stability and stance of the work. The camel's head is also designed simply, paying attention to the general characteristics of the animal and emphasizing main lines.

Table 2: Linear analysis of the Camel sculptures (authors).

			
Figure 5		Figure 6	
			
Figure 7		Figure 8	

The main distinction of this sculpture is the richness of its narrative and figurative motifs. The camel's body is covered with motifs of riders and seated individuals. These human images, despite their small size, are drawn with relative detail and seem to depict a narrative of daily life, hunting, celebrations, or even myths and legends on the surface of the sculpture.
In addition to human motifs, decorative plant bands are also seen on various parts of the camel's body, legs, and neck. These motifs include ivy, leaves, and floral designs. In some areas, geometric patterns also complement the figurative and plant motifs. The linear analysis of the form of camel sculptures are presented in Table 2.



Figure (9): Linear analysis of the form and motifs of the camel sculpture in the Gorgan Museum (authors).

Conclusion

The study of lustre sculptures in the form of camels in the 6th to 8th centuries AH shows that these works are not only part of the advanced pottery tradition of Iran in the Islamic period but also reflect the cultural, economic, and aesthetic values of the society of that era. An examination of examples obtained from centers such as Kashan, Rayy, and Jorjan shows that the artists of these periods, by utilizing complex lustre-making techniques and high skills in modeling, were able to transform the camel form from a natural state into an artistic and semantic structure.

From a morphological perspective, the camel figurines of this period tend towards simplification, compact volumetry, and exaggeration of the animal's main features; a matter similar to many lustre animal figurines, aimed at emphasizing the readability and symbolism of the work. Decorative elements such as medallions, complex plant motifs, geometric lines, and sometimes narrative human motifs have been added to the body of these figurines, indicating that artists found the camel to be a suitable canvas for visual storytelling.

Conceptually and functionally, the camel in the Iranian-Islamic culture of this period was a valuable animal with an economic, social, and even symbolic role; a role that is also reflected in the lustre figurines. Larger sculptures with a litter or jar had a commemorative and ritual function, while smaller examples were mostly decorative and domestic. The addition of elements such as a jar or litter also expresses an emphasis on the role of this animal in transport, movement, and caravan life, which formed an important part of the economy of the Seljuk and Ilkhanid periods.

The analysis of the motifs of these figurines showed that lustreware artists did not merely represent the camel as a natural subject, but elevated it to a level of cultural semiotics; in such a way that aesthetic aspects, storytelling, and social values are all manifested in it. The continued production of these sculptures in various regions of Iran is also evidence of the extent and popularity of the lustre technique and the enduring importance of this animal in Iranian culture.

Overall, the examination of lustre camel figurines in the 6th to 8th centuries AH shows that these works are the result of a link between technical skill, artistic creativity, and cultural meanings; a link that has caused these figurines to gain a special place in the art of Iranian pottery and to be considered by researchers as enduring documents of the life, beliefs, and art of the Islamic period.

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URL2: https://www.khalilicollections.org/collections/islamic-art/khalili-collection-islamic-art-figurine-of-a-dromedary-pot857/
URL3: https://www.bukowskis.com/en/auctions/605/174-a-sculpture-a-dromedary-pottery-with-luster-decor-height-ca-17-cm-persia-iran-12th-13th-century

MADRID MUSICAL CULTURAL HERITAGE ROUTES, SPAIN

María Dolores Castellón-Pérez[13]

Abstract
This work analyses and studies the impact of Clasical Music as Cultural Heritage in Madrid, giving rice to the Madrıd Musical Cultural Heritage Routes, Spain.
The main objective of this study is to find out how Cultural Heritage helps us to improve sustainability and alternative tourism solutions by providing us with another vision of the Madrid City. To get this objective I had to analyse and study the reception of Classical Music in Madrid and how this music introduces in everyday life in the city.
The methodology that I followed it was qualitative and quantitative. It was a mixed methodology.
On one hand, I have used specialized bibliography on musical topics and the history of the city.
In addition, posters, hand programs, newspapers, and magazines to obtain the necessary information and analyse it.
On the other hand, I did some questionnaires and interviews to the public that used to go to the Concerts and Theatres of Madrid, and another people who works there. All this information has been analysed and included in this study.
Madrid Musical Cultural Heritage Routes include places visited by those interested in Classical Music, History of Madrid´s City and the innovations that these bring us. These routes include theatres, meeting places, music shops, luthiers' workshops, commemorative plaques and statues, and historical sites that had a connection with classical music and its innovations throughout the city's history. Even providing solutions for sustainable tourism and including an alternative to mass tourism.
There are several Madrid Musical Cultural Heritage Routes, but on this occasion, have been selected only five routes.
Madrid Musical Cultural Heritage Route 1: Royal Palace
Madrid Musical Cultural Heritage Route 2: Royal Theatre and Royal Palace
Madrid Musical Cultural Heritage Route 3: Royal Theatre and surrounding area
Madrid Musical Cultural Heritage Route 4: Museum of Instruments
Madrid Musical Cultural Heritage Route 5: Royal Theatre and surroundings – Auschwitz Exhibition
Finally, it explains how these Musical Cultural Heritage Routes in Madrid came about and what sites are visited along them.
Keywords: Musical Cultural Heritage, Routes, Madrid Tourism.

1. Introduction

Through this work with the analysis and study of Clasical Music as Cultural Heritage in Madrid, is discovered how our Cultural Heritage helps us to better understand our environment. As a result of this study, the Madrid Musical Cultural Heritage Routes were created.
The main objective of this study is to find out how Cultural Heritage helps us to improve sustainability and alternative tourism solutions by providing us with another vision of the Madrid City.
To get this objective I had to analyse and study the reception of Classical Music in Madrid and how this music introduces in everyday life in the city.
To achieve this objective, the different theaters, meeting places, music shops, luthiers' workshops, commemorative plaques and statues and historical places that had a relationship with classical music in Madrid are studied on the ground and through the existing bibliography, as well as their functionality to ensure the survival of Classical Music over time by modifying the structure of the city.
The following methodology is qualitative and quantitative. It was a mixed methodology.
On one hand, the specialized bibliography on musical topics and the history of the city. In addition, posters, hand programs, newspapers, and magazines to obtain the necessary information and analyse it.
On the other hand, questionnaires and interviews have been conducted with the public who regularly attend concerts and theaters in Madrid, and with other people who work there. All this information has been analysed and included in this study.

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The suggested itineraries for our routes were developed by personally exploring the indicated locations and assessing their accessibility. All of this information has been analyzed and included in this study.
Madrid Musical Cultural Heritage Routes include places visited by those interested in Classical Music, History of Madrid´s City and the innovations that these bring us. On these routes you can find theatres, meeting places, music shops, luthiers' workshops, commemorative plaques and statues, and historical sites that had a connection with classical music and its innovations throughout the city's history. Even providing solutions for sustainable tourism and including an alternative to mass tourism.
The information collected has been classified into different topics related to this study:
1. Some tourist route guides for the city of Madrid have been analyzed, revealing different routes through Madrid and its province related to its fauna and flora, gastronomy, traditions, festivals, etc.
2. Articles and periodicals providing information on activities related to concerts held in Madrid theaters have been reviewed.
3. Information leaflets and posters have been analyzed, revealing a variety of events related to the topic of this study, such as private concerts, workshops, meetings, etc., which help to disseminate and promote the Musical Cultural Heritage in the city.
4. Maps and books on the evolution of the landscape of Madrid and its surroundings have been consulted.
5. Five routes have been selected from among all the existing ones, which serve as an example of the great variety of routes that can be taken when visiting Madrid.

2. Methodology

The methodology used in this work was both qualitative and quantitative. It was a mixed methodology.
On the one hand, specialized literature on musical topics and the history of the city was used. In addition, posters, programs, newspapers, and magazines were consulted to obtain and analyze the necessary information. Moreover, this study also includes videos and photographs of visitors to the different locations of the Madrid Musical Cultural Heritage Routes.
On the other hand, questionnaires and interviews were conducted with the public who used to attend concerts and theaters in Madrid, as well as with other people who work there. All this information has been analyzed and included in this study.
The methodology used for this work has been varied.
Although the bibliography consulted was extensive, some of the books and documents that were relevant to this work are presented below:
Fernando Doménech Rico's book (2005), "*La Compañía de los Trufaldines y el primer teatro de los Caños del Peral,*" has been fundamental in contextualizing the birth of the Teatro Real in Madrid. For her part, Loli Castellón's work (2017), entitled "*Wagner en Madrid, Volume I and Volume II*," has been very useful in understanding the reception of Richard Wagner's music in Madrid, as well as the dissemination of classical music in the city's various theatres and concert halls. We also have María Dolores Castellón's work, "*Rutas Wagnerianas. Guía de campo,"* which serves as a precedent for the Madrid Musical Cultural Heritage Routes. And, above all, Pedro López Carcelen's book (2006), "*Atlas Ilustrado de la Historia de Madrid,"* which recounts the evolution of the City of Madrid over time.
In addition, the 140 posters and handbills and the more than 300 press articles that have been consulted provide valuable information about the singers, entrepreneurs, set designers and the different places where Classical Music was performed in Madrid.

3. Findings

Madrid Musical Cultural Heritage Routes is the result of the analysis and study of Classical Music as Cultural Heritage in Madrid, it is discovered how our Cultural Heritage helps us to better understand our environment. The main objective of this study is to find out how Cultural Heritage helps us to improve sustainability and alternative tourism solutions by providing us with another vision of the Madrid City.
To get this objective I had to analyse and study the reception of Classical Music in Madrid and how this music introduces in everyday life in the city.
When we study the evolution of the city of Madrid and consult the city maps, we can see how some buildings have been relocated to facilitate the layout of streets like La Gran Vía street.
We also found that some theaters have had several locations throughout the city's history. For example, the Teatro de la Comedia was initially located at Calle Urosas, 8, but after a few years it moved to Calle del Príncipe, 14.

Figure 3.1. Inside of the Teatro de la Comedia.



Figure courtesy of Castro, 2015.

At number 8 on this street, the theater of the Instituto Español, named Teatro de la Comedia, was inaugurated on November 1, 1845, with a performance by Juan Lombía's company (Calle de Luis Vélez de Guevara, 2023). Calle de Luis Vélez de Guevara (formerly Calle de las Urosas) is a street in the Centro district, in the Barrio de las Letras (Literary Quarter). It connects Calle de Atocha with Calle de la Magdalena, running north-south and descending gently towards Lavapiés (Calle de Luis Vélez de Guevara, 2023).
As we can see in Table 3.1. Meeting places of classical music supporters, there are several cafes and houses that have had several locations, just like some of the meeting places for classical music supporters.

Table 3.1. Meeting places of classical music supporters.

Meeting places	Location
Lhardy Circle	Carrera de San jerónimo nº8 (in 1839) Plaza de las Cortes nº4 (in 1911) Calle Cedaceros (Today)
Private home of Félix and José Borrell	Puerta del Sol (Pharmacy)
Private home of the sculptor Mariano Benlliure and the painter Agustín Lhardy	Calle Gorguera (today: Calle de Núñez de Arce)
Hotel de la Paz (Residence of Luigi Mancinelli, 1890)	Puerta del Sol
Café Suizo	Casino de Madrid (before) Plaza Santa Ana, 2 (Today)
Café Español	Calle Carlos III, nº 1 (next to the Royal Theatre) Calle del Príncipe, 25 (Today)
Café Levante	Calle Arenal (1903 – 1916) Calle de la Victoria, 4 (Today)

Table of my own creation.
In Table 3.2. Classification of Madrid Theatres in the 19th and 20th Centuries, we can see the different theatres in the city and their various locations as mentioned before.
The stop numbers correspond to the classification of Madrid's theaters published in the book titled Wagnerian Routes: A Field Guide (2016), which is used as a reference. It should be noted that the Teatro de la Comedia is listed in different locations depending on the period being referenced. For this reason, it appears as stop numbers 3 and 36.
In the aforementioned publication we find the explanation for this numbering of the theaters and places to visit on the Wagnerian Routes:
Using newspaper articles about Madrid's theatrical life and the books by Ana Suarez Perales and Pedro Felipe Monlau as references, I have compiled the following list of theaters in the capital during the period under consideration. This list is divided into three parts:
• Madrid theaters of the 19th century. Temporary theaters (19th century).
• Madrid theaters of the 19th century. Permanent theaters (19th century).
• Madrid theaters of the 20th century.
This division reflects the fact that some theaters have a short lifespan or are relocated several times due to various reasons (demolition, fires, change of ownership, etc.). Conversely, there are other theaters, the

permanent ones, that have a more continuous presence in the city. The life of each theater is different in each case and depends on a multitude of factors (Castellón, 2016).
The location of all theaters marked with an asterisk (*) is taken from the articles consulted for the creation of this list in the publication of the Wagnerian Routes. Field Guide (2016).
Table 3.2. Classification of Madrid Theatres in the 19th and 20th Centuries.

Madrid theaters of the 19th century	Temporary theaters (19th century)	Permanent theatres (19th century)	Madrid theaters of the 20th century
Teatro Español*: calle del Príncipe, núm. 31 Teatro del Drama*: calle de la Cruz, núm. 35 Teatro de la Comedia*: calle de la Urosas, núm. 8 Teatro de Variedades*: calle de la Magdalena, núm. 40 Teatro de la Ópera (Teatro del Circo*): plazuela del Rey, núm. 1 Teatro de Oriente (6b.Teatro de los Caños del Peral) (6.Teatro Real*): Plazuela de Oriente Café Español*: en la Puerta del Sol El corral de la Pacheca*: calle del Príncipe	Teatro de la Esmeralda: calle de las Aguas, planta nº 9 Teatro España: calle Costanilla de San Andrés, nº 7 Teatro – Fuencarral: calle Fuencarral nº 20 (1874) Teatro Luzón: Travesía de los Señores de Luzón nº 4 (1874) Teatro Martín*: calles Santa Brígida y Santa Águeda (1870, reformado en 1919) Teatro del Instituto*: calle de las Urosas nº 7 (actualmente calle Luís Velez de Guevara) (1845) Teatro Novedades*: calle Toledo esquina calle de las Velas (hoy calle de López Silva) (1857) Teatro Eslava*: callejón de San Ginés (1871) Circo Colón: plaza de Alonso Martínez, entre las calles de Almagro y Santa Engracia (1889) Circo Gallístico: Paseo de Santa Mª de la Cabeza (1889) Circo Paul*: Calle Barquillo nº5 (1875) (Teatro de la Bolsa hasta 1880) Circo de Verano*: calle Atocha (1902) Circo Olímpico – Circo de Price: Circo Olímpico: calle Caballero de Gracia; en 1834 en el jardín de la Casa de las Siete Chimeneas (hoy plaza del Rey). Teatro-Circo Price* (1880) Teatro – Circo del Príncipe Alfonso*: Paseo de Recoletos, junto al palacio de Medinaceli (1863). Teatro Circo de Madrid (1870) Teatro Rossini: calle Velázquez (1864) Teatro Recoletos: calle de Salustiano Olózaga nº 2 (1882) Teatro Tívoli: plaza de la Lealtad (hoy Hotel Ritz). Luego en calle de la Colegiata nº3 (solar del primer Teatro Romea) (1881) Teatro de los Jardines del Buen Retiro – Teatro Felipe: ángulo oeste del Real Sitio del Buen Retiro (hoy plaza de la Independencia, calle de Alcalá y plaza de Cibeles) (1870). Nuevo Teatro de los Jardines del Buen Retiro (1885). Nuevo	Teatro Real*: plaza de Oriente y plaza Isabel II (1850) Teatro Romea*: calle de la Colegiata nº 3 (1873) Teatro de Variedades*: calle de la Magdalena y calle de la Rosa (1840) Teatro Madrid – Teatro Barbieri: calle de la Primavera (1880) Teatro Eldorado: calle de Ruíz de Alarcón esquina a Juan de Mena (1890) Teatro de la Zarzuela*: calle de Jovellanos solares nº4 y 6 (1856) Teatro de la Comedia*: calle del Príncipe nº14, en el interior de una casa (1874) Teatro de Novedades*: calle Toledo nº 83 (1857) Teatro Alhambra* – Teatro Moderno: calle San Marcos con vuelta a la calle Libertad (1870) Teatro Moratín – Teatro Apolo*: calle Alcalá, casi semiesquina a la Gran Vía (1871) Teatro de los Basilios* – Teatro Lope de Vega*: calle Desengaño esquina a la de Valverde (1850) Teatro Lara*: calle San Roque nº 10 (1879) Teatro Panorama: Plaza de la Lealtad (hoy el Hotel Ritz) (1880) Teatro Maravillas: calle Sandoval Esquina a las de Ruiz y Fuencarral (1887). Se traslada a calle de Felipe IV (1891). Se instala de forma estable en la calle Manuela Malasaña con vuelta a la calle San Andrés (1918) Teatro María Guerrero – Teatro de la Princesa*: calle de Tamayo y Baus (1885)	Teatro Noviciado: calle de San Bernardo (1906) Teatro – Cine Alcalá: calle Alcalá (1922) Teatro Atocha: calle Atocha con vuelta a la calle Santa Isabel y Duque Fernán Nuñez (1923) Teatro Odeón – Teatro Calderón: calle Atocha con vuelta a calle Trinidad (actual Doctor Cortezo) (1917) Salón Madrid* – Teatro Cervantes: (1907) (Alcalá de Henares, Madrid) Teatro de los Cuatro Caminos: (1904) Teatro Escuela: calle Arturo Soria (1906) Teatro Fontalba: con fachada a calle del Pi y Margall (actual Gran Vía) (1920) Teatro Infanta Beatríz: esquina calle Hermosilla con Claudio Coello (en la actualidad es el restaurante y bar de copas Teatriz) (1920) Cine Petit Palais – Teatro Infanta Isabel: solar nº14 de la calle Barquillo (1906) Teatro Lírico o Gran Teatro*: calle del Marqués de la Ensenada (1902) Teatro Monumental: calle Atocha 65 (1922) Teatro – Cine Encomienda: calle Encomienda nº 16 (1916) Teatro – Cine Pavón: en el solar nº 11 de la calle de Embajadores con vuelta a Dos Hermanas (1924) Teatro Príncipe Alfonso* – Cine Génova: confluencia de la calle Génova y General Castaños Teatro Reina Victoria: en el solar nº 28 sito en la Carrera de San Jerónimo con vuelta a la calle de Echegaray (1915) Teatro Rey Alfonso – Salón Madrid* – Cine

	emplazamiento en 1892: entre la calle Bailén y la antigua plaza de San Marcial (hoy plaza de España). Último emplazamiento: calle Altamirano esquina a Álvarez Mendizábal (1893) Teatro de la Ciudad Lineal: en una de las principales arterias de Madrid (parque de diversiones y posterior recinto de los estudios cinematográficos C.E.A.) Teatro el Paraíso: formaba parte de un parque de verano en la calle Alcalá esquina a la calle Hermosilla (1911) Teatro de los jardines Orientales*: calle Barquillo esquina a Fernando VI (1874)		Cedaceros: solar sito en la calle Cedaceros (1909 – 1916 – 1920) Teatro Romea* – Teatro Infantil*: calle Carretas nº 14 (1914) Teatro La Latina*: (1919) (c/ Humilladero) Palacio de los Recreos – Teatro Alkázar: (1922). (C/Alcalá, 20) Teatro ABC: calle Serrano (1925) Cine – Teatro El Cisne: Paseo del Cisne (actual calle Eduardo Dato) (1923) Cine – Teatro Fígaro: calle del Doctor Cortezo (1931)

Table of my own creation.

Below are some examples of theaters in the city with different locations:

No. 6. Teatro de Oriente

Location: Teatro de Oriente (6b. Teatro de los Caños del Peral) (6. Teatro Real): Plazuela de Oriente.

The Teatro Real was initially called the Teatro de Oriente, as construction began in 1818 and was completed in 1850.

Located in the Plaza de Oriente, opposite the Royal Palace, it was built on the site of the demolished Teatro de los Caños del Peral. Construction began in 1818, but it was not inaugurated until 1850. This building was always linked to the Crown, which sought to construct a theater of a quality and size that could compete with the best in Europe. Ferdinand VII, within the project to remodel the Plaza de Oriente, already included the construction of a theater (Cultural Heritage and Urban Landscape, 2015).

Figure 3.2. Teatro de Oriente. Teatro Real 1860.



Figure courtesy of the Internet.

No. 6b. Teatro de los Caños del Peral

Location: Plazuela de Oriente

The Teatro de los Caños del Peral was a theater in Madrid, located in what would later become the Plaza de Isabel II. It was built in the early 18th century on the site of a corral de comedias (open-air theater) and demolished in 1817 to make way for the current Teatro Real (Royal Theater). It was named for its location next to the public washhouses at the Fuente de los Caños del Peral (Wikipedia, 2024).

Figure 3.3. Façade of the Teatro de los Caños del Peral.

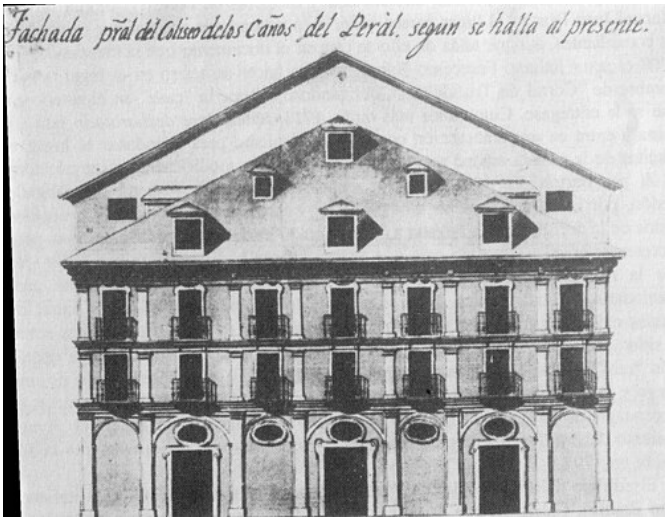


Figure courtesy of the Internet.

On the Madrid Musical Cultural Heritage Routes, we visited the remains of the Caños del Peral fountain, located inside the Ópera metro station.

Beneath the Plaza de Isabel II, the Ópera metro station houses the remains of the historic Caños del Peral fountain. The visit allows you to see the fountain, the barrel-vaulted supply gallery, and the area's sewer, as well as the aqueduct that supplied water to the Royal Palace from the 17th century until practically the 20th century (Museo de los Caños del Peral, 2025).

Figure 3.4. Museo de los Caños del Peral.



Figure courtesy of the Internet.

As we can see, much of our cultural heritage has evolved in its location within the city, and today we can visit its sites and learn its history firsthand. This is a great advantage for all those who love classical music and visit the city of Madrid.

Seasonal tourism and mass tourism in Madrid

On the other hand, we have conducted a study of the number of foreign and domestic visitors to Madrid. For this study, we collected data from the National Institute of Statistics, which we present below.

In this section is analysed the number of tourists visiting Madrid over the last four years, from 2022 to 2025. The information is based on the data obtained by the National Institute of Statistics (2025), and on various press articles that highlight the great impact that tourism has on Madrid.

Seasonality is a constant and determines the tourist activity of the city. For this reason, in the article published by the *Variation XXI* (Castellano and Martinez, 2024, November 16), where it informs of the impact of mass tourism in Madrid at a social level and a breakdown of the causes of tourist arrivals. With mass tourism comes this dilemma: whether to please the tourist or the residents who live daily in these areas of the city centre.

Madrid is losing its soul. Mass tourism, once celebrated as one of the capital's economic engines, now threatens to devour the very essence of the city. Residents of historic neighborhoods like Malasaña, Lavapiés, and the Literary Quarter are witnessing a radical transformation: what were once vibrant neighborhoods brimming

with local life have become theme parks for the quick consumption of tourists (Castellano and Martinez, 2024, November 16).
To address the problems caused by mass tourism in Madrid, the Madrid City Council has created a Strategic Tourism Plan for the City of Madrid for the period 2024-2027.
The Strategic Tourism Plan for the City of Madrid for the period 2024-2027 has been developed by the Delegate Area of Tourism in coordination with the Madrid tourism sector. It serves as an action plan to guide the medium- and long-term strategy, addressing the need for balanced tourism that integrates sustainability, identity, and collaboration.
It includes participatory development, a tourism assessment, a comparison with best practices in other cities, and a strategic vision.

It is structured around three fundamental premises:
Redefinition, focused on making Madrid a better city to live in, by promoting its essence, lifestyle, culture, gastronomy, traditions, talent, and diversity.
Regeneration, focused on making Madrid a better city to invest in, with projects that revitalize the city's infrastructure and the organization of major events that generate wealth for the capital.
Redistribution, focused on balanced and sustainable tourism that respects coexistence with residents, promoting the reduction of seasonality and the decentralization of visitor flows.
Sustainability, in its economic, social and environmental aspects, plays a fundamental role in the implementation of the plan (Ayuntamiento de Madrid, 2025).
There are other aspects such as mass tourism at specific times of the year and in specific areas of Madrid city and its Mountains, above all. But what is meant by mass tourism?
The concept of mass tourism is not only a reference to the number of visitors, but also to the standardisation of tourist experiences and services. It has led to the development of specific infrastructures, such as high-capacity hotels, organised tours and mass attractions, designed to meet the demands of a high volume of tourists. Although it has contributed significantly to the economic development of many regions, mass tourism has also raised concerns about its effects on cultural heritage, local identity and the environment (Estudiar Turismo, 2024, December 10).
Having defined the concept of mass tourism and observed that public administrations are investing in improving tourism in Madrid, we also analysed when the largest number of tourists visit the city. This confirms that the city has long suffered the consequences of mass and seasonal tourism.
In the following graphs taken from the National Institute of Statistics we can observe how during the years 2022 to 2025 the highest hotel occupancy in Madrid occurs during the months of December and January for tourism by residents of Spain (see figure 3.6. Spanish visitors to Madrid from 2022 to 2025), and for tourism by foreigners during the months of May and October (see figure 3.5. Foreign visitors to Madrid from 2022 to 2025).
Figure 3.5. Foreign visitors to Madrid from 2022 to 2025.

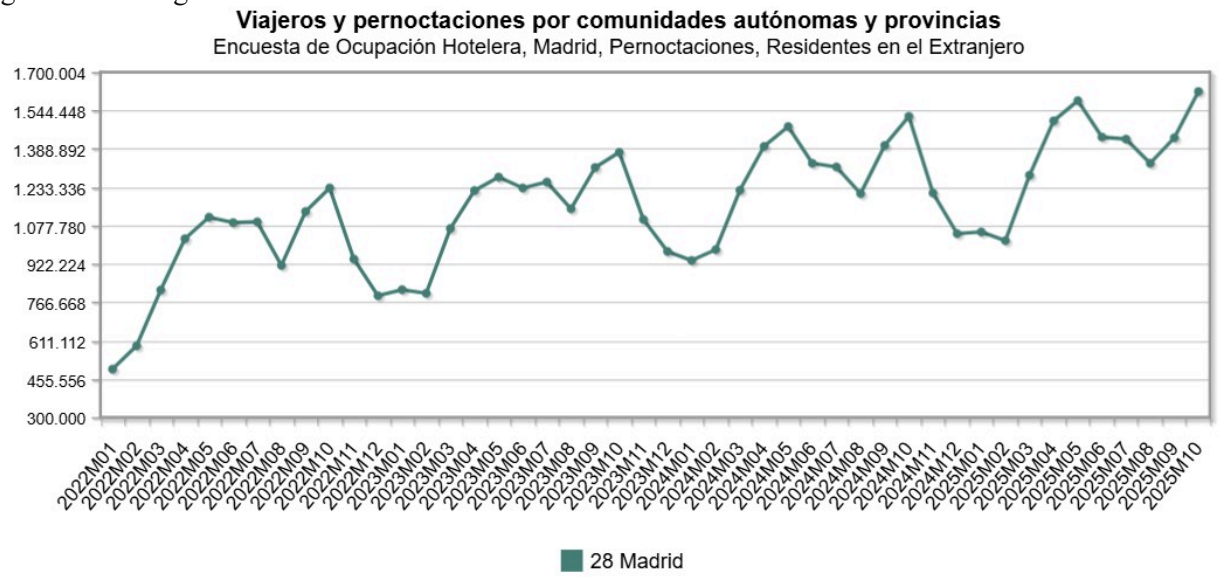


Figure courtesy of the National Institute of Statistics.

However, upon closer inspection, some nuances emerge between the two graphs. For example, Figure 3.5. Foreign visitors to Madrid from 2022 to 2025, shows higher occupancy rates in May and October. In contrast, the number of tourists is lower, almost negligible, in August and January.

Figure 3.6. Spanish visitors to Madrid from 2022 to 2025.

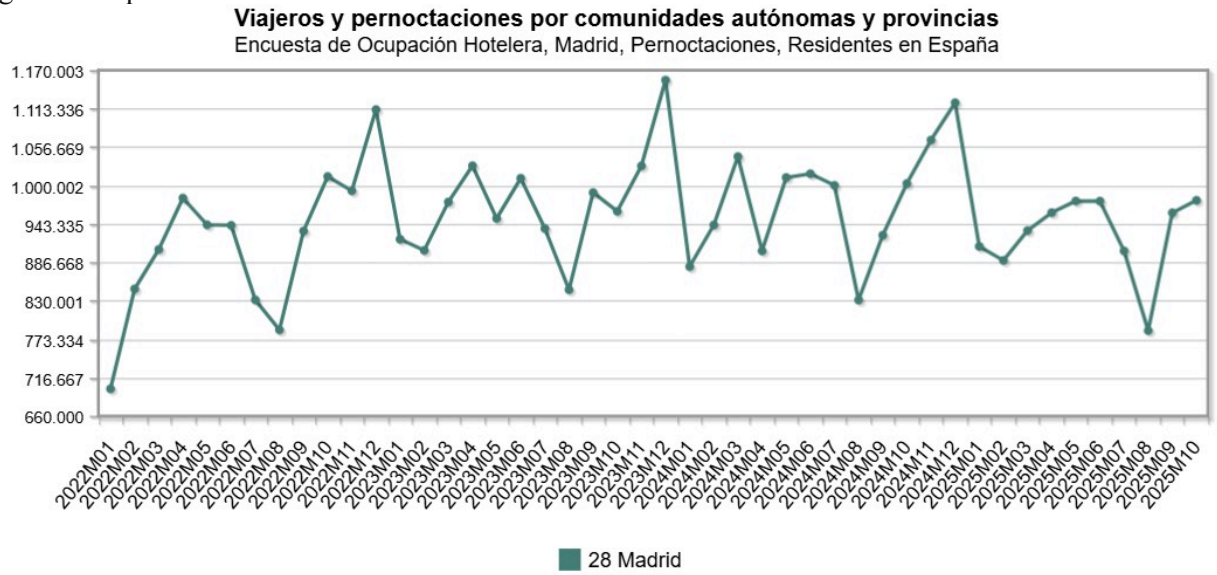


Figure courtesy of the National Institute of Statistics.

Analysing Figure 3.6. Spanish Visitors to Madrid from 2022 to 2025, it can be seen that the months with the highest influx of travellers are the months of Christmas, December and January, and Easter, March and April, but a medium or high occupancy is also observed the rest of the year, except in the month of August.

In summary, we have observed that hotel occupancy in Madrid follows a clear seasonal pattern, with higher occupancy during Easter and Christmas for Spanish tourists. For international tourists, the peak occupancy months are May and October. Conversely, the lowest occupancy for both domestic and international tourists occur in August, the hottest month. We also see that hotel occupancy is variable throughout the rest of the year. For this reason, the trend in tourism is to make cultural tourism activities available year-round, thus mitigating seasonality.

Sustainable tourism in Madrid

Our proposal is based on understanding Madrid's cultural heritage as a response to sustainable tourism and an alternative to the seasonal mass tourism that the city experiences at certain times of the year.

In previous sections, we have explained Madrid's cultural heritage and the concept of seasonal mass tourism. Now we will attempt to define sustainable tourism.

Sustainability

The first thing we need to be clear about is: what is sustainability? According to Germán Portillo (2024): «Sustainability seeks balance between resources and social, economic and environmental development». In addition, he tells us what types of sustainability we can find: «Types of sustainability: environmental, economic, social and political». Finally, he gives us some examples: «Examples include sustainable policies in companies such as Unilever or cities such as Stockholm».

It is important to highlight that sustainability is an action of the present so that in the future we can continue living on this planet. Therefore, it is necessary to interrelate several disciplines to achieve it: social development, economic development and environmental protection. These three factors must go hand in hand to achieve the desired balance. And the next question that arises is: how?

If we continue reading Germán Portillo's article, we realize that natural resources are not inexhaustible. And for this reason, it is necessary to protect them and manage them responsibly.

Types of sustainability

The different types of sustainability are classified according to their response to the main global problems such as climate change, poverty and natural resource management. According to these criteria, the main types are:

- Environmental sustainability
- Economic sustainability
- Social sustainability

- Political sustainability

Sustainable Tourism

Once we have seen the types of sustainability that exist, we now ask ourselves: what is sustainable tourism?

According to the World Tourism Organization (WTO) (Andalucia, 2019):

The development of sustainable tourism responds to the needs of tourists and host regions today, while protecting and enhancing opportunities for the future. It is focused on managing all resources in such a way that they meet all economic, social and aesthetic needs, while respecting cultural integrity, essential ecological processes, biological diversity and life support systems (Andalucia, 2019).

With this definition of sustainable tourism, we see that it is related to the principles defended in the other types of sustainability that we have defined above. But it goes a little further and defines sustainable tourism activity in the following way:

In this way, any tourist activity (rural, sporting, cultural, etc.) that involves the conservation of resources and biodiversity, concern for environmental impact and the distribution of benefits among the local community may be included within the category of Sustainable Tourism (Andalucia, 2019).

In short, both sustainability and sustainable tourism provide us with guidelines to follow to preserve the planet and our own survival on it.

4. Discussion

As we have seen previously, the various historical sites linked to classical music have resulted in the Madrid Musical Cultural Heritage Routes.

On these routes, we will visit the classical music sites in the center of Madrid. Five routes have been designed for this purpose.

Madrid Musical Cultural Heritage Routes include places visited by those interested in Classical Music, History of Madrid´s City and the innovations that these bring us. These routes include theatres, meeting places, music shops, luthiers' workshops, commemorative plaques and statues, and historical sites that had a connection with classical music and its innovations throughout the city's history. Even providing solutions for sustainable tourism and including an alternative to mass tourism.

Our proposal includes the idea “Breathe, Feel, Live Madrid”. This invitation seeks to promote tourist experiences that engage all five senses. It is a personalized offer since most of the proposed routes can be done individually.

We recommend contacting María Dolores Castellón Pérez, an expert researcher and promoter of Madrid's Musical Cultural Heritage, to arrange any of these tours. Thanks to her experience in the field, it will be a more complete, insightful, and sensory experience than exploring the routes independently.

This Routes are organized in small groups to provide a lower environmental impact. Having greater control over the possible waste left. Even generating a prolific economic impact with the with the supply stops in the commercial premises of the area.

Through education and knowledge of our Madrid Musical Cultural Heritage, we will obtain solutions better adapted to the future needs of our environment.

Madrid Musical Cultural Heritage Routes

There are several Madrid Musical Cultural Heritage Routes, but on this occasion, have been selected only five routes. To learn more about each site you visit, you can click on the name of each stop, and this link will take you to the Wikipedia information about each place.

Madrid Musical Cultural Heritage Route 1: Royal Palace

1.1. Starting point: Plaza de Oriente - Eastern square
1.2. Catedral de la Almudena - Almudena Cathedral
1.3. Fundación Isaac Albeniz - Isaac Albeniz Foundation
1.4. Plaza Ramales (Cruzeiro de Velázquez) - Ramales Square (Velázquez Cross)
1.5. La Quinta de Mahler (Tienda de música) - Mahler's Fifth (Music Shop)
1.6. Taller del Luthier - Luthier's Workshop
1.7. Plaza de Isabel II - Isabel II Square
1.8. Museo de los Caños del Peral - Museum of the Caños del Peral
1.9. Escultura a Julián Gayarre - Sculpture of Julián Gayarre
1.10. Palacio Real - Royal Palace
1.11. Jardines de Sabatini - Sabatini Gardens

Figure 4.1. Madrid Musical Cultural Heritage Route 1: Royal Palace.

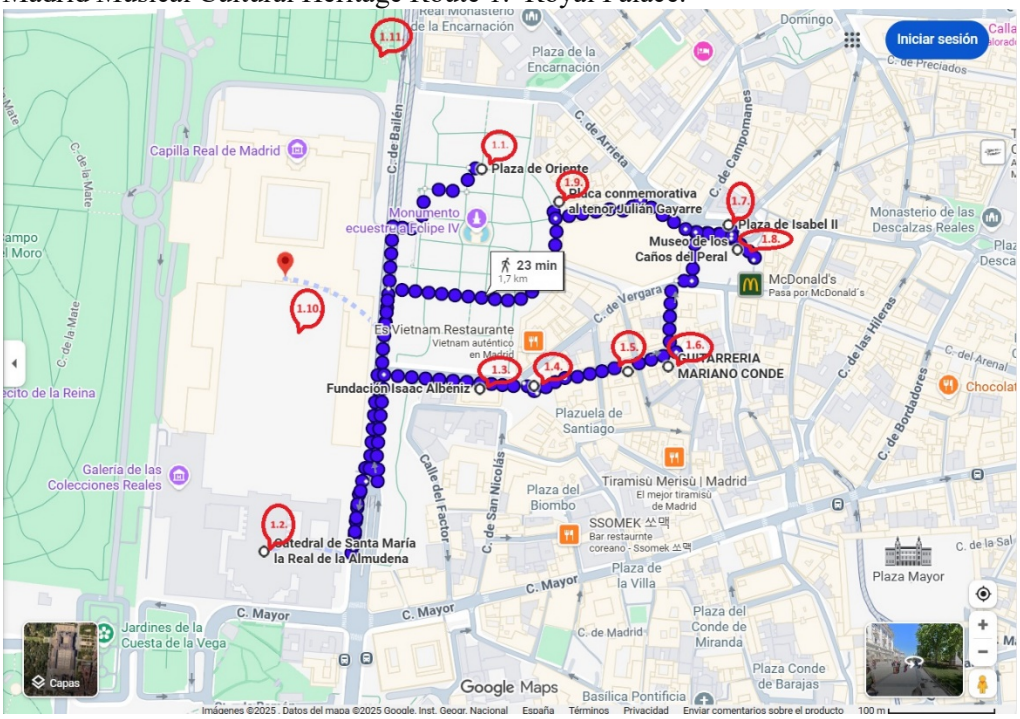


Figure created by the author on a Google Maps map.
Google Maps Madrid Musical Cultural Heritage Route 1: Royal Palace, link:
https://maps.app.goo.gl/V7UDSM7wFDuuELGY7

Figure 4.2. Visit to the Royal Palace of Madrid.



Figure from Castellón, L. (2018).

Madrid Musical Cultural Heritage Route 2: Royal Theatre and Royal Palace
2.1. Starting point: Teatro Real - Royal Theatre
2.2. Escultura a Julián Gayarre - Sculpture of Julián Gayarre
2.3. Palacio Real - Royal Palace
2.4. Catedral de la Almudena - Almudena Cathedral
2.5. Fundación Isaac Albeniz - Isaac Albeniz Foundation
2.6. La Quinta de Mahler (Tienda de música) - Mahler's Fifth (Music Shop)
2.7. Taller del Luthier - Luthier's Workshop
2.8. Tienda Musical 72 - Music Store 72
2.9. Plaza de Isabel II - Isabel II Square
2.10. Museo de los Caños del Peral - Museum of the Caños del Peral

Figure 4.3. Madrid Musical Cultural Heritage Route 2: Royal Theatre and Royal Palace.

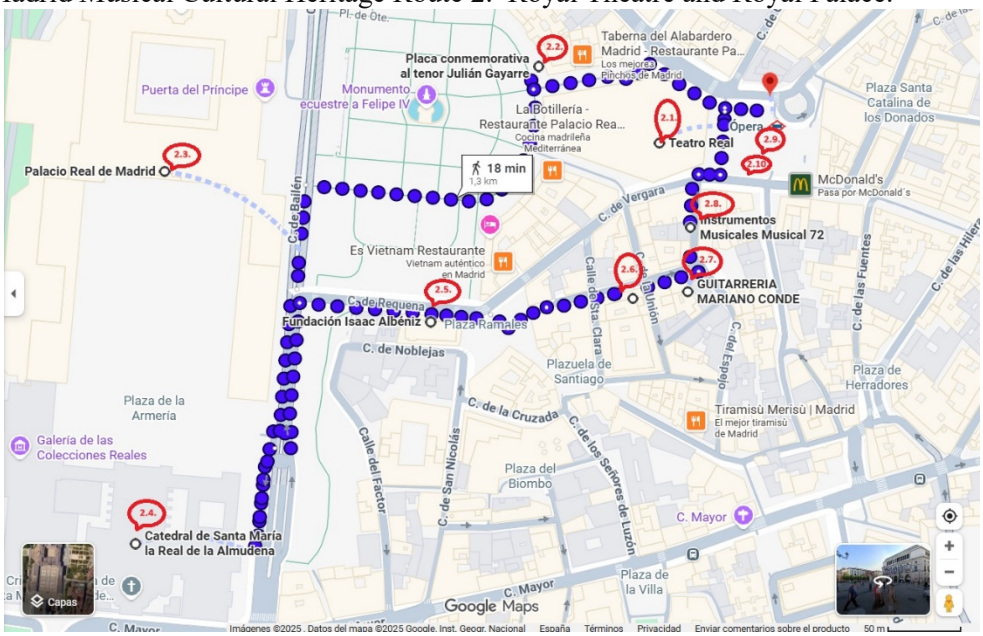


Figure created by the author on a Google Maps map.

Google Maps Madrid Musical Cultural Heritage Route 2: Royal Theatre and Royal Palace, link: https://maps.app.goo.gl/xY1CpLW52TzihKy47

Figure 4.4. Hall of the Royal Theatre with students from the IES. Villablanca, Madrid (2016).



Figure from Castellón, L. (2016).

Figure 4.5. Stairs of the Royal Palace with students from the IES Villablanca, Madrid (2016).



Figure of Castellón, L. (2016).

Madrid Musical Cultural Heritage Route 3: Royal Theatre and surrounding area
3.1. Starting point: Teatro Real - Royal Theatre
3.2. Escultura a Julián Gayarre - Sculpture of Julián Gayarre
3.3. Palacio Real - Royal Palace
3.4. Catedral de la Almudena - Almudena Cathedral
3.5. Fundación Isaac Albeniz - Isaac Albeniz Foundation
3.6. Tienda La Quinta de Mhaler - Mahler's Fifth (Music Shop)
3.7. Taller del Luthier - Luthier's Workshop
3.8. Tienda Musical 72 - Music Store 72
3.9. Plaza de Isabel II - Isabel II Square
3.10. Museo de los Caños del Peral - Museum of the Caños del Peral
3.11. Convento de las Descalzas Reales - Convent of the Royal Barefoot Nuns
3.12. Teatro Joy Eslava - Joy Slavic Theatre
3.13. Hotel Moderno - Modern Hotel
3.14. Restaurante L´hardy - L'hardy Restaurant
3.15. Teatro de la Comedia - Comedy Theatre
3.16. Teatro Español - Spanish Theatre

Figure 4.6. Madrid Musical Cultural Heritage Route 3: Royal Theatre and surrounding area.

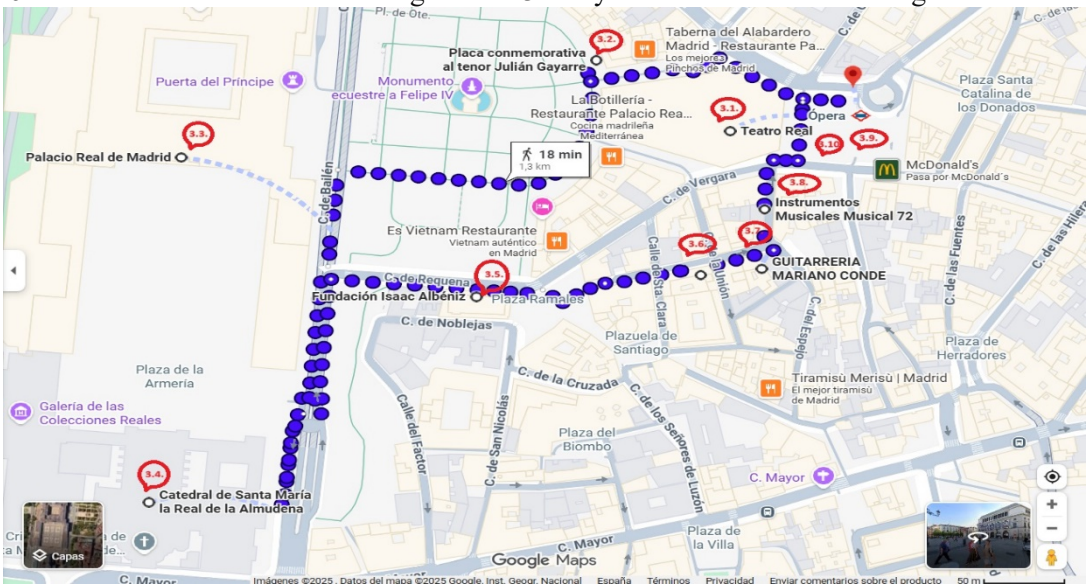


Figure created by the author on a Google Maps map (Stops from 3.1. to 3.10.).

Google Maps Madrid Musical Cultural Heritage Route 3: Royal Theatre and surrounding area. Link 4.6.: https://maps.app.goo.gl/xY1CpLW52TzihKy47

Image 4.7. Madrid Musical Cultural Heritage Route 3: Royal Theatre and surrounding area.



Figure created by the author on a Google Maps map (Stops from 3.10. to 3.16.).
Google Maps Madrid Musical Cultural Heritage Route 3: Royal Theatre and surrounding area. Link 4.7.: https://maps.app.goo.gl/QH9GgP78STG5JWBw5

Figure 4.8. Stage of the Teatro Real with students from the Mariana Pineda High School, Madrid (2016).

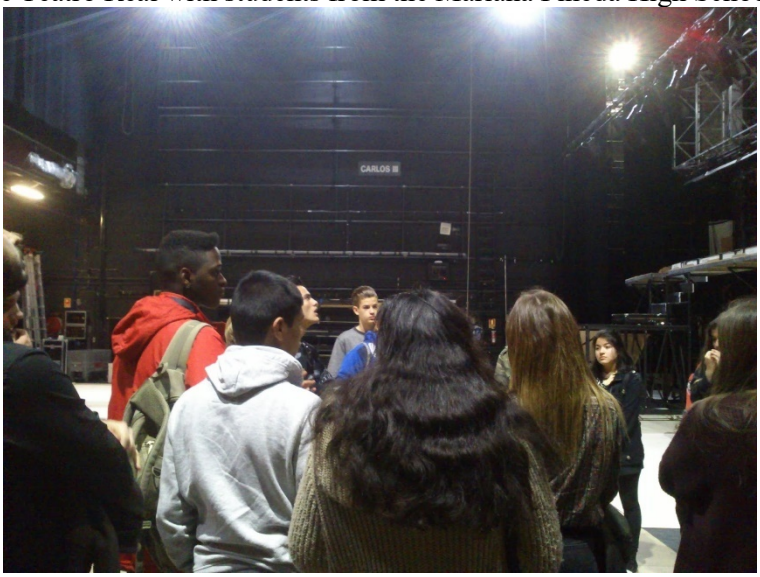


Figure from Castellón, L. (2016).

Madrid Musical Cultural Heritage Route 4: Museum of Instruments
4.1. Starting point: Museo de los Instrumentos (Real Conservatorio de Música de Madrid) - Museum of Instruments (Royal Conservatory of Music of Madrid)
4.2. Museo Reina Sofía - Reina Sofía Museum (Guernica - Picasso and Botero rooftop sculptures)
4.3. La Casa Encendida - The House On Fire
4.4. Teatro Circo Price - Price Circus Theatre
4.5. Estación de Atocha - Atocha Station
4.6. Museo Antropológico - Anthropological Museum
Figure 4.9. Madrid Musical Cultural Heritage Route 4: Museum of Instruments.

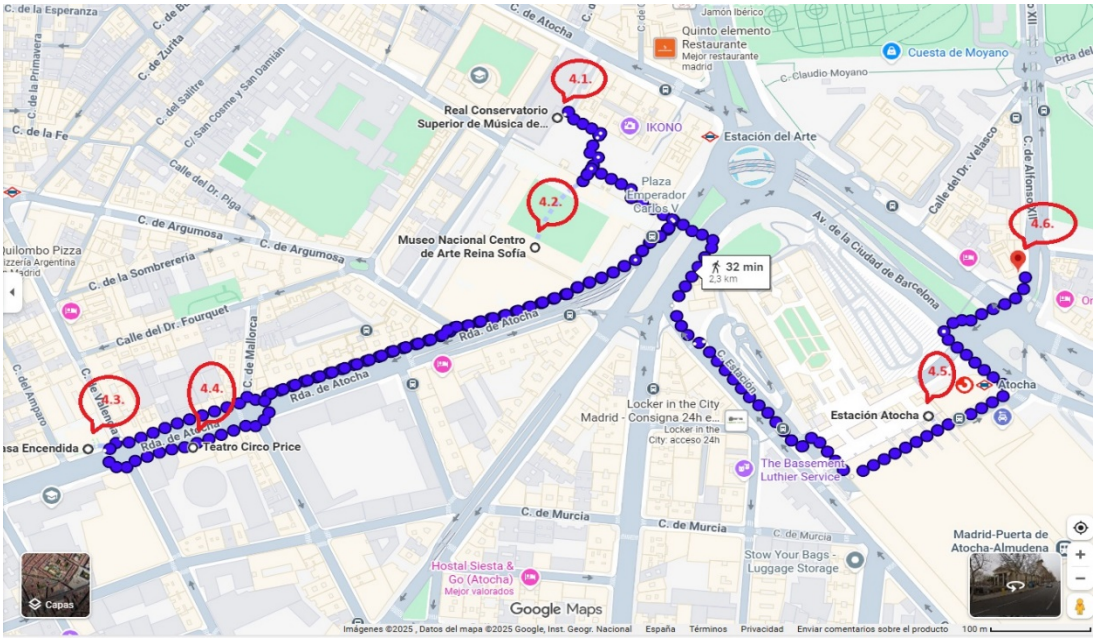


Figure created by the author on a Google Maps map.
Google Maps Madrid Musical Cultural Heritage Route 4: Museum of Instruments. Link: https://maps.app.goo.gl/ufjvqiDsjymEVEC1A
We carried out route 4 with the students of IES Barrio Loranca in 2018, and with IES Ciudad de Jaén in 2016.
Figure 4.10. Outside of the Reina Sofía Museum (2016).

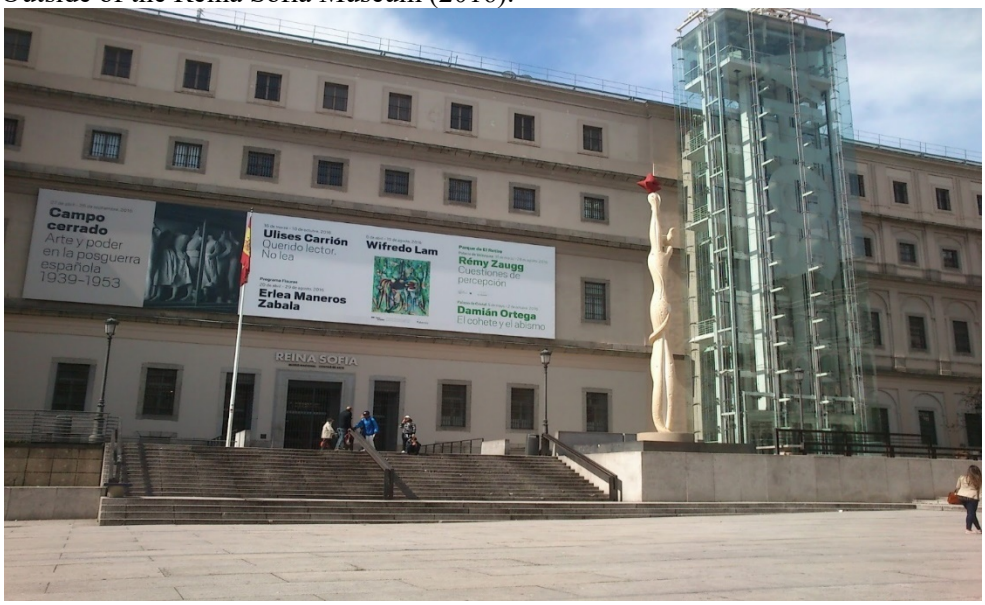


Figure from Castellón, L. (2016).

Figure 4.11. Upper terrace of La Casa Encendida (2016).



Image of Castellón, L. (2016).

Figure 4.12. Interior of the Museum of Musical Instruments with students from the IES (Secondary School). City of Jaén, Madrid (2016).



Figure from Castellón, L. (2016).

Figure 4.13. Interior of the Museum of Musical Instruments with students from the IES (Secondary School). City of Jaén, Madrid (2016).

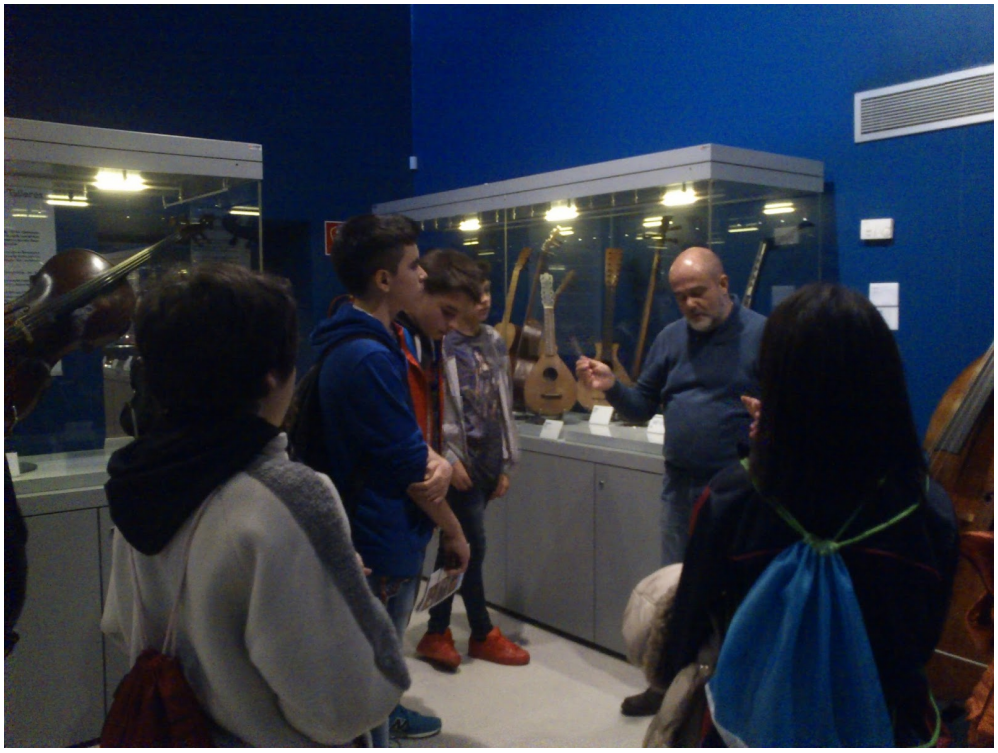


Figure of Castellón, L. (2016).

Madrid Musical Cultural Heritage Route 5: Royal Theatre and surroundings – Auschwitz Exhibition
5.1. Starting point: Teatro Real - Royal Theatre
5.2. Escultura a Julián Gayarre - Sculpture of Julián Gayarre
5.3. Palacio Real - Royal Palace
5.4. Catedral de la Almudena - Almudena Cathedral
5.5. Fundación Isaac Albeniz - Isaac Albeniz Foundation
5.6. Tienda La Quinta de Mhaler - Mahler's Fifth (Music Shop)
5.7. Taller del Luthier - Luthier's Workshop
5.8. Tienda Musical 72 - Music Store 72
5.9. Plaza de Isabel II - Isabel II Square
5.10. Museo de los Caños del Peral - Museum of the Caños del Peral
5.11. Exposición sobre Auschwitz. Sala de Exposiciones del Canal de Isabel II - Exhibition about Auschwitz. Exhibition Hall of the Canal de Isabel II

Figure 4.14. Madrid Musical Cultural Heritage Route 5: Royal Theatre and surroundings – Auschwitz Exhibition.

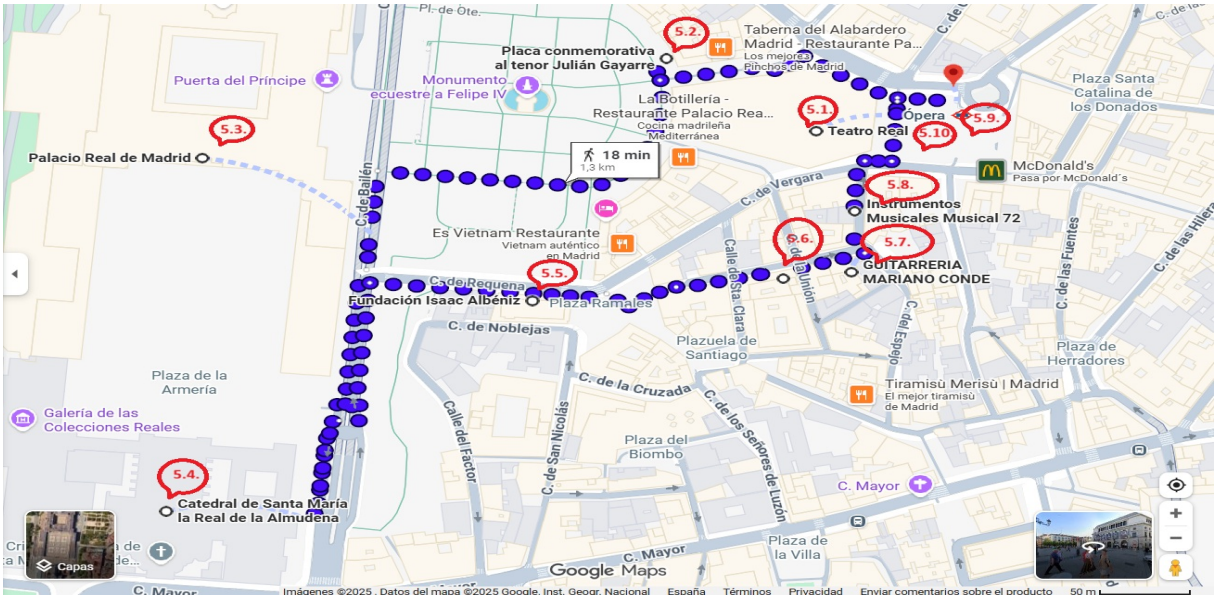


Figure created by the author on a Google Maps map.
Google Maps Madrid Musical Cultural Heritage Route 5: Royal Theatre and surroundings – Auschwitz Exhibition. Link 4.14.: https://maps.app.goo.gl/xY1CpLW52TzihKy47

Figure 4.15. Madrid Musical Cultural Heritage Route 5: Royal Theatre and surroundings – Auschwitz Exhibition.

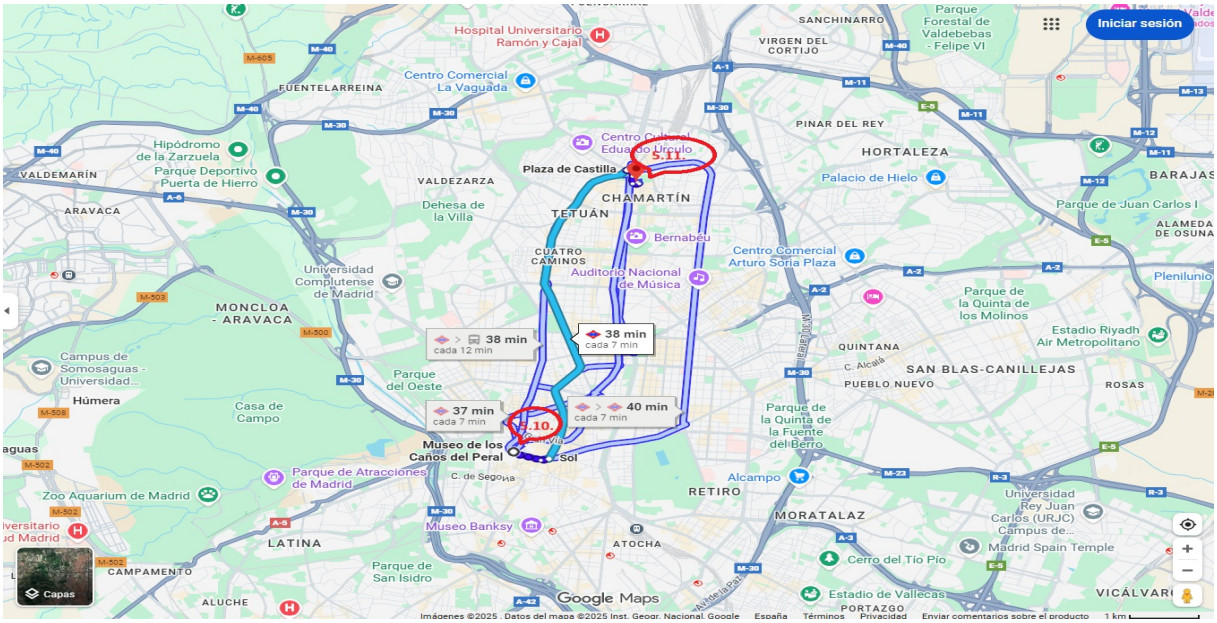


Figure created by the author on a Google Maps map.
Google Maps Madrid Musical Cultural Heritage Route 5: Royal Theatre and surroundings – Auschwitz Exhibition. Link4.15: https://maps.app.goo.gl/JBSF4JLAiqHjP6wP8

Figure 5.1. Entrance to the Royal Theatre with students from the IES (Secondary School). Loranca neighborhood, Fuenlabrada, Madrid in 2018.



Figure of Castellón, L. (2028).

Figure 5.2. Arte Canal Exhibition Center (2018) with students from the IES. Barrio Loranca, Fuenlabrada, Madrid.



Figure of Castellón, L. (2028).

5. Conclusion and Recommendations

This work addresses the main objective, which is to understand how Cultural Heritage helps us to improve sustainability and achieve alternative tourism solutions, giving us a different perspective of the city of Madrid. To achieve this objective, the reception of classical music in Madrid and how this music is integrated into the city's daily life are analyzed and studied. In this way, we see how our cultural heritage helps us better understand our surroundings. Thanks to this research, the Madrid Musical Cultural Heritage Routes have been created.

The methodology employed in this work was both qualitative and quantitative. It was a mixed-methods approach.

On the one hand, specialized literature on musical topics and the history of the city was used. Posters, programs, newspapers, and magazines were also consulted to obtain and analyze the necessary information. Furthermore, this study includes videos and photographs taken by visitors at the various locations along Madrid's Musical Cultural Heritage Routes.
On the other hand, questionnaires and interviews were conducted with members of the public who regularly attend concerts and theaters in Madrid, as well as with other people who work there. All of this information, along with tourism data provided by the National Institute of Statistics, has been analyzed and included in this study.
From the introduction, which gives an overview of this work and its components, to the most important bibliography in this research related to theaters, meeting places and spaces for classical music, all the important topics in this work can be seen.
The section dedicated to findings presents a review of theaters, cafes, concert halls, and exhibition spaces, as well as other venues where classical music is performed or associated with it, with specific examples, within the city of Madrid. It also analyzes seasonal and mass tourism patterns in Madrid. Furthermore, it identifies sustainability as a key factor in Madrid's tourism sector. As a result, solutions for sustainable seasonal and mass tourism in Madrid are proposed.
Finally, five Madrid Musical Cultural Heritage Routes have been launched as a model of sustainable tourism and an alternative to seasonal mass tourism. These routes allow visitors to experience firsthand, on-site, the different structures and their strategies for facilitating musical performance in a way that is respectful, sustainable, and balanced with the environment and the area's tourist flows.
Furthermore, education on these topics offers future generations the opportunity to propose sustainable solutions in different aspects of our society and economy, and even in our future policies. Education and knowledge of our environment are the solution to future problems, and this is achieved through respect for and understanding of our Cultural Heritage.
Even the Madrid Musical Cultural Heritage offers the opportunity to discover its routes with the help of an expert and researcher from the Rey Juan Carlos University, María Dolores Castellón-Pérez.

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A READING OF THE ELEMENTS OF POWER IN THE PAINTING OF "BAHADUR SHAH ZAFAR" THROUGH HOMI K. BHABHA'S THIRD SPACE APPROACH*

Zahra Mehdipour Moghaddam[14], Mehdi Mohammadzadeh [15], Shamimeh Sadat Roknalsadati[16]

Abstract
Painting, which during the Mughal era was regarded as extending beyond personal expression or aesthetic pleasure, exerted a complex influence on the socio-political structure of the empire and its modes of governance. It was consistently viewed as a medium for consolidating imperial legitimacy and as a strategic instrument of cultural diplomacy, deliberately employed by the Mughals to communicate these notions. However, with the advent of colonialism and the rise of the East India Company, this trajectory was partially altered, and Mughal painting experienced a semantic transformation. Accordingly, this study seeks to identify the influential elements involved in the creation of an artwork from the reign of the last Mughal emperor, Bahadur Shah Zafar, and, based on Homi Bhabha's theory of the Third Space, to analyze the symbols and visual elements present in this royal iconography. The research explores how the Third Space and cultural interaction facilitate the representation of power and legitimacy for the last Mughal ruler amid the dynasty's decline and the height of colonial intervention in India. The aim is to interpret the cultural identity of the influential elements in Mughal royal iconography and to access the Third Space at the boundary between Mughal and colonial cultures. The results of this study, which employed a descriptive-analytical method and library-based research, indicate that British colonial identity was not the sole source of power in the emergence of painting. Rather, the cultural identities of both sides, by entering each other's spheres, created a fluid space within the artwork. In other words, Mughal authority was not entirely explicit; it remained embedded in discursive layers and operated as a form of visual knowledge for legitimization and symbolic resistance against colonialism.
Keywords: Mughal Empire, British colonialism, painting, Third Space, imperial legitimacy.

Introduction

In the last era of the Islamic empire in India, a descendant of Timur[17]succeeded in founding a dynasty that, for more than two centuries, came to be recognized as one of the most brilliant empires in world history. Consequently, the height of their rule in India (1526–1857) created an environment conducive for aesthetic, artistic delicacy, and artistic craftsmanship, leaving a long-lasting mark on the cultural and visual landscape of the Indian subcontinent (Sah, 2024: 186). The Mughals' particular attention to painting led their visual works to encompass a broad spectrum of subjects and courtly chronicles, especially those relating to the emperors' lives, practices, and quotidian interactions (Welch, Schimmel, Swietochowski, Thackston, 1987: 17). Considering the significance of these works, particularly imperial Mughal iconographies, it can be said that they not only reflect the artists' technical expertise but also embody a symbolic visual language that, beyond its documentary value, played a significant role in conveying imperial authority and cultural values. Accordingly, these works have functioned not only as historical documents but also as strategic instruments for recording and consolidating Mughal identity (Ramanjaneya, 2018: 512), serving as a vehicle for expressing political intentions, legitimization, and ideological goals (Mahmoudi, 1402 [2023]: 174). The British arrival in India, however, brought notable changes to this trajectory. As Mughal authority gradually declined, the East India Company increasingly intervened in political and governmental affairs (Hameed, 2025: 2). By the last years of the Mughal Empire, during Bahadur Shah Zafar's reign, the gradual collapse of imperial power was underway, and the British colonizers, aware of the necessity to secure their dominance, imposed their culture

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* This article is extracted from the Master's Degree of Shamimeh Sadat Roknalsadati, titled: "Third Space and Cultural Interactions: Recognizing the Elements of Power of the Mughal Emperors through Royal Iconography " supervised by Dr Zahra Mehdipour Moghaddam and Prof. Dr Mehdi Mohammadzadeh at the University of Mazandaran.

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[17] Babur's father, Mirza Umar Sheikh, was directly descended from Timur the Great. It is also noteworthy that Babur's mother was the daughter of Yunus Khan, a descendant of Genghis Khan (Shimel, 2007 [1386]: 19–20).

on the colonized people of India. This ultimately led to the transformation of Mughal court art, particularly their visual arts and iconographies (Danish & Hussain, 2025: 48-49)

This study, grounded in Homi Bhabha's (1994) theory of the Third Space, aims to recognize the elements that influenced the creation of the work of the last Mughal emperor, Bahadur Shah Zafar, during the empire's decline. Its purpose is to interpret the cultural identity embedded in the influential elements of Mughal royal iconography and to explore the Third Space at the boundary between their culture and colonial influence. According to Bhabha, "identity is a spatially and temporally situated product" (Farahmandfar, 2014: 18), which can emerge within a hybrid space known as the Third Space. Thus, the analysis of the last Mughal royal iconography seeks to answer how the Third Space and cultural interactions, facilitated the depiction of power and legitimacy for the last Mughal emperor at a time of imperial decline and heightened colonial influence in India.

Methodology

The present study is fundamental research and employs a descriptive-analytical methodology, grounded in Homi Bhabha's theory of the Third Space and conducted through library-based research. It seeks to identify the cultural identity in the influential elements that shaped royal Mughal iconography during the final phase of the Mughal reign. Using purposive sampling, an artwork from the period of imperial decline and the height of British colonial influence in India was selected. Consequently, the painting "Enthroned Scene of Bahadur Shah Zafar," preserved in the Art and History Collection of the Smithsonian Institution, Washington, was chosen as the primary case study. It should be noted that in 1837–1838, the artist, Ghulam Ali Khan[18], produced two additional versions of the same subject depicting Bahadur Shah Zafar; these two versions are not analyzed in the present study. The second version belongs to the Nasir Khalili Collection (access number MSS 987), and the third was originally in the Cambridge Collection and is now housed at the Museum of Islamic Art in Doha.

Literature Review

Considering the interdisciplinary nature of this research, two categories of studies are addressed. The first category includes research focused on Mughal painting and royal iconography, particularly those related to Bahadur Shah Zafar. The second category encompasses studies concerned with Homi Bhabha's theory of the Third Space and its application in the analysis of artworks, which may be outlined as follows:

Delzendeh (2015), in his article "Iconography in the Indian Subcontinent," explores the formal and symbolic evolution of Indian iconography and shows how modern iconography draws upon historical iconographic sources. Ramanjaneya (2018), in "Mughal Art and Miniature Painting: Themes and Techniques," highlights the themes and techniques of Mughal painting and emphasizes their role in reflecting the grandeur and cultural richness of the imperial court. Mahmoudi (2023), in "Reflection of the Elements of Authority and Spirituality in the Mughal Empire Portraiture," concludes that paintings of this period primarily emphasize the ruler, portraying him in a sanctified and transcendent manner through symbols of power and spirituality. Ramazani (2023), in his master's thesis entitled "Exploring the Third Space in the Works of Iranian Pop Art Painters from 2001 to 2021: Practical Project: Destruction," demonstrates that by integrating indigenous and Western sign systems and creating an interactive space, artists produced an intercultural and innovative identity in their works, visually representing the acceptance of cultural coexistence. Mehdipour Moghaddam (2024), in the article "Genealogy of Indian Mughal Emperors' Jewels Narration by Royal Iconography (Case Study: Painting of "The Rulers of the Mughal Dynasty from Babur to Aurangzeb, with Their Ancestor Timur")" adopting a Foucauldian genealogical approach, demonstrates that jewelry in Mughal paintings signified not only the wealth and splendor of the court but also played a crucial role in legitimizing imperial authority and emphasizing dynastic power. Mehdipour Moghaddam and PourGharib (2025), in their article "Explaining the Cultural Identity of Jewelry in the Indian Subcontinent During the British Colonial Era Based on Homi Bhabha's Third Space Theory," demonstrate that Indian artists, often unconsciously, integrated traditional elements alongside components of colonial culture in their works. Consequently, the cultural identities of both sides entered an interactive realm, producing artifacts that neither merely reflected indigenous Indian identity nor fully represented the culture of the colonizer. Based on a review of existing research, it becomes clear that

[18] Ghulam Ali Khan, a prominent Indian painter born in Delhi, over more than four decades of artistic activity, depicted a diverse array of Mughal royal iconography, including those of Akbar II and Bahadur Shah Zafar. Notably, he continued to collaborate with the court during the final decade of Bahadur Shah Zafar's reign (Dalrimple & Sharma, 2012: 41, 48).

the interaction between colonial power and the Mughal court in shaping royal iconography, especially representations of Bahadur Shah Zafar, has not yet been examined through the lens of Homi Bhabha's Third Space. The present study, therefore, addresses this gap by applying the concept of the Third Space to paintings from the late Mughal period, when colonial authority was beginning to assert itself in India.

Theoretical Foundation

One of the emerging fields of inquiry in the study of cultures in colonized societies is postcolonial studies, which places particular emphasis on examining the relationship between culture and systems of colonial power. As a cultural approach, postcolonial theory does not merely announce the end of the colonial era; rather, it asserts that pathways for disengagement from colonial domination have been identified (Shirzadi, 2009: 151–152). Within this framework, among postcolonial theorists, Homi Bhabha has played a central and influential role by focusing primarily on the behavioral and relational dynamics between the colonizer and the colonized. Unlike Edward Said, Bhabha argues for the existence of a space referred to as the "Third Space," in which the colonized subject is also able to articulate personal experiences and desires. Within this space, power is not exclusively held by either side; instead, an interactive and negotiated relationship emerges. In other words, the Third Space constitutes a site where diverse cultures, including those of the colonizer and the colonized, can enter into dialogue and mutual interaction (Pourmokhtar & Marashi, 2020: 110). In fact, Bhabha explains the location of culture through the lens of the Third Space by suggesting that within this space, both indigenous and foreign cultures lose their inherent authenticity and purity. According to him, the Third Space is ambiguous and indeterminate, revealing that meaning and reference are always relational and two-sided. Consequently, cultural symbols and meanings possess no inherent unity or fixed stability. The Third Space, in essence, dispels the belief that signs and their meanings are timeless and unchangeable, allowing them to be dehistoricized, translated, and reinterpreted afresh. In other words, meaning is generated through a constant and reciprocal exchange between the two realms, without the need for them to come into direct contact (Bhabha, 1994: 37–38). It is precisely in this space that intersubjective and collective experiences of a nation, social interests, and cultural values are formed (Bhabha, 1994: 2). Bhabha maintains that all hybrid cultural systems emerge within the Third Space, and that cultural identity is produced in a dual and often contradictory manner within this space.

From his perspective, the authenticity and purity of each cultural side are contested, and an interaction emerges between cultures, whether colonizer or colonized. Based on the relationship between colonizer and colonized within the Third Space, this space can be characterized by the following features:

A fluid, ambiguous, and indeterminate space that arises through interactions among two or more individuals or cultures.

Symbols and their meanings do not possess eternal continuity.

The notion of intrinsic purity of each culture is negated.

It is not founded on binary oppositions but is formed through cultural interactions between the colonizer and the colonized.

The Third Space articulates a gap across unstable boundaries, where different cultures lose their assumed purity and enter each other's domain (Pourmokhtar & Marashi, 2020: 111).

Notably, recognizing this mutual condition opens a path toward overcoming alienation and conflict between diverse cultures (Mohammadpour & Alizadeh, 2010: 160), resulting in a revaluation of colonial identity through the repeated effects of the colonized identity (Bhabha, 1994: 159).

Description of the Case Study

"Identity is that through which an individual's being and essence are recognized" (Yaghoubi, 2016: 52), and a variety of factors, such as historical, cultural, and social transformations, can function as identity-forming forces within a society. In this context, the advent of colonialism in India led to significant transformations in the identity of Mughal visual arts. Colonialism constituted "a powerful cultural front on a global scale that, in diverse and multifaceted forms, transformed the identity and culture of colonized peoples" (Darabi, 2015: 140).



Figure 1. The Royal Iconography of Bahadur Shah Zafar's Accession, watercolor, ink, and gold on paper, attributed to Ghulam 'Ali Khan, dated 1837–38. Art and History Collection, Smithsonian Institution, Washington, D.C. (Dalrymple & Sharma, 2012: 177).

An iconography of the accession of Bahadur Shah Zafar in the nineteenth century, during the period of British presence in India. As shown in the image, the Mughal emperor is seated on the throne in a display of grandeur and authority. On either side of him stand his favored son, Mirza Fakhr al-Din, and his other son, Mirza Farukhandeh, both dressed in elaborate attire and richly adorned, and accompanied by a royal attendant. It is important to note that Ghulam 'Ali Khan, the painter of Figure 1, intentionally excluded the emperor's eldest son from the pictorial frame, to emphasize the elevated status and privileged position of Bahadur Shah Zafar's favored heir (Losty, 2014: 4). In other words, the artist's intention in this image, as well as in its two similar versions, was to place particular emphasis on political considerations in the arrangement of courtly figures (Losty, 2014: 11).

The Representation of the Third Space in the Royal Iconography of Bahadur Shah Zafar

As previously discussed, colonial identity and power cannot be considered foundational or inherently authentic. Rather, according to Homi Bhabha, an interaction emerges between the colonizer and the colonized within an interstitial space. This entails an attention to the multiplicity of voices between the identities of the colonizing and colonized cultures (Bhandari, 2022: 172), which are in motion toward one another within an interstitial space. Accordingly, within Bhabha's approach, the colonizing culture does not possess absolute authority. The colonized subject becomes capable of resisting colonial power only when able to respond to the colonizer's gaze, to look back at the colonizer and, through this reciprocal gaze, challenge colonial authority (Shirzadi, 2009: 170). In other words, the colonizer seeks to impose imitation and mimicry as a superior identity upon the colonized. However, as Bhabha argues, this relationship is fundamentally reciprocal: transformation is not imposed solely upon the colonized, but ultimately the colonizer is also transformed through this process and becomes influenced by the colonized (Delzendeh, 2017: 439).

Hence, in the painting "The Enthronement of Bahadur Shah Zafar", it is possible to identify elements that not only illustrate the tendency of dominant and subordinate cultures to move toward one another but also convey notions of power and authority during a period of imperial decline. Therefore, to achieve the answer to the research question, the study first identifies and analyzes the cultural elements that shaped this figure, to understand how the Third Space operated in expressing the power and grandeur of the Mughals.

In this regard, it can be argued that although the painter created figure 1 during the period of the Mughal empire's decline, the presence of indigenous and traditional elements in the work cannot be overlooked. In fact, what most prominently draws the viewer's attention is the extensive use of jewelry by Bahadur Shah and even his sons. These include turbans adorned with jewels, necklaces, rings, bracelets, armlets, earrings, belts, and jeweled weapons, which were considered an inseparable part of Mughal life (Mehdi-Pour Moghadam, 2024: 85). High-ranking court officials frequently offered such precious ornaments as symbols of royal favor (Ali Sayed, 2015: 3, 19). According to the sources, "no other state in Asia or Europe possessed jewelry comparable to that of the Mughal empire in India…" (Carvalho, 2010: 11). It can therefore be argued that the artist deliberately depicted the emperor and his entourage adorned with a variety of jewels, presenting a striking figure of Mughal imperial grandeur in the face of Britain (MehdiPour Moghaddam, 2024: 85). In addition to gold ornaments, emeralds and rubies (e.g., the crown shown in figure 1) and pearls were the most frequently employed materials. Emeralds, highly valued by the Mughal emperors (Mehdipour Moghaddam, 2024: 84), resonated deeply with their engagement with Islamic traditions (Nigam, 1999: 40). In fact, the Mughals

believed that anyone who wore an emerald would be endowed with divine favor and protection (Bala Krishnan, 2001: 182). The ruby, highly valued in Indian culture and symbolic of the sun (Bala Krishnan, 2001: 144), also held special significance for the Mughals. Beyond the influence of indigenous Indian traditions, the ruby, particularly its deep red color, because of its mentioned in the Qur'an (Ahsan Bilal & Nasir Khan, 2021: 10) and in emulation of the Timurid precedent (Carvalho, 2010: 44). But, multi-strand pearl necklaces, considered since ancient times by the inhabitants of the Indian subcontinent as the most exquisite element of Indian jewelry (Mehdi-Pour Moghadam, 2024: 82), have consistently served as symbols of purity and wealth (Ali Sayed, 2015: 73, 83). Thus, jewelry can be understood as an integral part of the visual language of power, forming an inseparable connection with royal attire, social status, and political legitimacy (Rice, 2024: 258–259).

Another notable element in the figure is the emperor's thin and emaciated face, which contrasts sharply with the robust depictions of earlier Mughal rulers such as Akbar or Shah Jahan during the empire's peak. This frailty can be interpreted as a visual marker of the crisis of power and governance during the Mughal decline. Furthermore, the representation of a scene devoid of movement and dynamism creates a completely still and tranquil space, which may signify the collapse of royal discourse. It appears that the artist sought to present Bahadur Shah, beleaguered and diminished before British authority, as an ostensibly powerful monarch merely through the display of opulent jewelry. In other words, the power of the last Mughal ruler survives only in ceremonial appearance and courtly ritual. It should be noted that in Mughal iconography, the painter employed a restricted typology, treating the body as a composite, delineated subject rendered with detailed color layers, textiles, and jewelry. As seen in figure 1, the central placement of the emperor's figure, with a narrow waist, conveys the presence of an empire ready for service or battle, a compositional pattern repeated in many Mughal royal iconographies, constituting a key visual marker of authority (Rice, 2022: 35–36). Another significant element is the presence of a halo encircling Bahadur Shah's head, rendered in the form of a radiant sun. This visual element may be interpreted as the artist's attempt to portray the ruler as a luminous solar presence, emblematic of a legitimate and powerful empire. In Mughal iconography, the halo functions as a metaphor for the divine emperor, emphasizing his royal status both as the political center and as a visual symbolic axis (Sparavigna, 2016: 2). The sun-like halo, in conjunction with the emeralds and rubies adorning the royal crown, further reinforces this symbolism. It should be noted that this halo was likely derived from the concept of farr-e izadi (divine glory) in the Iranshahri tradition (Delzendeh, 2015: 160). Moreover, Bahadur Shah Zafar is depicted without weapons, holding a hookah instead. Silver and gold hookahs, particularly from the reign of Akbar and especially under Shah Jahan, were consistently represented in royal paintings and iconographies as prestigious symbols of courtly life (Chaudhary, 2018: 528–529). Hence, its presence in the emperor's hand may also be regarded as another visual marker of power. Additionally, at the center of the figure, two lions appear prominently as the bases of Bahadur Shah's royal throne. In Mughal culture, much as in other civilizations, the lion serves as a symbol of power, courage, and legitimate kingship, and, more broadly, represents the political authority of the empire. Placed alongside the frail, emaciated figure of the emperor, these lions evoke the continued presence of a powerful imperial order during a period marked by foreign intervention, much as dragon motifs on the armrests of Bahadur Shah's enthronement throne.

Furthermore, the element depicted above the emperor's head, representing the scales of Justice, constitutes a significant symbolic element. Positioned above the emperor, who occupies the visual and symbolic center of the composition, emphasizes the emperor's role as the ultimate arbiter of justice and recalls the long-standing association between legitimate kingship and the administration of justice (Rice, 2024: 258–259). Another noteworthy element within the image is the white handkerchief held by one of Bahadur Shah's sons. According to existing sources, the presence of the handkerchief reflects notions of civility, social distinction, and etiquette, and is generally associated with European manners and modes of adornment. Within colonial societies, the use of the white handkerchief as a symbol of cleanliness and order has been understood as deriving from Western cultural practices and has been interpreted as a form of imitation of European social status (Rusyeni, 2016: 3–14).

Moreover, the presence of an attendant holding a fly-whisk on the right side of the composition, positioned behind the emperor, has been interpreted as a symbol of reverence and loyalty to the monarch, as well as a visual affirmation of his political authority and imperial grandeur. Alongside these iconographic elements in Figure 1, particular attention must be paid to the artist's deliberate arrangement of figures within the composition. Notably, the figure contains no visual reference to Bahadur Shah Zafar's eldest son or designated heir; instead, the painter depicts only the sons favored by the emperor, rendered at differing scales. In this regard, it is significant to recall that Akbar II, Bahadur Shah Zafar's father, initially sought to appoint his favored son, Mirza Salim, as his successor rather than Bahadur Shah Zafar. However, under British pressure

to adhere to the principle of primogeniture, he was ultimately unable to prevent Bahadur Shah Zafar's accession to the throne. Drawing upon this political background (Losty, 2014: 11), the painter appears to have intentionally conveyed that Bahadur Shah Zafar disregarded British influence and authority in matters of succession.

Despite the growing British threat, their domination, and the eventual arrest of Bahadur Shah, which led to instability and the collapse of Mughal rule (Gupta, 2015: 86), the painter presents this royal iconography as a powerful and splendid vision of the empire's final moments. In other words, through the visual representation of the Mughal court's luxurious lifestyle in royal iconography (Mahdipour Moghaddam, 2024: 85), the artist aimed to assert Mughal superiority in the face of British colonial power. Although the painting depicts a slender and frail emperor adorned with various jewels, Mughal courtly paintings not only reflect the emperors' interest in ornamentation and luxury but also signify the authority and superiority of those who wore such regalia (Carvalho, 2010: 451, 453). Accordingly, the painter's attention to elaborate clothing, the crown, jewelry, and the throne conveys not merely wealth, but the power and dominance of the Mughals in the face of the British forces, positioning Bahadur Shah at the center of this authority. Furthermore, the deliberate omission of the emperor's eldest son, Darabkht, and the depiction of his other sons in a painting created during British colonial pressures over India, illustrates a network of relationships, the use of imagery as a substitute for violence, and the symbolic assertion of Mughal power and dynastic continuity. In essence, the painting, functions as a tool for legitimization, the communication of political messages, and the symbolic perpetuation of the Mughal dynasty.

It is noteworthy that although the colonial powers attempted to assert their superiority and dominance over the final phase of the Mughal presence in India, they were unable to establish themselves as a superior identity over the colonized. According to Homi Bhabha, the subjugated culture initially engages in mimicry of other elements as a form of resistance against colonial power. By altering the colonizer's perspective and drawing their attention toward the colonized identity, this mimicry challenges the unilateral nature and, in other words, the presumed purity of the colonizer's identity, allowing the subjugated culture to preserve and reconstruct its own identity. This dynamic is reflected in the iconography (Figure 1) and elements, in which the painter depicts the subjugated ruler in a manner that, while acknowledging the superior colonial power, Britain, also evokes the authority of the Mughal dynasty as established by its founder, Babur, and his successors. In other words, the Indian painter, while initially yielding to colonial demands, by revisiting elements of Mughal courtly culture, "produced agency that escaped monologue and singular meaning [and the absolute dominance of the colonizer]" (Niazi & Araji, 2019, p. 75), meaning that the colonized "influences the colonizer as much as it is influenced by them" (Shirzadi, 2009, p. 170). Consequently, the resulting artwork reflects the assertion of Mughal power amid the political and cultural turbulence of the late Mughal period. Ultimately, the interstitial space between colonizer and colonized, the Third Space, enabled the painter, by returning to the identity and culture of the Mughal Empire, to shift expressions of power from the colonizer toward the colonized.

Conclusion

The primary aim of this study was to examine the cultural identity of the constituent elements in the royal iconography "Bahadur Shah Zafar enthroned" and to explore the manifestation of the Third Space at the intersection of Mughal and colonial cultures. Unlike other postcolonial theorists, Homi Bhabha does not focus solely on the power and monologue of the colonizer, but rather emphasizes the multiplicity of voices between colonizer and colonized within a Third Space. As the analysis revealed, elements such as the throne, the sun-like halo, the lions, and the scales of justice, which had previously been employed in Mughal royal iconography, here confer symbolic legitimacy upon Bahadur Shah Zafar and establish a connection with the tradition of earlier Mughal rulers. Furthermore, elements such as richly patterned and luxurious garments, the crown, the royal throne, multiple jewelry pieces, and the enthroned scene, considered part of formal court rituals, not only reflect splendor and wealth but also convey political messages to colonial powers. Moreover, the arrangement of figures, with Bahadur Shah Zafar placed at the center, reinforces the visual representation of his legitimate rule in the face of colonial authority. The placement of his attendant behind him, the two young princes flanking the emperor, and the deliberate omission of his eldest son, contrary to British preferences, signify loyalty, respect, and the continuity of the Mughal dynasty. Although Bahadur Shah Zafar is depicted as frail and slender compared to earlier Mughal rulers and holds a hookah rather than weapons, the presence of his favored son, Mirza Fakhruddin, standing beside him with a dagger at his waist, further emphasizes the continuity of sovereignty and the legitimacy of the Mughal legacy.

In this regard, it is noteworthy that Britain, as one of the most powerful colonial powers, sought to undermine the culture and identity of the people of India, particularly the Mughal Empire, by imposing its own culture and compelling them to imitate it as a superior and absolute identity. The white handkerchief in the hands of the prince, the depiction of the emperor, and the stillness and immobility throughout the painting signify the collapse of the Mughal sovereignty under British pressure. Indeed, it can be argued that the painter, influenced by colonial authority, initially adopted elements of the dominant culture and portrayed the last Mughal emperor in a static, frail, and slender form, reflecting his weakness and defeat before Britain. However, despite depicting a subdued ruler, the painter, through careful attention and the selective use of elements favored by earlier Mughal emperors, primarily the display of precious jewelry, produced an image that conveys a sense of continued grandeur and imperial authority, suggesting that the Mughal Empire remained at the height of its power. The painter managed to challenge the supposed superiority of colonial identity and reshape the royal iconography in subtle ways. According to Homi Bhabha, in the intermediary space known as the Third Space, both cultures, colonizer and colonized, move toward one another, producing an image that is neither a full realization of the colonizer's absolute will nor entirely akin to earlier Mughal royal iconography. This painting, set during the decline of the Mughal Empire and the rise of British influence, becomes a visual document layered with notions of power. Here, the representation of authority functions as a form of political propaganda aimed at reinforcing imperial power, maintaining dynastic legitimacy, and sustaining the continuity of the empire. Amidst political crises, military weakness, and British supremacy, the work seeks, through Mughal symbols such as the use of jewelry and the arrangement of loyal courtiers, and via the lens of the Third Space, to reconstruct and preserve the discourse of power, portraying Bahadur Shah Zafar as an ostensibly powerful monarch in the face of colonial dominance.

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SOUL AND DEATH IN THE PHENOMENOLOGY OF PLATO AND SUHRAWARDĪ: A COMPARATIVE STUDY OF MANIFESTATION AND SPIRITUAL EMBODIMENT

Ashoori-Neda[19]

Abstract
This study adopts a phenomenological framework to investigate the lived experience of soul and death across two distinct philosophical traditions: Plato's Phaedo and Suhrawardī's Illuminationist philosophy. The central question asks how "death" and "soul" manifest and disclose themselves to human consciousness as horizons of meaning. In the Phaedo, the soul is revealed at the threshold of bodily separation, exemplified in Socrates' serenity before death and the emergence of ideal realms that orient understanding. By contrast, Suhrawardī's Illuminationism articulates the embodiment of the soul through luminosity, the intensification of perception, and the encounter with the imaginal world (ʿālam al-mithāl al-muʿallaqa), thereby rendering the soul a luminous manifestation rather than a merely conceptual entity.
Rather than treating the soul as an abstract metaphysical object, the study situates it within lived experience, examining conditions of appearance and disclosure. It argues that Plato's dialogical form operates as a phenomenological medium wherein truth becomes present through discourse, while Suhrawardī's hierarchy of lights and orientation toward the Mashriq al-Anwār (Orient of Lights) formalizes spiritual embodiment as an intensification of awareness. These differing metaphysical backgrounds nonetheless converge on a shared phenomenological choreography in which death functions as a moment of unveiling: detachment from corporeality, the transformation or intensification of consciousness, and entry into a renewed semantic horizon.
The comparative analysis isolates three recurrent structures of phenomenality that cut across the traditions: first, the progressive release from bodily attachment that clarifies the soul's self-disclosure; second, a heightened mode of perception—cast as inner clarity in Plato and as ascendant luminosity in Suhrawardī—that reconfigures the field of appearance; and third, the opening of a new horizon of meaning—ideal forms in the Greek context and imaginal presence in the Illuminationist schema—in which the purified or luminous soul is encountered. In this reading, death is not annihilation but the moment of truth in which the soul's reality becomes manifest to consciousness.
The contribution of the study lies in shifting comparative focus from metaphysical doctrines to the phenomenality of transition and illumination. By presenting death as disclosure and soul as manifestation, it advances an interpretive model that integrates dialogical revelation and luminous embodiment into a unified analytic of appearance. The model also resonates with artistic and literary narratives, particularly within the Iranian allegorical tradition, where imaginal figuration and symbolic light stage processes of spiritual manifestation. This opens avenues for interdisciplinary work at the intersection of philosophy, phenomenology, and aesthetics, demonstrating how ritual, dialogue, and imagery jointly mediate the soul's presence within experience.
Keywords: Plato, *Phaedo*, Illuminationist philosophy, immortality, soul and psyche

Extended Abstract

Introduction

This research adopts a phenomenological framework to examine the lived experience of soul and death across two distinct philosophical traditions: Plato's *Phaedo* and Suhrawardī's Illuminationist philosophy. The central question concerns how "death" and "soul" disclose themselves to human consciousness as horizons of meaning. In *Phaedo*, the soul is revealed at the threshold of bodily separation, exemplified in Socrates' serenity before death and the emergence of ideal realms that orient understanding. By contrast, Suhrawardī's Illuminationism articulates the embodiment of the soul through luminosity, intensification of perception, and encounter with the imaginal world (*ʿālam al-mithāl al-muʿallaqa*), thereby rendering the soul a luminous manifestation rather than a merely abstract concept.

Methods

The study situates the soul not as an abstract metaphysical object but within lived experience, analyzing the conditions of appearance and disclosure. It argues that Plato's dialogical form functions as a phenomenological medium wherein truth becomes present through discourse, while Suhrawardī's hierarchy of lights and

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orientation toward the *Mashriq al-Anwār* (Orient of Lights) formalize spiritual embodiment as an intensification of awareness.

Results

Despite their differing metaphysical backgrounds, both traditions converge on a shared "phenomenological choreography" in which death operates as unveiling: detachment from corporeality, transformation or intensification of consciousness, and entry into a renewed semantic horizon. The comparative analysis highlights three recurrent structures of phenomenality:

The progressive release from bodily attachment that clarifies the soul's self-disclosure.

A heightened mode of perception—inner clarity in Plato and ascendant luminosity in Suhrawardī—that reconfigures the field of appearance.

The opening of a new horizon of meaning—ideal forms in the Greek tradition and imaginal presence in the Illuminationist schema—in which the purified or luminous soul is encountered.

Discussion & Contribution

In this reading, death is not annihilation but the moment of truth in which the reality of the soul becomes manifest to consciousness. The study's contribution lies in shifting comparative focus from metaphysical doctrines to the phenomenality of transition and illumination. By presenting death as disclosure and soul as manifestation, it advances an interpretive model that integrates dialogical revelation and luminous embodiment into a unified analytic of appearance.

This model also resonates with artistic and literary narratives, particularly within the Iranian allegorical tradition, where imaginal figuration and symbolic light stage processes of spiritual manifestation. It thereby opens avenues for interdisciplinary research at the intersection of philosophy, phenomenology, and aesthetics, demonstrating how ritual, dialogue, and imagery jointly mediate the soul's presence within experience.

Keywords: Plato, *Phaedo*, Illuminationist philosophy, immortality, soul and psyche

Introduction

The soul occupies a central position in both Greek and Islamic philosophical traditions. In ancient Greece, from the *Phaedo* to the *Republic*, the question of the soul's immortality is interwoven with a network of arguments, myths, and ethical formulations. In Islamic philosophy, from Ibn Sīnā and Suhrawardī to Mullā Ṣadrā, the soul is conceived as an immaterial and creative reality whose complex relation to the body grounds ontological and epistemological theories (Plato, 1988; Suhrawardī, 1987; Dīnānī, 2000; Nasr, 2010). The significance of this comparative inquiry lies in moving beyond abstract doctrines to the phenomenality of how soul and death appear within consciousness: where Socratic dialogue becomes a medium of truth's disclosure, and Illuminationist lights reconfigure the field of appearance through *ishrāq* and visionary insight (Amānī, 2022; Qorbānī, 2015).

Furthermore, the relation between Greek and Islamic traditions, as seen in Suhrawardī and the Neoplatonists, reveals historical pathways of transmission and transformation of concepts. Suhrawardī rewrites the Peripatetic system of intellects in the language of light and, by introducing the detached imaginal realm, bridges the categorical gap between immaterial and material orders. This reformulation simultaneously establishes new relations between "forms" and "lights" (Suhrawardī, 1987; Qorbānī, 2015; Nasr, 2010).

Research Innovation

The primary innovation of this study lies in shifting the perspective on the immortality of the soul. Previous scholarship has largely examined Plato's *Phaedo* and Suhrawardī's Illuminationism from metaphysical or historical standpoints (Copleston, 2009; Bormann, 2001; Nasr, 2010). This research, however, relocates the focus from abstract doctrines to the phenomenology of how soul and death disclose themselves within human consciousness. In this way, the soul is understood not merely as a philosophical concept but as a lived experience and a moment of truth's unveiling. This methodological shift enables a precise comparison between Socrates' experience at the threshold of death and the luminous embodiment of souls in Suhrawardī's Illuminationist system.

A further innovation of the study is its simultaneous engagement with Greek, Islamic, and Orphic sources. Whereas many studies have limited themselves to Plato or Suhrawardī, this research incorporates Orphic tablets and Pythagorean traditions to demonstrate that the problem of reincarnation and the liberation of the soul in all three traditions is linked to degrees of purity and sacred memory (Mohammadzadeh & Beheshtī,

2014; Guthrie, 1993; Huffman, 2020). This tripartite comparison opens a new horizon for understanding both commonalities and differences, showing how diverse philosophical and religious traditions conceive death as a moment of truth and the soul as an eternal essence.

Significance and Necessity of the Study

The importance of this research lies in its engagement with one of the most fundamental philosophical questions: the nature of the soul and its destiny after death. From a comparative and phenomenological perspective, the study responds to this question at a time when contemporary philosophy—particularly in the fields of philosophy of religion and philosophy of mind—has renewed its focus on consciousness and immortality. Revisiting Greek and Islamic traditions opens new horizons for dialogue between classical and contemporary philosophy (Amānī, 2022; Dīnānī, 2000). The study demonstrates that Socrates' experience of death and the luminous embodiment of souls in Illuminationist philosophy both exemplify "the disclosure of truth within consciousness," thereby contributing meaningfully to current debates on awareness and survival.

The necessity of this research also lies in bridging the gap between historical and philosophical studies. Previous scholarship has either concentrated solely on the intellectual history of Plato and Suhrawardī or limited itself to abstract metaphysical analysis. By combining phenomenological methodology with comparative analysis, this study shows how classical texts can be mobilized to illuminate the lived experience of soul and death. Such an approach is significant not only for comparative philosophy but also for theology, philosophy of religion, and interdisciplinary inquiries in consciousness and psychology (Ahmadī & Rāsakhī, 2017; Qorbānī, 2015; Nasr, 2010).

Methodology

The methodology of this research is based on comparative and phenomenological analysis. In the first stage, primary texts—Plato's *Phaedo* and Suhrawardī's Illuminationist works (especially *Ḥikmat al-Ishrāq* and *Talwīḥāt*)—were studied directly. Secondary sources, including commentaries and interpretations by Muslim philosophers (such as Dīnānī, 2000; Qorbānī, 2015; Ahmadī & Rāsakhī, 2017) and Western scholarship (Copleston, 2009; Bormann, 2001; Guthrie, 1993; Huffman, 2020), were then consulted to gather analytical data. Phenomenology here is understood as focusing on the appearance of soul and death within human consciousness, rather than abstract doctrinal analysis. Accordingly, Socrates' experience at the threshold of death and the luminous embodiment of souls in Suhrawardī's Illuminationist system were analyzed as two paradigmatic phenomenological events.

In the second stage, the collected data were subjected to comparative analysis. This included juxtaposing Plato's arguments for the immortality of the soul with Suhrawardī's division of lights and hierarchy of existence, as well as comparing perspectives on reincarnation in Plato, the Orphic tradition, and Suhrawardī. For greater clarity, descriptive tables were employed to visually map the structure of arguments and the hierarchy of lights. Finally, the findings were integrated into a unified phenomenological framework, demonstrating that both traditions regard death as a moment of unveiling and the soul as an eternal reality.

Problem Statement

The central problem of this study is the comparative examination of the concepts of soul and death within two distinct philosophical traditions: Plato's *Phaedo* and Suhrawardī's Illuminationist philosophy. Both traditions regard the soul as an immaterial and eternal reality, yet their foundations and modes of argumentation differ. In Plato, the soul is established through philosophical proofs such as opposition, recollection, simplicity, and form (Plato, 1988; Copleston, 2009; Bormann, 2001; Amānī, 2022). In Suhrawardī, the soul is conceived as a luminous reality situated within the hierarchy of lights, with death defined as the separation of the soul from the body and its entry into the imaginal or sacred realm (Suhrawardī, 1987; Ahmadī & Rāsakhī, 2017; Dīnānī, 2000). Despite these shared assumptions, few studies have simultaneously compared the two traditions from the perspective of the phenomenality of how soul and death appear within human consciousness.

Accordingly, the problem addressed in this research is to demonstrate how soul and death are understood in both traditions not merely as metaphysical doctrines but as phenomenological moments of disclosure within consciousness. This problem is significant because it can establish a bridge between ancient Greek philosophy, Islamic philosophy, and contemporary debates on consciousness and immortality (Amānī, 2022; Qorbānī, 2015; Nasr, 2010).

Research Objectives

To conduct a phenomenological analysis of the soul in Plato's *Phaedo*.
To examine the system of light and the position of the soul in Suhrawardī's Illuminationist philosophy.
To provide a comparative analysis of Plato and Suhrawardī's views on soul, death, and reincarnation.
To clarify the role of Orphic and Pythagorean traditions in understanding reincarnation and the liberation of the soul.
To propose a phenomenological framework for analyzing the commonalities and differences between the two traditions.

Research Questions
How does the soul in Plato's *Phaedo* disclose itself as an independent and eternal reality?
How does Suhrawardī explain death and eschatology within the hierarchy of lights and the imaginal realm?
What similarities and differences exist between Plato and Suhrawardī's perspectives on soul and death?
What role does reincarnation play in both traditions, and how is it linked to the liberation of the soul?
How can a phenomenological approach analyze Socrates' experience of death and the luminous embodiment of souls in Suhrawardī's Illuminationism within a shared framework?

Literature Review
Numerous studies have addressed the immortality of the soul in Platonic philosophy. Copleston (2009) and Bormann (2001) examined Plato's arguments in the *Phaedo*, showing that the argument from recollection establishes only the soul's prior existence rather than directly proving its survival after death. Gharībī (2011) and Amānī (2022) further critiqued and analyzed these arguments, emphasizing their limitations. Within the Orphic and Pythagorean traditions, Guthrie (1993) and Huffman (2020) highlighted the significance of reincarnation and sacred memory in the liberation of the soul. These studies provide the necessary foundation for comparing Plato's perspective with ancient Greek religious traditions.
In Islamic philosophy, extensive research has been conducted on Suhrawardī and Illuminationist thought. Dīnānī (2000) explained the position of the soul within Suhrawardī's hierarchy of lights, demonstrating that sanctified souls preserve their individuality while receiving illumination from overpowering lights. Qorbānī (2015) and Nasr (2010) analyzed the system of light and the division of existence in Illuminationist philosophy. Ahmadī and Rāsakhī (2017), adopting a comparative approach, examined the influence of Neoplatonism on Suhrawardī. Dehqānī and Mīrjalīlī (2014) addressed the issue of reincarnation in Suhrawardī's thought, revealing his cautious stance. Nevertheless, few studies have simultaneously compared Plato's *Phaedo* and Suhrawardī's Illuminationism from the perspective of phenomenology. This gap underscores the necessity of the present research.

Theoretical Framework
The theoretical framework of this study is grounded in the combination of two approaches: comparative philosophy and phenomenology. Comparative philosophy enables the juxtaposition of Greek and Islamic traditions, revealing both their similarities and differences. Phenomenology, rather than focusing on abstract doctrines, emphasizes the manner in which soul and death appear within human consciousness. Within this framework, Socrates' experience at the threshold of death and the luminous embodiment of souls in Suhrawardī's Illuminationist system are analyzed as two paradigmatic phenomenological events (Amānī, 2022; Ahmadī & Rāsakhī, 2017; Qorbānī, 2015).
This framework also relies on the concepts of "intensification of awareness" and "horizon of appearance." In Plato, intensification of awareness is associated with inner clarity and recollection of forms; in Suhrawardī, it is linked to luminosity and illumination. Both traditions regard death as the moment in which consciousness enters a new horizon. Accordingly, the theoretical framework of this study allows the concepts of "soul," "death," "form," and "light" to be analyzed within a shared phenomenological field.

The Soul in Plato's *Phaedo*
Plato's *Phaedo* is one of the most significant texts on the immortality of the soul, in which Socrates, during the final hours of his life, presents death with serenity and philosophical reasoning as liberation from the prison of the body. In this dialogue, Plato offers four principal arguments for the immortality of the soul: the argument from opposites, the argument from recollection, the argument from simplicity, and the argument from form (Copleston, 1984; Bormann, 2001; Amānī, 2022).

The argument from opposites rests on the principle that "each opposite arises from its contrary," establishing a transition from death to life and from sleep to awakening. This principle suggests that death cannot be an absolute end but must lead to its opposite, namely life. The argument from recollection maintains that knowledge of intelligibles is not derived from sensory perception but from the remembrance of prior forms; hence, the soul must have existed before birth (Gharībī, 2011). Yet Plato himself acknowledges that this argument proves only the soul's pre-existence, not its survival after death.

The argument from simplicity presents the soul as a non-composite reality, and therefore imperishable, since the cause of perishability in things is their composite nature. The argument from form asserts that the soul participates in the form of life, and since the form of life is eternal, the soul cannot admit death (Plato, 1988; Amānī, 2022).

From a phenomenological perspective, the Socratic dialogue becomes the medium through which the truth of the soul is disclosed. At the threshold of death, Socrates experiences serenity that emanates from the horizon of ultimate understanding, interpreting death as a "moment of truth"—a moment in which the soul is freed from bodily constraints and enters the realm of ideal forms. This view regards death not as annihilation but as unveiling of the soul's reality. Within this framework, the relation between soul and body is one of independence and governance rather than bodily quality. Socrates' response to Simmias' harmony theory demonstrates that the distinction between virtuous and vicious souls does not stem from bodily constitution but from the soul's mode of attachment to forms and truth (Amānī, 2022).

Moreover, Plato in the *Phaedrus* and the *Republic* refers to the cycle of reincarnation as a stage of purification for the soul. Comparison with Orphic tablets reveals that, for Plato, liberation from the cycle is possible after three philosophical lives, whereas in Orphism adherence to ritual and sacred memory is required (Mohammadzadeh & Beheshtī, 2014; Guthrie, 1993; Huffman, 2020). Thus, the *Phaedo* is not merely a philosophical text but also a phenomenological one, transforming Socrates' experience of death into a medium for the disclosure of the soul's truth.

Table 1 – Description of the Arguments for the Immortality of the Soul in *Phaedo* (Author's Compilation)

Argument	Basis	Conclusion	Critique/Objection	Socratic Response
Opposition	Each opposite arises from its contrary	Death leads to life	The immortality of the soul is not yet confirmed	Requires reinforcement of the reasoning
Recollection	Knowledge = remembrance of prior forms	Pre-existence of the soul	Does not directly prove survival after death	Plato himself acknowledges this limitation
Simplicity	The soul is non-composite	Incapable of perishing	Simmias' harmony theory challenges independence	The soul is independent of the body
Form	The soul partakes in the form of life	Immortality of the soul	Objection by Cebes: immortality ≠ infinite survival	The soul does not admit the form of death

The Soul in Suhrawardī's Illuminationist Philosophy

With the establishment of Illuminationist philosophy (*ḥikmat al-ishrāq*), Suhrawardī constructed his system upon the polarity of light and darkness. He regarded light as a self-evident and indefinable reality—manifest in itself and the source of manifestation for all other beings (Suhrawardī, 2009, vol. 2: 113; Dīnānī, 2000: 73–74). Human soul, in his view, is itself light, since it is present to itself, endowed with self-awareness, and immaterial in essence—qualities that reveal its luminous nature (Suhrawardī, 1987: 208; Zīyā'ī, 2014, vol. 2: 297–305; Amīn Razavī, 1998: 106).

Suhrawardī's division of existence into four categories—substantial lights, accidental lights, dark bodies, and dark accidents—marks a departure from Aristotelian and Avicennian classifications (Suhrawardī, 2009, vol. 2: 107–117; Nasr, 2010: 226). Within this system, substantial lights such as the *Light of Lights*, overpowering lights, and human souls constitute the true causes of other beings, since only substantial lights possess self-conscious reality and can generate effects. Dark bodies and accidents lack causality and depend entirely upon light (Suhrawardī, 1987: 202–203; Qorbānī, 2015).

From a phenomenological perspective, Suhrawardī interprets death as the dissolution of temperament and the separation of the soul from the body. Resurrection occurs immediately after death, with souls directed to three destinations according to their attachments: perfected souls ascend to the realms of sanctity and dominion (*quds* and *malakūt*); intermediate souls inhabit luminous imaginal bodies in the detached imaginal world; and the wicked are confined to dark imaginal forms that constitute suffering and torment (Ahmadī & Rāsakhī, 2017; Dīnānī, 2000; Suhrawardī, 2009, vol. 2: 222–233). Sanctified souls preserve their individuality and

particularity, illuminated by overpowering lights, without any union with other souls; their distinction rests upon luminous identity and the mode of bodily governance (Dīnānī, 2000: 450).
On the question of reincarnation, Suhrawardī initially aligns with the Peripatetics in rejecting it, offering arguments against its plausibility. Yet he later engages partially with reincarnationist motivations and Eastern doctrines, adopting a cautious position. He considers the human body as the "gateway of gateways," denies the possibility of transition from animal to human, and provides explanations consistent with the architecture of light regarding the multiplicity of animals and the direct effusion of light. Ultimately, however, he judges the arguments of both sides insufficient (Dehqānī & Mīrjalīlī, 2014).

Table 2 – Hierarchy of Lights in Illuminationist Philosophy (Adapted from Suhrawardī 1987; 1993; Qorbānī 2015, Author's Compilation)

Rank	Characteristics	Examples	Relation to Other Levels
1	*Light of Lights*: absolute richness, pure and sacred light	God	Apex of the hierarchy; cause of all lights
2	Dominant Lights (*anwār qāhira*): immaterial, self-aware, true causes	First Intellect, angels	Emanate from the Light of Lights; cause of accidental lights
3	Governing Lights (*anwār mudabbira*, archetypal lights)	Lords of species	Direct relation with the material world
4	Accidental Lights: perceptible lights	Sun, fire	Dependent upon the dominant lights
5	Dark Bodies: devoid of light, independent in existence	Material elements	Subjugated by light; lack causality
6	Dark Accidents: dependent, non-substantial	Colors, odors	Subsist in bodies; devoid of self-awareness

Comparative Analysis
A comparative study of Plato's *Phaedo* and Suhrawardī's Illuminationist philosophy reveals that both traditions converge on the principle of the soul's immortality, yet their foundations and modes of reasoning differ. In Plato, the soul is conceived as an independent reality distinct from the body, established through philosophical arguments such as opposition, recollection, simplicity, and form (Plato, 1988; Copleston, 1984; Bormann, 2001; Amānī, 2022). In Suhrawardī, the soul is understood as a luminous reality situated within the hierarchy of lights, with death defined as the separation of the soul from the body and its entry into the imaginal or sacred realm (Suhrawardī, 1987; Ahmadī & Rāsakhī, 2017; Dīnānī, 2000). The principal commonality between the two traditions lies in their affirmation of the soul's immateriality and survival after death; both regard death not as annihilation but as unveiling of the soul's truth. The divergence, however, is evident in their foundations: Plato relies on "forms" and "ideas," whereas Suhrawardī grounds his system in "light" and its hierarchical gradations.
From a phenomenological perspective, both traditions interpret the experience of death as a moment of disclosure of the soul's reality, though the pathways of disclosure differ. In Platonic philosophy, philosophical life and recollection of forms are the conditions for liberation from the cycle of reincarnation; similarly, in Orphic traditions, sacred memory and ritual practices fulfill this role (Mohammadzadeh & Beheshtī, 2014; Guthrie, 1993; Huffman, 2020). In Suhrawardī's philosophy, intensification of luminosity and illumination constitute the conditions for entry into the sacred realm or the detached imaginal world. Perfected souls ascend to the realm of pure light, intermediates inhabit luminous imaginal bodies, and the wicked are confined to dark imaginal forms (Suhrawardī, 1987; Ahmadī & Rāsakhī, 2017; Dīnānī, 2000).
Thus, both traditions emphasize the "gradual nature of liberation": in Plato, through philosophical lives and correct choices; in Suhrawardī, through intensification of light and illumination.

Table 3 – Comparative Views of Plato and Suhrawardī on Soul and Death (Adapted from Plato, Suhrawardī, Ahmadī & Rāsakhī, Dīnānī; Author's Compilation)

Dimension	Plato in *Phaedo*	Suhrawardī in Illuminationist Philosophy
Foundation	Forms and Ideas	Light and hierarchical gradations of luminosity
Method of Proof	Philosophical arguments (opposition, recollection, simplicity, form)	Division of light and darkness; illumination and visionary insight
Relation of Soul & Body	Independence of the soul from the body	Attachment of the governing light (*nūr isfahbad*) to human temperament
Death	Liberation and entry into the realm of forms	Separation of the soul and entry into the imaginal or sacred realm
Condition of Liberation	Philosophical life and recollection of forms	Intensification of luminosity and illumination

Dimension	Plato in *Phaedo*	Suhrawardī in Illuminationist Philosophy
Destiny of Souls	Philosophers ascend to the realm of the gods; others remain in the cycle of reincarnation	Perfected souls ascend to the realm of pure light; intermediates inhabit luminous imaginal bodies; the wicked are confined to dark imaginal forms

Discussion and Analysis

The findings of this research demonstrate that both Platonic and Illuminationist traditions conceive the soul as an immaterial and eternal reality, and death as the moment of unveiling this truth. Yet the divergence in foundations is evident: Plato relies on forms and ideas, whereas Suhrawardī grounds his system in light and its hierarchical gradations. This distinction shows that each tradition employs its own language to articulate the experience of soul and death, while at the phenomenological level both converge upon a shared horizon.

Research Question 1: How does the soul in Plato's *Phaedo* disclose itself as an independent and eternal reality?

Plato regards the soul as a reality distinct from the body, established through the arguments of opposition, recollection, simplicity, and form. Death is interpreted as liberation and entry into the realm of ideal forms (Plato, 1988; Amānī, 2022; Gharībī, 2011).

Research Question 2: How does Suhrawardī explain death and eschatology within the hierarchy of lights and the imaginal realm?

Suhrawardī defines death as the separation of the soul from the body and its entry into the imaginal or sacred realm. Perfected souls ascend to the realm of pure light, intermediates inhabit luminous imaginal bodies, and the wicked are confined to dark imaginal forms (Suhrawardī, 1987; Ahmadī & Rāsakhī, 2017; Dīnānī, 2000).

Research Question 3: What similarities and differences exist between Plato and Suhrawardī's perspectives on soul and death?

Both traditions affirm the immateriality and immortality of the soul and interpret death as unveiling of its truth. The difference lies in their foundations: Plato emphasizes "forms" and "ideas," while Suhrawardī emphasizes "light" and its hierarchical gradations (Qorbānī, 2015; Nasr, 2010).

Research Question 4: What role does reincarnation play in both traditions, and how is it linked to the liberation of the soul?

Plato conceives reincarnation as a stage of purification, with liberation possible after three philosophical lives. In Orphic traditions, sacred memory and ritual practices serve as conditions for liberation. Suhrawardī adopts a cautious stance, largely rejecting reincarnation, yet explains the fate of wicked souls through dark imaginal forms (Mohammadzadeh & Beheshtī, 2014; Guthrie, 1993; Huffman, 2020; Dehqānī & Mīrjalīlī, 2014).

Research Question 5: How can a phenomenological approach analyze Socrates' experience of death and the luminous embodiment of souls in Illuminationist philosophy within a shared framework?

Both traditions regard death as a moment of truth within consciousness: in Plato, through inner clarity and recollection of forms; in Suhrawardī, through intensification of luminosity and illumination. Thus, phenomenology reveals that Socrates' experience of death and the luminous embodiment of souls in Illuminationism are both instances of "truth's disclosure within consciousness" (Amānī, 2022; Ahmadī & Rāsakhī, 2017; Qorbānī, 2015).

Conclusion

The comparative analysis of Plato's *Phaedo* and Suhrawardī's Illuminationist philosophy shows that both traditions conceive the soul as immaterial and eternal, and death not as annihilation but as unveiling of the soul's truth. In Plato, this unveiling is achieved through philosophical life and recollection of forms; in Suhrawardī, through intensification of luminosity and illumination. Both traditions emphasize the gradual nature of liberation: Plato through successive philosophical lives and correct choices, Suhrawardī through hierarchical intensification of light and illumination (Plato, 1988; Ahmadī & Rāsakhī, 2017; Amānī, 2022; Dīnānī, 2000; Qorbānī, 2015; Nasr, 2010). This convergence demonstrates that the experience of death in both traditions is phenomenological, wherein human consciousness enters a new horizon of meaning.

Innovation of the Study

The innovation of this study lies in its emphasis on the phenomenology of the soul and death rather than a mere focus on metaphysical doctrines. In this framework, the soul is understood as a luminous phenomenon or imaginal form, and death as a moment of truth within consciousness—thus aligning both traditions on a shared horizon.

For future research, incorporating Mullā Ṣadrā and Islamic mysticism could deepen the comparative analysis. Ṣadrā's doctrines of substantial motion (*ḥarakat jawhariyya*) and the principle of potentiality and actuality provide a distinctive account of the soul's transition from potentiality to actuality, while rejecting downward reincarnation as incompatible with the soul's perfectional ascent (Ṣadr al-Dīn Shīrāzī, *al-Asfār*, 1410 AH; Dehqānī & Mīrjalīlī, 2014). Moreover, Iranian allegorical mysticism, with imaginal realms such as Jābalqā and Hūrqalyā, reinforces the aesthetic roots of the experience of disclosure (Suhrawardī, 2009; Nasr, 2010).
Thus, the study advances an integrated model of the soul and death as phenomenological truths, offering a foundation for interdisciplinary work across philosophy, phenomenology, and aesthetics.

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ASSESSMENT OF THE ENVIRONMENTAL AND RADIOLOGICAL SUSTAINABILITY CHALLENGES OF LIGNITE-FIRED POWER PLANTS

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Abstract
Lignite-based power generation continues to be a primary energy source in Kosovo and other parts of the Balkans, yet it poses significant environmental and radiological sustainability challenges. Lignite naturally contains radionuclides such as uranium-238 (^{238}U), thorium-232 (^{232}Th), and potassium-40 (^{40}K), which become concentrated during combustion processes and are redistributed in coal ash and fly ash. This study investigates the levels of radionuclide enrichment in ash, where activity concentrations can increase by factors of 3–10 compared to raw lignite, reaching up to 200 Bq/kg for ^{238}U and 400 Bq/kg for ^{40}K. Field measurements around lignite-fired power plants reveal elevated gamma dose rates, typically 10–30% higher than local background levels, along with increased radionuclide content in surrounding soils and enhanced radon exhalation from inadequately managed ash deposits. Such conditions present long-term sustainability concerns, including the accumulation of radioactive contaminants, potential contamination of soil and water resources, and disturbances to local ecosystems due to airborne dispersion and leaching. While general population exposure remains within international regulatory limits, occupational exposure and chronic environmental effects highlight the need for targeted mitigation strategies. The study emphasizes the importance of improved ash handling, secure disposal practices, continuous environmental monitoring, and incorporation of sustainable engineering solutions to reduce both radiological and ecological impacts. Ultimately, transitioning toward cleaner energy technologies and resilient energy systems is essential for ensuring environmental sustainability in regions that currently depend on lignite-based power generation. The findings serve as a critical reference for policymakers, energy planners, and environmental managers seeking to balance energy needs with radiological safety and ecological protection.
Keywords: Lignite combustion; Environmental radioactivity; Fly ash enrichment; Sustainability; Gamma dose rates; Radiological risk; Ash management.

1. Introduction

1.1. Background and Context

Lignite coal remains a cornerstone of energy production in Kosovo and the broader Balkan region, accounting for approximately 96% of Kosovo's energy consumption [10]. The Kosovo energy sector operates two major lignite-fired power plants Kosova A and Kosova B located near Obiliq, approximately 3 km northwest of the capital Prishtina. These facilities possess the largest coal reserves in South-East Europe and are expected to continue powering domestic electricity production for the foreseeable future [10]. However, this heavy reliance on lignite combustion presents substantial environmental and radiological challenges that require comprehensive assessment and mitigation strategies.

Lignite, as a low-rank coal, naturally contains elevated concentrations of naturally occurring radioactive materials (NORMs), including uranium-238 (^{238}U), thorium-232 (^{232}Th), and potassium-40 (^{40}K) [19]. During combustion processes, these radionuclides become concentrated in combustion residues—particularly fly ash and bottom ash—through a phenomenon known as technologically enhanced naturally occurring radioactive materials (TENORM) (19; 12). The enrichment factor typically ranges from 3 to 10 times the original concentration in raw lignite, creating significant radiological and environmental sustainability concerns (Jamasali et al., 2024).

1.2. Radiological Significance

The radiological impact of lignite combustion extends beyond the immediate vicinity of power plants through multiple pathways: atmospheric dispersion of fly ash particles, deposition on soil and water surfaces, leaching to groundwater, occupational exposure during ash handling, and potential accumulation in the food chain [17]. Studies from Turkey, Greece, Serbia, and other Balkan countries have documented elevated gamma dose

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rates—typically 10–30% above background levels—in areas surrounding lignite-fired facilities (Xhixha et al., 2018; 12).

The Kosovo context is particularly relevant given the geological characteristics of the region, which features metal-enriched minerals with higher contents of heavy metals (Cr, Mn, Co, Zn) and contact zones between harzburgite, serpentinite, and limestones [10]. The total amount of ash accumulated from Kosovo's power plants is estimated at approximately 55 million tons, with inadequate protection against wind erosion allowing ash re-deposition across the region [10].

1.3. Research Objectives

This study aims to provide a comprehensive assessment of the environmental and radiological sustainability challenges associated with lignite-fired power plants, with particular emphasis on:

Quantifying radionuclide enrichment in combustion residues

Evaluating gamma dose rates and radiological hazards in surrounding environments

Assessing the impact on soil, water, and air quality

Examining case studies from Kosovo and neighboring Balkan countries

Proposing mitigation strategies and sustainable ash management practices

Discussing the transition pathway toward cleaner energy alternatives

The findings serve as a critical reference for policymakers, energy planners, and environmental managers seeking to balance energy needs with radiological safety and ecological protection.

2. Methodology

2.1. Research Objectives

A comprehensive literature review was conducted to gather data on radionuclide concentrations, enrichment factors, dose rates, and environmental impacts associated with lignite combustion. The review encompassed peer-reviewed journal articles, technical reports, and case studies from lignite-fired power plants in Turkey, Greece, Serbia, Kosovo, Poland, and other European countries. Particular attention was given to studies employing gamma-ray spectrometry for radionuclide measurement and RESRAD code for radiological risk assessment (Jamasali et al., 2024; Turhan et al., 2018).

2.2. Radionuclide Measurement Techniques

The primary methodology for assessing natural radioactivity in lignite and combustion residues involves high-resolution gamma-ray spectrometry using High Purity Germanium (HPGe) detectors (Qafleshi et al., 2021; 19). This technique allows for precise determination of activity concentrations of ^{226}Ra (as a proxy for ^{238}U), ^{232}Th, and ^{40}K through their characteristic gamma emissions.

Sample preparation typically involves:

Collection of raw lignite, fly ash, and bottom ash samples from power plants

Crushing and grinding to approximately 2 mm grain size powder for homogenization

Drying to constant weight

Sealing in cylindrical containers (typically 180 cm³) for 3-4 weeks to establish secular equilibrium in the ^{226}Ra decay chain [15]

The main gamma emissions of radon progenies (^{214}Pb and ^{214}Bi) are used to determine ^{226}Ra activity concentration, while ^{232}Th is determined through gamma emissions of ^{228}Ac, ^{212}Pb, and ^{208}Tl. The activity concentration of ^{40}K is determined through its direct gamma emission at 1460.8 keV [17].

2.3. Environmental Dose Rate Assessment

Gamma dose rates in the environment surrounding lignite-fired power plants were assessed through in-situ measurements using portable gamma-ray spectrometry systems and dosimeters. Measurements were conducted at various distances from power plants and ash disposal sites to establish spatial distribution patterns of elevated radiation levels [21].

The absorbed dose rate in air (D, nGy/h) was calculated using the formula:

$D = 0.92A_{226}{}^{R}{}_{a} + 1.1A_{232}{}^{Th} + 0.08A_{40}{}^{K}$

where A represents activity concentrations in Bq/kg [15].

2.4. Radiological Hazard Indices

Several radiological hazard indices were calculated to assess the potential health risks:

Activity Concentration Index (I):
$I = A_{40}{}^{K}/3000 + A_{226}{}^{R}{}_{a}/300 + A_{232}{}^{Th}/200$
According to EU Council Directive 2013/59/EURATOM, $I \leq 0.5$ for bulk use of materials and $I \leq 2$ for restricted use [15].
Annual Effective Dose (AED, mSv/y):
$AED = D\ (nGy/h) \times 8760\ h \times 0.8 \times 0.7\ Sv/Gy \times 10^{-6}$
where 0.8 represents the indoor occupancy factor and 0.7 Sv/Gy is the dose conversion coefficient [15].

2.5. Radon Exhalation Measurements
Indoor radon activity concentrations in dwellings near lignite-fired power plants were measured using solid-state nuclear track detectors (CR-39) exposed for three-month periods during winter seasons [10]. Detectors were placed in ground floor living rooms at 1-1.5 m above the floor and analyzed using established protocols.

2.6. Case Study Analysis
Detailed case studies were analyzed from Kosovo (Kosova A and B power plants), Turkey (Yatağan, Kangal, and Afşin-Elbistan facilities), Greece, Serbia (Kolubara and Tent A), and Poland to provide comparative data on radionuclide enrichment, environmental impacts, and mitigation approaches (Xhixha et al., 2018; 12; Janković et al., 2016).

3. Findings
3.1. Radionuclide Concentrations in Raw Lignite and Combustion Residues
3.1.1. Activity Concentrations in Raw Lignite
Analysis of raw lignite samples from various Balkan and Turkish power plants reveals typical activity concentration ranges for naturally occurring radionuclides. In Kosovo lignite, mean activity concentrations were measured at 36 ± 8 Bq/kg for ^{40}K, 9 ± 1 Bq/kg for ^{226}Ra, and 9 ± 3 Bq/kg for ^{232}Th [10]. These values are relatively low compared to global averages for lignite, which typically range from 20-60 Bq/kg for ^{238}U, 15-40 Bq/kg for ^{232}Th, and 50-150 Bq/kg for ^{40}K [19].

Table 1. Activity concentrations of natural radionuclides in raw lignite and combustion residues [3,17,12].

Material	226Ra (Bq/kg)	232Th (Bq/kg)	40K (Bq/kg)	Enrichment factor
Raw lignite (Kosovo)	9	9	36	1
Fly ash (Kosovo)	30	30	133	≈3–4
Fly ash (Turkey)	135	105	300	≈3–10
Bottom ash	30	34	195	≈3

3.1.2. Enrichment in Fly Ash
Fly ash, the fine particulate matter carried by flue gases and collected by electrostatic precipitators, exhibits significant radionuclide enrichment compared to raw lignite. In Kosovo power plants, fly ash showed markedly higher concentrations: 133 ± 16 Bq/kg for ^{40}K, 30 ± 3 Bq/kg for ^{226}Ra, and 30 ± 3 Bq/kg for ^{232}Th—representing enrichment factors of approximately 3.7, 3.3, and 3.3, respectively [10].
Turkish facilities demonstrated even higher enrichment levels. At the Yatağan plant, fly ash samples contained activity concentrations reaching 70-200 Bq/kg for ^{238}U, 60-150 Bq/kg for ^{232}Th, and 200-400 Bq/kg for ^{40}K, representing enrichment factors of 3-10 times compared to raw coal [19, 12]. The radium equivalent activities (Raeq) in fly ash samples reached 467.42 Bq/kg, significantly exceeding the 370 Bq/kg limit recommended for building materials [17].
A comprehensive study of Turkish lignite-fired power plants found that fly ash exhibited absorbed dose rates ranging from 76.04 to 217.44 nGy/h, with internal and external hazard indices ranging from 0.44 to 1.26 and 0.63 to 1.77, respectively [17]. The excess lifetime cancer risk (ELCR) oscillated from 1.30×10^{-3} to 3.75×10^{-3} indoors and 0.32×10^{-3} to 0.95×10^{-3} outdoors, indicating potential health concerns for populations exposed to fly ash-containing materials.

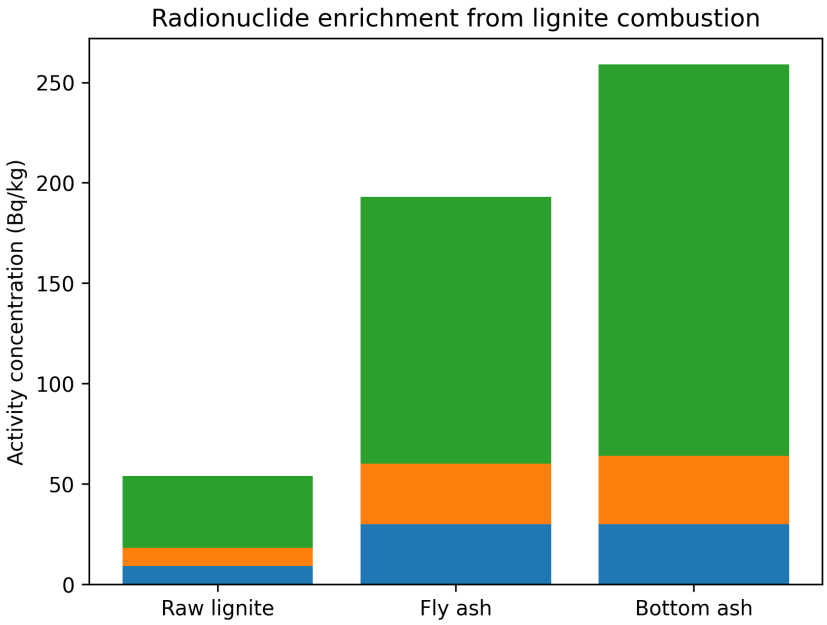


Figure 1. Radionuclide enrichment in raw lignite, fly ash, and bottom ash as a result of lignite combustion [12,7,17].

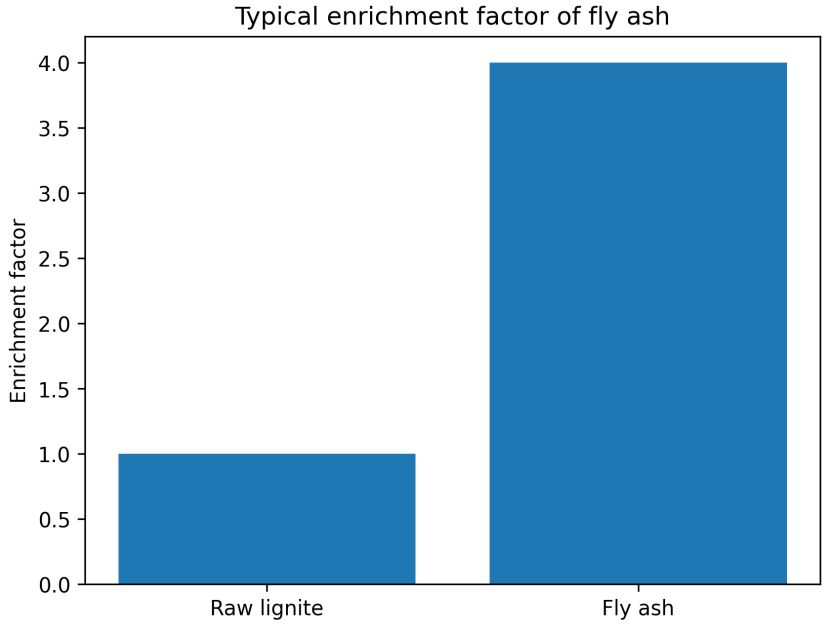


Figure 2. Typical enrichment factor of natural radionuclides in fly ash relative to raw lignite [3,11].

3.1.3. Bottom Ash and Slag Characteristics

Bottom ash, the coarser residue that falls to the bottom of combustion chambers, also shows radionuclide enrichment, though typically to a lesser degree than fly ash. Kosovo bottom ash samples contained 195 ± 13 Bq/kg for ^{40}K, 28 ± 3 Bq/kg for ^{226}Ra, and 34 ± 2 Bq/kg for ^{232}Th [10]. Turkish bottom ash samples showed radium equivalent activities of 429.09 Bq/kg [17].

The distribution of natural radionuclides in ash collected by electrostatic precipitators shows systematic variation, with finer particles generally exhibiting higher specific activities due to their larger surface area-to-volume ratio [11].

3.2. Environmental Gamma Dose Rates

3.2.1. Measurements Around Power Plants

Field measurements conducted around lignite-fired power plants in the Balkans consistently reveal elevated gamma dose rates compared to regional background levels. In the vicinity of Kosovo's Kosova A and B power plants, ambient dose rates were found to be 10-30% higher than local background levels [10].
A comprehensive radiological hazard assessment around two lignite-fired power plants in Kosovo using in-situ gamma spectrometry found elevated activity concentrations in surface soils near ash disposal sites [21]. The study documented spatial patterns of radionuclide distribution consistent with atmospheric deposition and wind-driven dispersion of fly ash particles.
Similar findings were reported from Serbia's Kolubara and Tent A power plants, where environmental radioactivity monitoring in 2015 confirmed elevated levels of natural radionuclides in soil and vegetation samples collected within a 5 km radius of the facilities [4]. The study emphasized that improper waste management practices were the primary cause of environmental contamination.

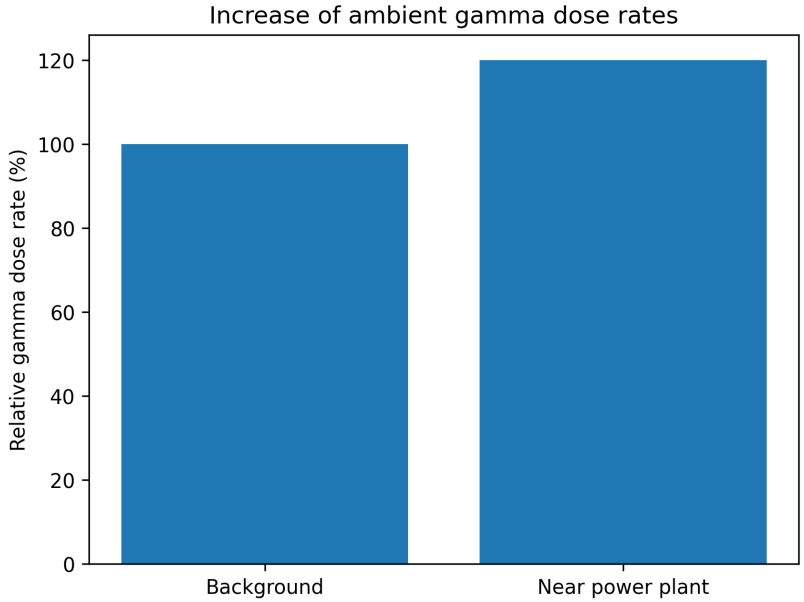


Figure 3. Relative increase of ambient gamma dose rates near lignite-fired power plants compared to background levels [21,9,14].

3.2.2. Soil Contamination Patterns

Soil samples collected near lignite-fired power plants show elevated concentrations of uranium, thorium, and potassium compared to control sites. A study from the Kakanj coal-fired power plant in Bosnia and Herzegovina found that annual effective doses for the population in the vicinity ranged from 0.05 to 0.15 mSv/y above background levels, with higher values observed in areas downwind from ash disposal sites [2].
The migration of radionuclides from ash ponds to surrounding soils has been documented in multiple studies. Research from the Kolaghat thermal power plant in West Bengal, India, demonstrated measurable radionuclide migration patterns extending several kilometers from the facility, with ^{226}Ra and ^{232}Th showing preferential accumulation in clay-rich soil horizons [14].
Table 2. Summary of environmental gamma dose rates and indoor radon activity concentrations [10,17].

Parameter	Typical value	Reference
Background gamma dose	~84 nGy/h	UNSCEAR
Near power plants	10–30% higher	Nafezi & Bahtijari (2024)
Fly ash dose rate	Up to 217 nGy/h	Turhan et al. (2018)
Indoor radon (mean)	111 Bq/m³	Nafezi & Bahtijari (2024)

3.3. Radon Exhalation and Indoor Exposure

3.3.1. Radon Activity Concentrations

Radon (^{222}Rn), a radioactive noble gas produced in the ^{238}U decay chain, represents a significant radiological concern in areas with elevated uranium concentrations. Indoor radon measurements in 51 dwellings in the Prishtina region near Kosovo's lignite-fired power plants revealed concentrations ranging from 41 to 327 Bq/m³, with an arithmetic mean of 111 ± 74.3 Bq/m³ and geometric mean of 92.8 Bq/m³ [10].

The resulting annual effective doses ranged from 0.74 to 5.83 mSv/y, with arithmetic and geometric means of 1.98 and 1.65 mSv/y, respectively—values higher than the world mean of 1.15 mSv/y [10]. Notably, 18% of surveyed dwellings exceeded the national limit of 200 Bq/m³ for new buildings, though none exceeded the 400 Bq/m³ limit for existing buildings.

3.3.2. Factors Influencing Radon Levels

Analysis of factors influencing indoor radon concentrations revealed several important patterns:
Building Age: Higher radon concentrations were observed in older houses constructed before 1980 compared to newer buildings constructed after 2000, likely due to improved basement isolation and ventilation in modern construction [10].
Building Materials: The highest radon concentrations were found in buildings constructed with red (clay) bricks, which naturally contain elevated levels of ^{238}U, ^{232}Th, ^{226}Ra, and ^{40}K. Clay samples from the region showed activity concentrations averaging 49 Bq/kg for ^{238}U, 47 Bq/kg for ^{226}Ra, 34 Bq/kg for ^{232}Th, 40 Bq/kg for ^{228}Ra, and 751 Bq/kg for ^{40}K [10].
Geological Context: The study area's geology, characterized by metal-enriched minerals and contact zones between harzburgite, serpentinite, and limestones, contributes to naturally elevated radionuclide concentrations independent of power plant operations [10].
Importantly, the study found no direct impact of lignite-fired power plant operations on indoor radon concentrations, suggesting that geological factors and building materials are the primary determinants of radon levels rather than atmospheric deposition from power plant emissions [10].

3.4. Radiological Hazard Assessment

3.4.1. Activity Concentration Index

The activity concentration index (I) provides a standardized measure of radiological hazard from building materials and environmental media. For concrete produced using limestone aggregates in Kosovo, the activity concentration index was calculated at 0.05 ± 0.02, well below the EU limit of 0.5 for bulk use of materials [15]. This low value reflects the very low natural radioactivity of limestone-based aggregates used in Kosovo construction.
In contrast, materials incorporating fly ash from lignite combustion show significantly elevated indices. Turkish studies found activity concentration indices ranging from 0.15 to 0.67 for various building materials incorporating coal ash, with some exceeding the 0.5 threshold for unrestricted use [17].

3.4.2. Dose Rate Calculations

The absorbed gamma dose rate in air for Kosovo concrete was calculated at 11.04 nGy/h, substantially lower than the world mean of 84 nGy/h [15]. The corresponding annual effective dose rate of 0.05 mSv/y is well below the 0.3 mSv/y criterion for unrestricted use of building materials.
However, for fly ash-containing materials from Turkish lignite plants, absorbed dose rates reached 217.44 nGy/h, with annual effective doses up to 1.5 mSv/y—approaching or exceeding recommended limits for continuous exposure [17].

3.5. Comparative Analysis: Regional Case Studies

3.5.1. Turkey

Turkey's lignite-fired power plants, particularly those in the Yatağan, Kangal, and Afşin-Elbistan regions, have been extensively studied. The Yatağan facility demonstrated significant enrichment of naturally occurring radionuclides and trace elements in both fly ash and bottom ash (12). Mineralogical and geochemical analysis of feed coals and combustion residues from the Kangal power plant revealed complex patterns of radionuclide partitioning during combustion, with volatile elements preferentially concentrating in fly ash [5].
Studies have also investigated the potential for recovery of trace elements, including uranium and thorium, from fly ash through leaching processes, suggesting possible economic benefits from waste valorization [6].

3.5.2. Greece

Greek lignite-fired power plants have shown similar patterns of radionuclide enrichment and environmental impact. Studies document elevated gamma dose rates in surrounding areas and accumulation of radionuclides in agricultural soils, raising concerns about food chain contamination [19].

3.5.3. Serbia
Environmental radioactivity studies around Serbia's Kolubara and Tent A power plants in 2015 confirmed elevated radionuclide levels in environmental media, with improper ash management identified as the primary cause [4]. The lack of vegetation cover on ash heaps and inadequate containment measures allowed significant wind-driven dispersion of contaminated particles.

3.5.4. Poland
Polish lignite-fired facilities have demonstrated similar radiological challenges, with studies documenting elevated radon exhalation rates from ash deposits and increased environmental radioactivity in surrounding areas [19].

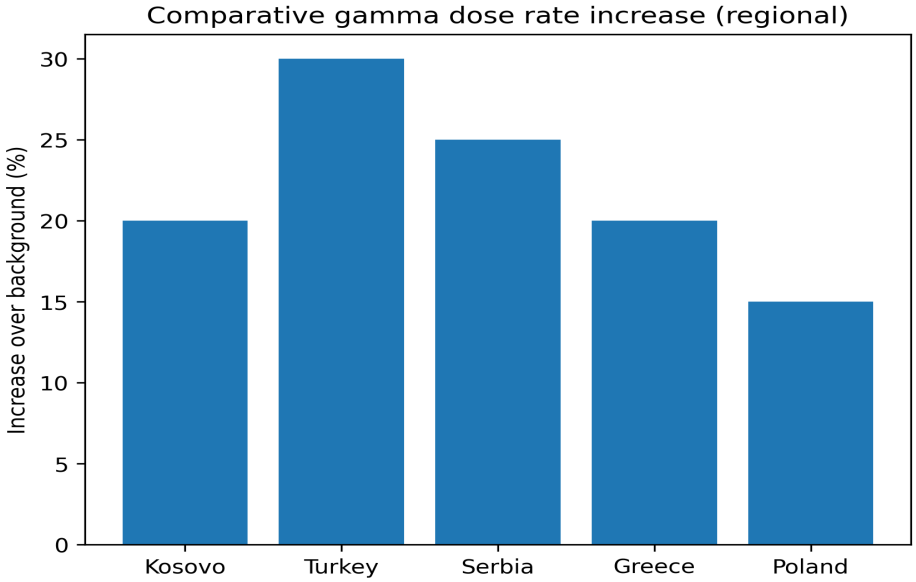


Figure 4. Comparative increase of ambient gamma dose rates reported around lignite-fired power plants in selected Balkan and European countries [2,1,17].

3.6. Ash Management and Disposal Practices
3.6.1. Current Practices
Kosovo's ash management practices vary by facility and combustion unit. Fly ash from Kosova A power plant units A1 and A2 was historically disposed of as pulp in settling ponds using wet disposal techniques. Bottom ash, slag, and fly ash from remaining units have been transported via open conveyor belt systems to disposal sites using dry disposal techniques [10].
The total accumulated ash volume of approximately 55 million tons represents a significant environmental liability. Critically, there is inadequate protection against wind erosion, allowing ash re-deposition across the region depending on meteorological conditions [10].

3.6.2. Current Practices
Inadequate ash management results in multiple environmental pathways for radionuclide dispersion:
Atmospheric Dispersion: Wind erosion of dry ash deposits releases fine particulate matter containing elevated radionuclide concentrations into the atmosphere [9].
Water Contamination: Leaching from ash ponds and disposal sites can contaminate surface water and groundwater with radionuclides and heavy metals [14].
Soil Accumulation: Deposition of airborne ash particles leads to gradual accumulation of radionuclides in surrounding soils, potentially affecting agricultural productivity and food safety [2].
Ecosystem Disruption: The lack of vegetation on ash heaps prevents natural stabilization and increases erosion potential, while elevated radionuclide levels may affect soil microorganisms and plant communities [4].

4. Discussion
4.1. Radiological Sustainability Challenges

The findings presented in this study highlight several critical radiological sustainability challenges associated with lignite-fired power generation:

4.1.1. Radiological Sustainability Challenges

The 3-10 fold enrichment of naturally occurring radionuclides during lignite combustion represents a fundamental challenge for sustainable ash management. While raw lignite contains relatively modest concentrations of ^{238}U, ^{232}Th, and ^{40}K, the concentration of these radionuclides in fly ash can reach levels that exceed recommended limits for unrestricted use of materials [19]. This enrichment occurs because radionuclides are non-volatile at combustion temperatures and become concentrated in the residual ash as the organic and volatile components of coal are consumed.

4.1.2. Long-Term Environmental Accumulation

The massive volumes of ash generated by decades of lignite combustion—55 million tons in Kosovo alone—represent a long-term environmental liability that will persist for generations [10]. Unlike organic pollutants that may degrade over time, radionuclides decay according to fixed half-lives: 4.47 billion years for ^{238}U, 14.05 billion years for ^{232}Th, and 1.25 billion years for ^{40}K. This means that ash deposits will remain radiologically significant essentially indefinitely from a human timescale perspective.

The gradual accumulation of radionuclides in soils surrounding power plants and ash disposal sites raises concerns about long-term ecosystem health and agricultural sustainability. Studies from India and Vietnam have documented measurable radionuclide migration from ash disposal sites into surrounding environments, with potential implications for food chain contamination [14, 8].

4.1.3 Occupational Exposure Concerns

While general population exposure from lignite-fired power plants typically remains within international regulatory limits, occupational exposure during ash handling, transport, and disposal operations can be significantly elevated [19]. Workers involved in ash management may experience chronic exposure to elevated gamma radiation, inhalation of radioactive dust particles, and dermal contact with contaminated materials.

The lack of adequate personal protective equipment and exposure monitoring in some facilities, particularly in developing countries, may result in occupational doses exceeding recommended limits [9]. This represents both a worker health concern and a regulatory compliance issue that requires attention from facility operators and government authorities.

4.2 Environmental Sustainability Implications

Beyond radiological concerns, lignite combustion presents broader environmental sustainability challenges:

4.2.1 Air Quality Impacts

Lignite-fired power plants are significant sources of air pollutants including particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and heavy metals [20]. The co-emission of radionuclides with these conventional pollutants creates a complex mixture of environmental stressors that may have synergistic health effects.

Studies from Turkey have documented the comprehensive environmental impacts of coal-fired power plants, emphasizing the need for integrated pollution control strategies that address both radiological and chemical contaminants [20].

4.2.2 Water Resource Contamination

Leaching of radionuclides and heavy metals from ash disposal sites poses risks to both surface water and groundwater quality. The geological context of many Balkan lignite facilities—characterized by karst limestone formations with high permeability—increases the potential for rapid contaminant transport to aquifers [10].

Monitoring studies from the Kolaghat thermal power plant in India demonstrated measurable radionuclide migration in groundwater, highlighting the need for comprehensive hydrogeological assessment and monitoring at ash disposal sites [14].

4.2.3 Ecosystem Health

The accumulation of radionuclides and heavy metals in soils can affect ecosystem function through multiple mechanisms:
Soil Microbial Communities: Elevated radionuclide concentrations may alter soil microbial diversity and function, potentially affecting nutrient cycling and organic matter decomposition.
Plant Uptake: Some radionuclides (particularly ^{40}K and ^{226}Ra) can be taken up by plants, potentially entering food chains and affecting both wildlife and human populations.
Habitat Quality: The lack of vegetation on ash disposal sites creates degraded habitats with reduced biodiversity and ecosystem services.

4.3 Comparison with International Standards and Guidelines

The radiological impacts documented in this study can be evaluated against several international standards and guidelines:

4.3.1 EU Council Directive 2013/59/EURATOM

The EU Basic Safety Standards Directive establishes activity concentration indices for building materials, with $I \leq 0.5$ for bulk use and $I \leq 2$ for restricted use [15]. Many fly ash samples from lignite combustion exceed these limits, restricting their potential use in construction materials without dilution or treatment.
Kosovo, as a candidate for EU membership, must harmonize its radiation protection regulations with EU standards, requiring comprehensive assessment of existing ash stockpiles and implementation of appropriate management measures [15].

4.3.2 ICRP Recommendations

The International Commission on Radiological Protection (ICRP) recommends reference levels of 200-300 Bq/m³ for radon in dwellings and 300-1000 Bq/m³ for workplaces. The finding that 18% of surveyed dwellings near Kosovo's power plants exceeded 200 Bq/m³ suggests the need for targeted radon mitigation measures in affected buildings [10].

4.3.3 UNSCEAR Global Averages

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) provides global average values for natural radiation exposure. The finding that annual effective doses in some areas near lignite plants exceed the world mean of 1.15 mSv/y indicates elevated exposure that warrants monitoring and potential mitigation [10].

4.4 Mitigation Strategies and Best Practices

Table 3. Sustainability challenges associated with lignite-fired power plants and recommended mitigation measures [20,1].

Sustainability challenge	Primary impact	Recommended mitigation measure
Fly ash dispersion	Soil and air contamination	Vegetation cover and dust suppression
Radionuclide leaching	Groundwater pollution	Impermeable liners and leachate control
Elevated gamma dose rates	Public radiation exposure	Continuous environmental monitoring
Occupational exposure	Worker health risk	Personal dosimetry and PPE
Long-term ash accumulation	Persistent environmental liability	Engineered containment and site remediation

Based on the findings and international experience, several mitigation strategies can be recommended:

4.4.1 Improved Ash Management

Containment Systems: Implementation of engineered containment systems for ash disposal sites, including impermeable liners, leachate collection systems, and groundwater monitoring wells [1].

Vegetation Cover: Establishment of vegetation cover on ash disposal sites to prevent wind erosion and stabilize surfaces. Selection of plant species should consider tolerance to elevated radionuclide concentrations and heavy metals.
Wet Disposal Optimization: For facilities using wet disposal techniques, optimization of settling pond design and operation to minimize leaching and maximize particle retention.
Dust Suppression: Implementation of dust suppression measures including water spraying, chemical stabilizers, and wind barriers at dry disposal sites and during ash transport operations.

4.4.2 Ash Utilization and Valorization
Beneficial use of fly ash in construction materials can reduce disposal volumes while providing economic value. However, such applications must be carefully evaluated to ensure compliance with radiological safety standards:
Dilution Strategies: Blending fly ash with low-activity materials to reduce overall activity concentration indices below regulatory limits [18].
Selective Use: Restricting fly ash use to applications with limited human exposure, such as road base materials or structural fill, rather than residential construction.
Treatment Technologies: Investigation of treatment technologies to remove or stabilize radionuclides before ash utilization, such as acid leaching or vitrification [6].

4.4.3 Environmental Monitoring Programs
Comprehensive environmental monitoring programs should include:
Ambient Radiation Monitoring: Continuous or periodic measurement of gamma dose rates at facility boundaries and in surrounding communities using thermoluminescent dosimeters (TLDs) or real-time monitoring stations.
Soil and Vegetation Sampling: Regular collection and analysis of soil and vegetation samples to track radionuclide accumulation patterns and assess food chain transfer.
Water Quality Monitoring: Monitoring of surface water and groundwater for radionuclides and associated heavy metals, with particular attention to drinking water sources.
Radon Surveys: Periodic radon surveys in nearby dwellings and workplaces to identify areas requiring mitigation measures.
Occupational Exposure Monitoring: Implementation of personal dosimetry programs for workers involved in ash handling and disposal operations.

4.4.4 Regulatory Framework Enhancement
Strengthening of regulatory frameworks should include:
Ash Classification: Development of clear classification criteria for ash based on radionuclide content, with corresponding management requirements for different categories.
Disposal Standards: Establishment of specific standards for ash disposal site design, operation, closure, and post-closure monitoring.
Utilization Guidelines: Development of guidelines for beneficial use of ash in construction and other applications, including testing requirements and activity concentration limits.
Enforcement Mechanisms: Implementation of effective enforcement mechanisms to ensure compliance with regulations, including regular inspections and penalties for violations.

4.5 Transition to Sustainable Energy Systems
While improved ash management can mitigate some impacts of lignite combustion, the fundamental solution to radiological and environmental sustainability challenges lies in transitioning to cleaner energy technologies:

4.5.1 Renewable Energy Integration
Kosovo and other Balkan countries possess significant renewable energy potential, including:
Solar Energy: High solar irradiation levels in the region make photovoltaic and concentrated solar power viable alternatives to lignite generation.
Wind Energy: Mountainous terrain provides opportunities for wind energy development, particularly in highland areas.
Hydropower: Existing hydropower resources can be expanded through development of small-scale run-of-river projects with minimal environmental impact.

Biomass: Sustainable biomass resources, including agricultural residues and energy crops, can provide dispatchable renewable generation.

4.5.2 Energy Efficiency Measures

Reducing energy demand through efficiency improvements can decrease reliance on lignite generation:
Building Retrofits: Improving thermal insulation and heating systems in existing buildings to reduce energy consumption.
Industrial Efficiency: Implementation of best available technologies in industrial processes to minimize energy intensity.
Grid Modernization: Upgrading transmission and distribution infrastructure to reduce losses and enable better integration of renewable energy.

4.5.3 Just Transition Considerations

The transition away from lignite must address social and economic impacts on communities dependent on coal mining and power generation:
Worker Retraining: Programs to retrain coal sector workers for employment in renewable energy, energy efficiency, and environmental remediation.
Economic Diversification: Support for economic diversification in coal-dependent regions to create alternative employment opportunities.
Community Investment: Investment in infrastructure, education, and healthcare in affected communities to support long-term development.

4.6 Limitations and Future Research Needs

This study has several limitations that should be acknowledged:
Temporal Coverage: Most measurements represent snapshot assessments rather than long-term monitoring, limiting understanding of temporal variability and trends.
Spatial Resolution: The spatial coverage of measurements, particularly for environmental dose rates and soil contamination, may not capture all areas of elevated exposure.
Exposure Pathways: Limited data on food chain transfer and ingestion exposure pathways restricts comprehensive dose assessment.
Health Outcomes: Epidemiological studies linking environmental exposures to health outcomes in affected populations are lacking.
Future research should address these gaps through:
Long-Term Monitoring: Establishment of long-term monitoring programs to track temporal trends in environmental radioactivity and assess the effectiveness of mitigation measures.
Comprehensive Exposure Assessment: Studies examining all exposure pathways, including ingestion of contaminated food and water, to provide complete dose assessments.
Health Studies: Epidemiological investigations to assess potential health effects in populations with elevated exposures, including cancer incidence and other radiation-related health outcomes.
Remediation Technology Development: Research on innovative technologies for ash treatment, stabilization, and remediation of contaminated sites.
Ecosystem Impact Studies: Detailed studies of radionuclide effects on ecosystem structure and function, including soil microbial communities, plant communities, and wildlife populations.

5. Conclusion and Recommendations

5.1 Key Conclusions

This comprehensive assessment of environmental and radiological sustainability challenges associated with lignite-fired power plants leads to several key conclusions:
Significant Radionuclide Enrichment: Lignite combustion results in 3-10 fold enrichment of naturally occurring radionuclides (^{238}U, ^{232}Th, ^{40}K) in fly ash and bottom ash, with activity concentrations reaching 70-200 Bq/kg for ^{238}U, 60-150 Bq/kg for ^{232}Th, and 200-400 Bq/kg for ^{40}K in fly ash from Turkish and Balkan facilities.
Elevated Environmental Dose Rates: Gamma dose rates in areas surrounding lignite-fired power plants are typically 10-30% higher than local background levels, with absorbed dose rates in fly ash reaching up to 217.44 nGy/h.

Radon Exposure Concerns: Indoor radon concentrations in dwellings near Kosovo's lignite facilities ranged from 41 to 327 Bq/m³, with 18% exceeding the national limit of 200 Bq/m³ for new buildings. However, no direct impact of power plant operations on radon levels was observed, with geological factors and building materials being the primary determinants.
Inadequate Ash Management: Current ash management practices in Kosovo and other Balkan countries are inadequate, with approximately 55 million tons of accumulated ash lacking proper containment against wind erosion and water infiltration, resulting in environmental dispersion of radionuclides.
Long-Term Environmental Liability: The massive volumes of radioactive ash represent a long-term environmental liability that will persist for generations, requiring sustained management and monitoring efforts.
Occupational Exposure Risks: While general population exposure typically remains within regulatory limits, occupational exposure during ash handling operations can be significantly elevated, requiring improved worker protection measures.
Compliance Challenges: Many fly ash samples exceed EU activity concentration index limits ($I > 0.5$) for unrestricted use in building materials, creating challenges for ash utilization and requiring careful management of disposal practices.

5.2 Recommendations for Policymakers

Based on these findings, the following recommendations are proposed for policymakers and energy planners:

5.2.1 Immediate Actions

Comprehensive Ash Inventory: Conduct a complete inventory of existing ash disposal sites, including characterization of radionuclide content, volume, and containment status.
Priority Site Remediation: Identify and prioritize high-risk disposal sites for immediate remediation, focusing on sites with inadequate containment, proximity to water resources, or high population density.
Regulatory Framework Development: Develop and implement comprehensive regulations for ash management, including disposal standards, utilization guidelines, and monitoring requirements, harmonized with EU Directive 2013/59/EURATOM.
Occupational Health Program: Establish mandatory occupational health programs for workers involved in ash handling, including personal dosimetry, health surveillance, and provision of appropriate protective equipment.
Public Information Campaign: Implement public information campaigns to educate communities near lignite facilities about radiological risks and available mitigation measures, particularly for radon in dwellings.

5.2.2 Medium-Term Actions

Environmental Monitoring Network: Establish a comprehensive environmental monitoring network including continuous gamma dose rate monitoring, periodic soil and water sampling, and radon surveys in affected areas.
Ash Utilization Standards: Develop clear standards and guidelines for beneficial use of fly ash in construction and other applications, including mandatory testing requirements and activity concentration limits.
Remediation Technology Pilot Projects: Support pilot projects to demonstrate and evaluate innovative technologies for ash treatment, stabilization, and site remediation.
Capacity Building: Invest in training and capacity building for regulatory authorities, facility operators, and environmental professionals in radiation protection and ash management best practices.
Research Funding: Allocate funding for research on radiological impacts, exposure pathways, health effects, and mitigation technologies specific to Balkan lignite facilities.

5.2.3 Long-Term Strategic Actions

Energy Transition Roadmap: Develop and implement a comprehensive roadmap for transitioning from lignite-based power generation to renewable energy sources, with specific timelines, milestones, and investment requirements.
Just Transition Program: Establish programs to support workers and communities affected by the phase-out of lignite generation, including retraining, economic diversification, and infrastructure investment.
Legacy Site Management: Develop long-term management plans for ash disposal sites that will remain after power plant closure, including institutional controls, monitoring requirements, and funding mechanisms.

Regional Cooperation: Strengthen regional cooperation among Balkan countries on radiation protection, ash management, and energy transition, including sharing of best practices and harmonization of standards.
EU Integration Alignment: Ensure full alignment of national regulations and practices with EU standards as part of the accession process, including implementation of the Basic Safety Standards Directive.

5.3 Recommendations for Facility Operators
Operators of lignite-fired power plants should implement the following measures:
Immediate Containment Improvements: Implement immediate improvements to ash disposal site containment, including dust suppression measures, vegetation establishment, and erosion control.
Monitoring Program Enhancement: Expand environmental monitoring programs to include comprehensive assessment of radionuclide dispersion pathways and impacts.
Worker Protection: Strengthen occupational health and safety programs, including provision of personal protective equipment, exposure monitoring, and health surveillance for workers involved in ash handling.
Best Available Techniques: Adopt best available techniques for ash management, including optimization of combustion processes to minimize ash generation, improved collection efficiency, and advanced disposal methods.
Stakeholder Engagement: Engage proactively with local communities, regulatory authorities, and other stakeholders to address concerns and demonstrate commitment to environmental protection.

5.4 Recommendations for Future Research
The scientific community should prioritize the following research areas:
Long-Term Epidemiological Studies: Conduct long-term epidemiological studies to assess health outcomes in populations with elevated exposures to radionuclides from lignite combustion.
Ecosystem Impact Assessment: Investigate the effects of radionuclide accumulation on ecosystem structure and function, including soil microbial communities, plant communities, and wildlife populations.
Remediation Technology Development: Develop and evaluate innovative technologies for ash treatment, radionuclide stabilization, and site remediation, with emphasis on cost-effective and sustainable approaches.
Exposure Pathway Analysis: Conduct comprehensive studies of all exposure pathways, including food chain transfer, to provide complete dose assessments for affected populations.
Climate Change Interactions: Investigate potential interactions between climate change and radionuclide dispersion, including effects of changing precipitation patterns on leaching and altered wind patterns on atmospheric transport.

5.5 Final Remarks
Lignite-fired power generation presents significant environmental and radiological sustainability challenges that require urgent attention and comprehensive mitigation strategies. While improved ash management practices can reduce some impacts, the fundamental solution lies in transitioning to cleaner, renewable energy technologies. This transition must be carefully planned and implemented to address social and economic impacts on affected communities while ensuring energy security during the transition period.
The findings of this study provide a critical evidence base for policymakers, energy planners, and environmental managers seeking to balance energy needs with radiological safety and ecological protection. By implementing the recommended actions and maintaining commitment to environmental sustainability, Kosovo and other Balkan countries can address the legacy of lignite combustion while building a cleaner, more sustainable energy future.
The path forward requires sustained political will, adequate financial resources, technical expertise, and stakeholder engagement. International cooperation and support, particularly from the European Union, will be essential for successful implementation of mitigation measures and energy transition. With appropriate actions, it is possible to manage the radiological risks of lignite combustion while transitioning to sustainable energy systems that protect both human health and the environment for future generations.

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CONSTRUCTIONS AND 3D IMAGING OF TECHNOLOGICAL SYSTEMS AND GEOMETRIC FORMS OF DISCOVERED INVENTIONS, BASED ON THE CLASSICAL GREEK PHILOSOPHY, GEOMETRY, MATHEMATICS AND PHYSICS

Panagiotis Stefanides[22]

Abstract
With my diverse experience in the fields of my professional work I was generally employed [mainly in AEROSPAGE ENGINES' FIELD – TESTS/ R@D /MANUFACTURING], in addition to my studies and necessary long-term training, I had the permanent need to search for the unknown. The unknown for me was everything that I needed to research, in my free time, outside of my working hours, as was usual for me in the evening hours and very late at night, too! In addition to the Philosophical and cosmological ideas and concepts involved, all the other ideas for the researched new thoughts for some applications and solutions, involved mathematics, along with technological knowledge. The need for Solar energy was an incentive to search for the various ways for a testable choice of object for research and the possible construction of a suitable and unique form of device. The "Solar System for Locating and Tracking of the Sun" was the starting point for a series of APPLICATIONS in the field of Light/Shadow and Interrelations with MATHEMATICS, SPACE GEOMETRY and SOLIDS.
Keywords: Mathematics1, Geometry 2, Solar 3, Heliotropio 4, Boolean 5, Logic 6, Polyhedra 7, Solids 8, Generator Polyhedron 9, Pyramid 10, Clinometer 11, Argos 12

INTRODUCTION

This paper summarizes the work of the author in the field of technological and geometrical constructions. All of the work described has been presented diachronically to national and international conferences, exhibitions with presentations of metallic models, of 3D representations of their geometries, of 3D prints and as well as in conference proceedings and books published by the author.

APPLICATIONS OF MATHEMATICS AND GEOMETRY

APPLICATION OF MATHEMATICS IN TECHNOLOGICAL CONSTRUCTIONS

1A. HELIOTROPIC SYSTEM

Original Construction used Relays for Boolean Algebra logical Implementations. A New Construction of the Control System involved use of a specially contrived Differential Light Amplifier.

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HELIOTROPIO STEFANIDES



The primary function is to orientate a solar collector to face the Sun [to be proshelios], with AZIMUTHIAL tracking of 270 Deg and ALTITUDINAL 90 Deg .The concept is based on the idea of combining a signal indicating the direction of the sun rays, within one solid angle of "quarter hemisphere", with a signal indicating, similarly quarterly, the relative angular displacement (or error) between the sun rays, within one solid angle of "quarter hemisphere", with a signal indicating, similarly quarterly, the relative angular displacement (or error) between the sun rays' direction and the tracker's orientation AZIMUTHIALLY.

Figure 1. HELIOTROPIO STEFANIDES -A Solar Locating and Tracking System

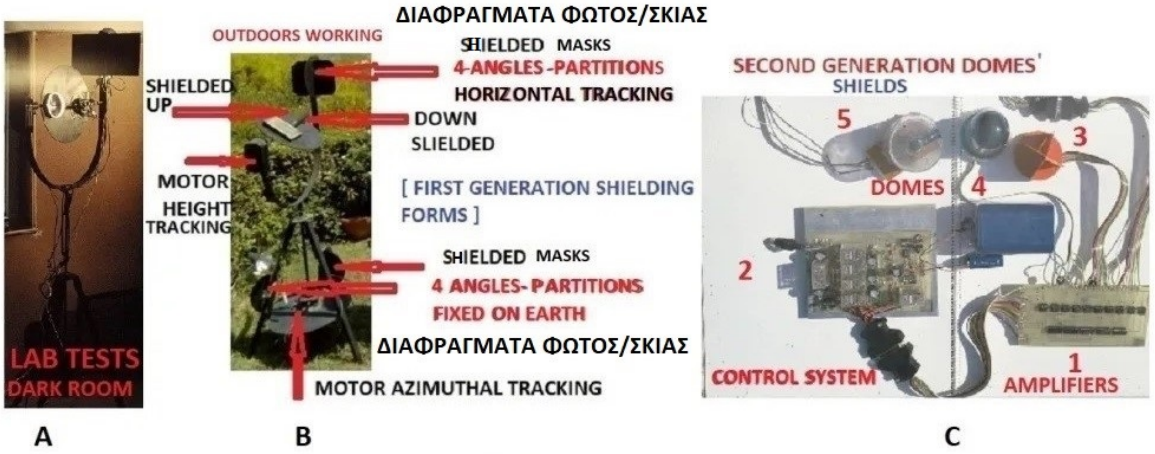


Figure 2. A and B, Original Construction using Relays for Boolean Algebra logical Implementation. C New Construction of Control System using Differential Light Amplifiers

1A1. HELITROPIO CONTROL SYSTEM DIAGRAMME BOOLEAN ALGEBRA FOR THE LOGIC GATES USED

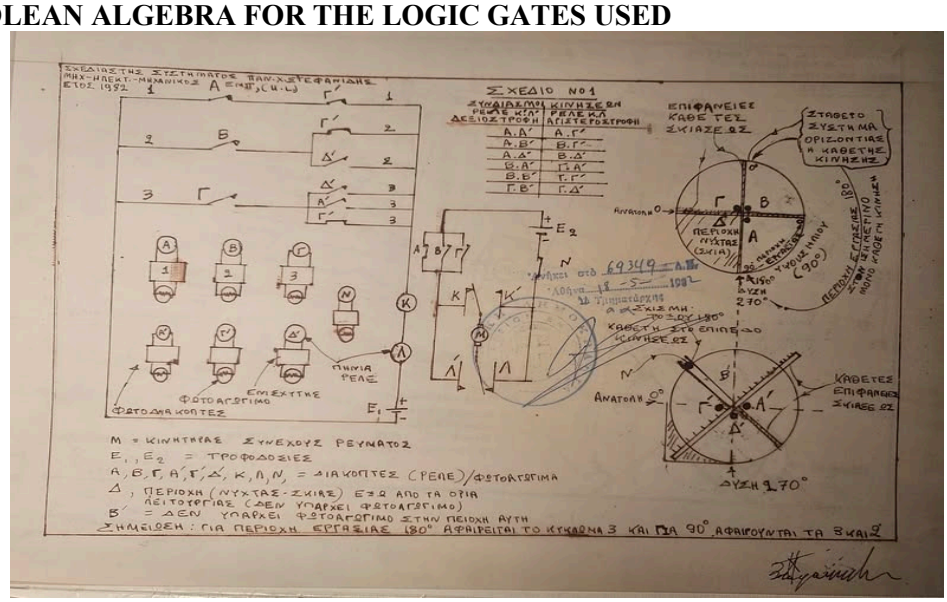


Figure 3. CONTROL SYSTEM

BOOLEAN ALGEBRA for LOGIC GATES was used for the Control of the Model Heliotropic System for "Locating and Tracking the Sun in order to Maximize Solar Radiation Capture by the Solar Energy Collectors, for the switching ON/OFF the system at sunrise/sunset, rotation Left, Right, STOP, Up and Down, the radiation Reception Frame, within an AZIMUTHAL ANGLE of 270 degrees [Height 0- 90 deg], without closing the circle beyond these degrees. Detected errors immobilize the system. [The angle corresponding to the area of Attica, Greece- Maximum at the Summer Solstice - was calculated, based on the parallel 38.17270762 degrees, to be: 360 – 137.5077641 degrees = 222.4922359 degrees. What is interesting here is the appearance of the number 137.507764

1A2. SYSTEM CONTROL

The system is controlled by photosensitive elements DOMED within DIAPHRAMATED 90 DEGREE SOLID ANGLES for light/shadow control, with the necessary geometries for the required accuracies [research-controlled]. Optoelectrical signals from the system of photosensitive elements within the fixed system of angles [DETERMINE THE AZIMUTH DIRECTION OF THE SUN-AT THE COMPASS CARD] and from the mobile angle system of the mechanism [DETERMINE THE AZIMUTHAL DIRECTION OF THE ANGLES OF THE MOBILE SECTION IN RELATION TO THE AZIMUTHAL DIRECTION OF THE SUN]. With the realization of a system of specially invented differential light amplifiers, optoelectrical signals

are combined between them in the Electronic Control System of the Mechanism [DC 6-9V], from where commands are sent to the Electric Motors [SIMPLE, DC-6V] to perform the corresponding movements [slow without oscillations]. "AND" BOOLEAN Combinations for Counterclockwise Movements are:A . Γ' , B . Γ' , B . Δ' , Γ . A' , Γ . Γ' , Γ . Δ' and "AND" for Clockwise Rotation are: A. A', A. B', A. Δ', B. A', B. B', Γ.B'.

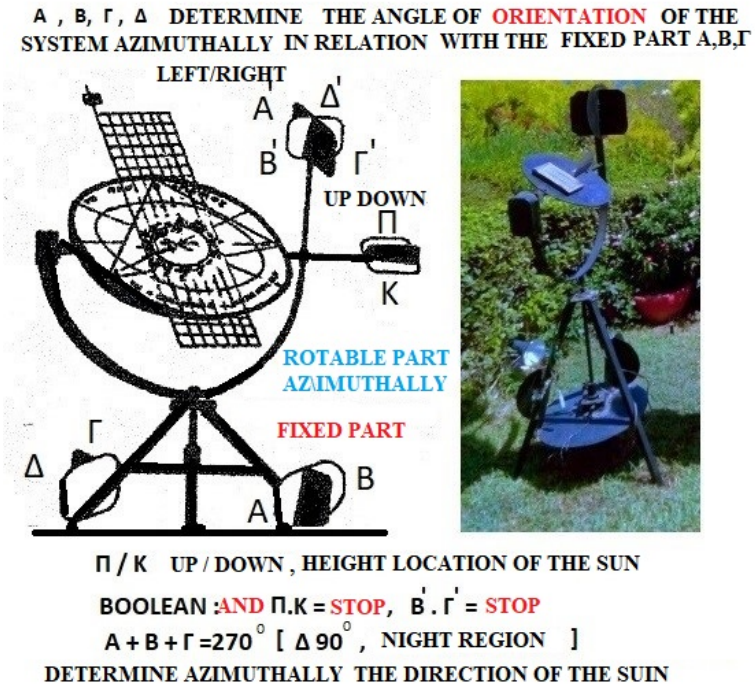


Figure 4. Heliotropic System [P. Chr. STEFANIDES] SOLAR LOCATING AND TRACKING SYSTEM.

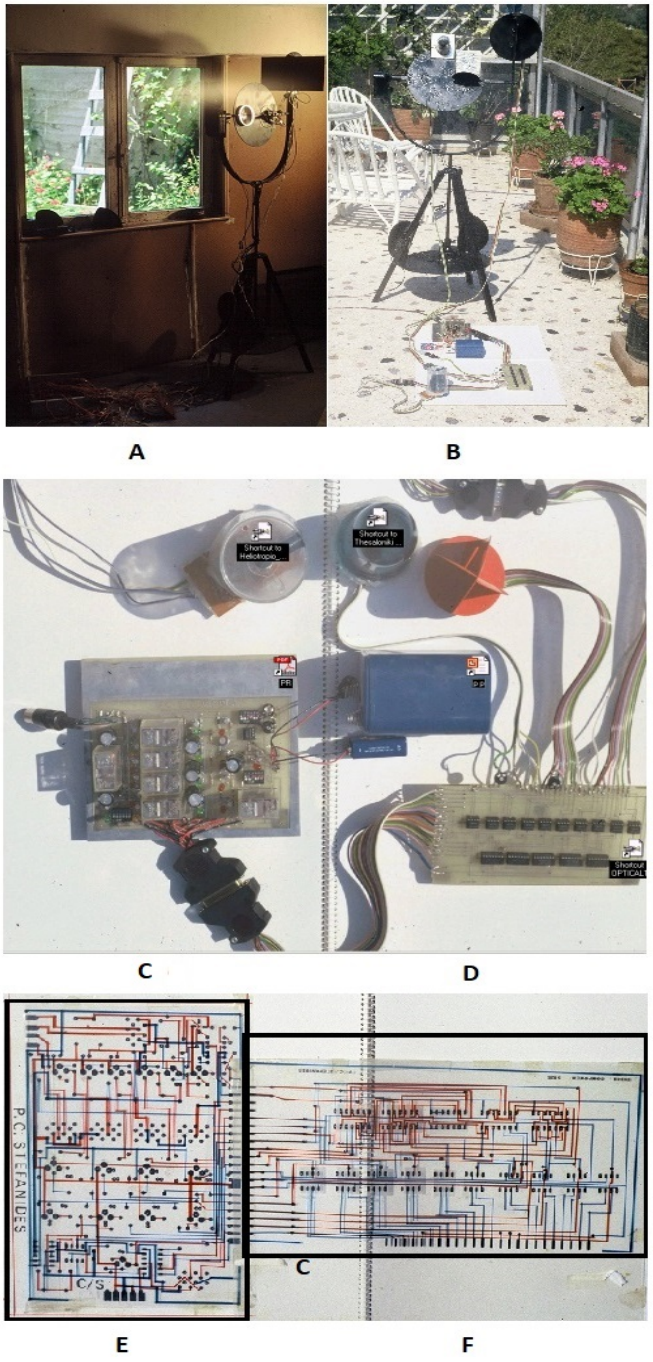


Figure 3. Figure 5. Heliotropic System [by Panagiotis Chr Stefanides]. A the Original Construction using Relays. B Newer Construction using Advanced Constructed Components, Photoconductors, Photocells and QUDRANT PHOTODIODES, [MORRIRICA - 4 PHOTODIODES IN A CIRCULAR BASE]. C Control System, D Optical Processor, E-F, PRINTED CIRCUITS OF C -D.

DRAWING OF THE DESIGNED AND FUNCTIONED ORIGINAL CONTROS SYSTEM

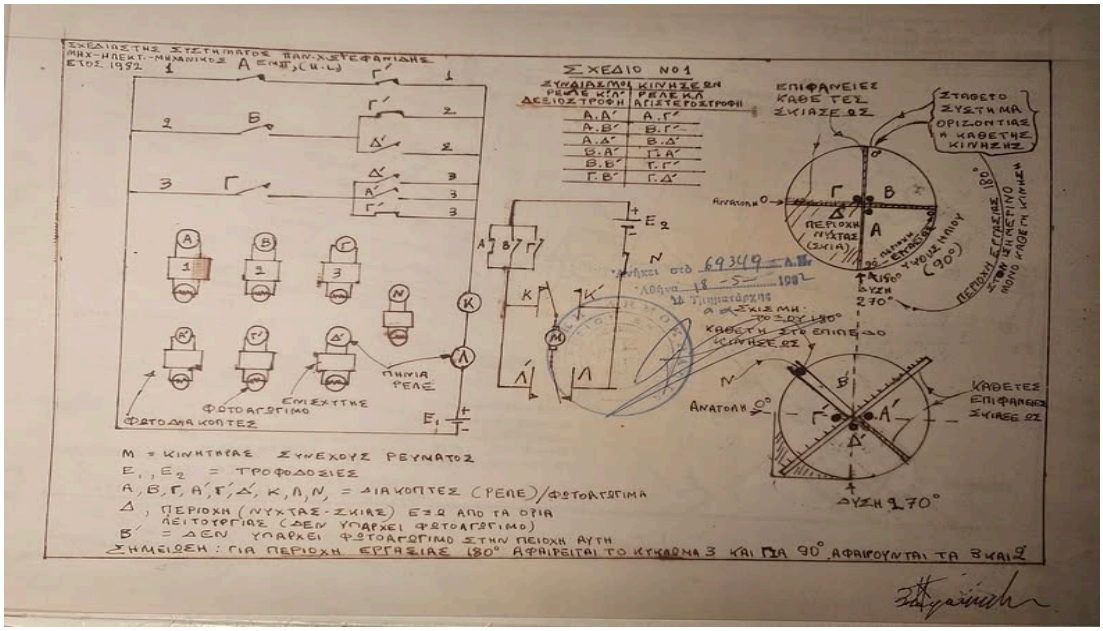


Figure 6. ANALYSIS OF THE CONTROL SYSTERM WITH RELAYS FOR SIMPLE DEMONSTRATION OF THE SYSTEM FUNCTIONING . SYSTEM FURTHER UPDATED , INVOLVING ELECTRONIC SMALLER SIZE , AND BETTER FUNCTIONING.

A2. DIFFERENTIAL LIGHT AMPLIFIER

The initial design used simple light amplifiers, followed by research and implementation of a unit that was highly effective in amplifying the light signal with precision: The "DIFFERENTIAL LIGHT AMPLIFIER USED FOR THE HELIOTROPIO STEFANIDES.

A Similar system, a "PHOTOCELL BEAM COUNTER SYSTEM" used for testings of NOZZLE CONTROL ACTUATORS of AIR ENGINES' MAIN FUEL CONTROLS, [CONFERENCE TECHNICAL CHAMBER OF GREECE [TCG] SENSORS-ΑΙΣΘΗΤΗΡΕ 1993] AND A SIMILLAR INVOLVING ELECTROMECHANICAL METHOD SYSTEM TO MEASURE TIME FOR A GIVEN DISTANCE TRAVELLED OF AN ACTUAROR SHAFT , FOR A DIFFERENT KIND OF ENGINE'S MECHANISM.

APPLICABLE DIFFERENTIAL LIGHT CAD AMPLIFIER DESIGN

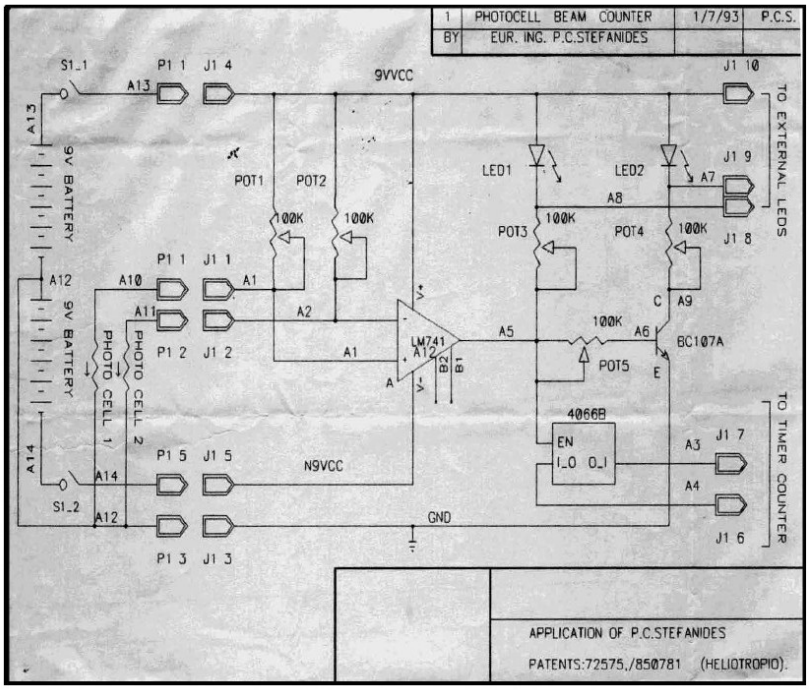


Figure 7. DESIGN OF A DIFFERENTIAL LIGHT AMPLIFIER DESIGNED ORIGINALLY TO DETECT LIGHT RAYS AND ACT AS FILTER FOR REFLECTED LIGHT FROM SKY. THE PURPOSE WAS TO ORIENTATE SOLLAR COLLECTORS BY SUN TRACKING. FURTHER IT WAS INCORPORATED IN A SPEED MEASURING SYSTEM FOR AIR ENGINES ‘ ACTUATORS. N.B. :THE accuracy involved was sufficient to, TRACK MOON!

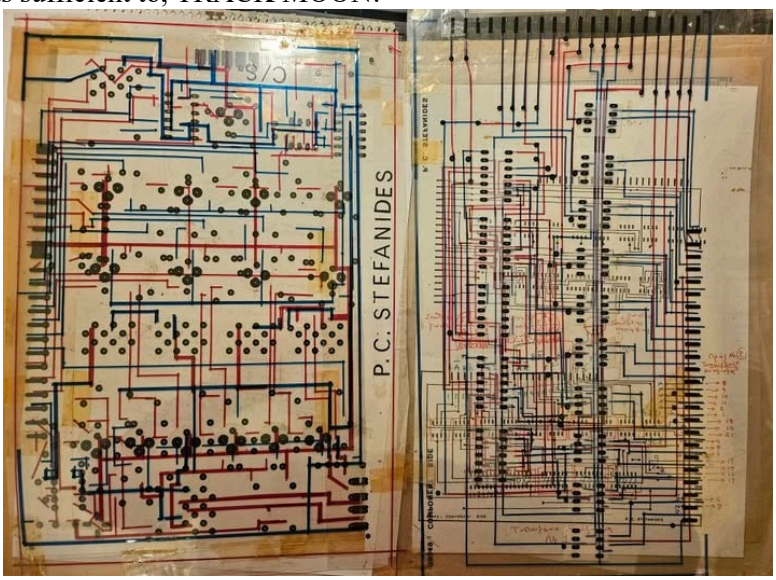


Figure 8. DESIGN FOR PRINTED CUIRCUIT BOARDS PREPARATION

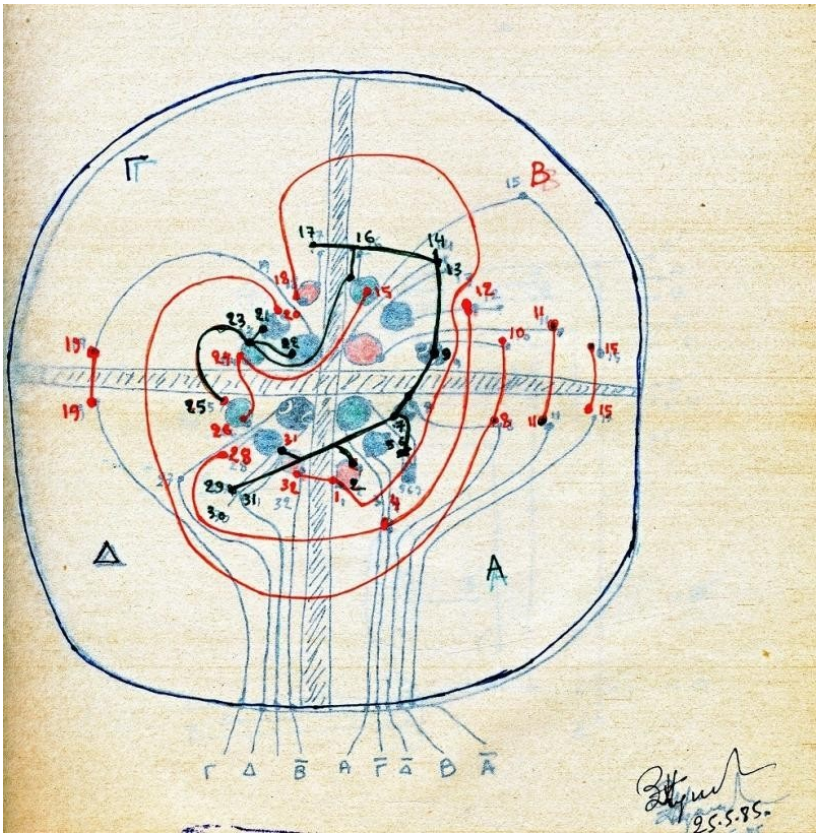


Figure 9. QUADRANT PHOTODIODES WITHIN FOUR DIAPHAGAMATED ANGLES

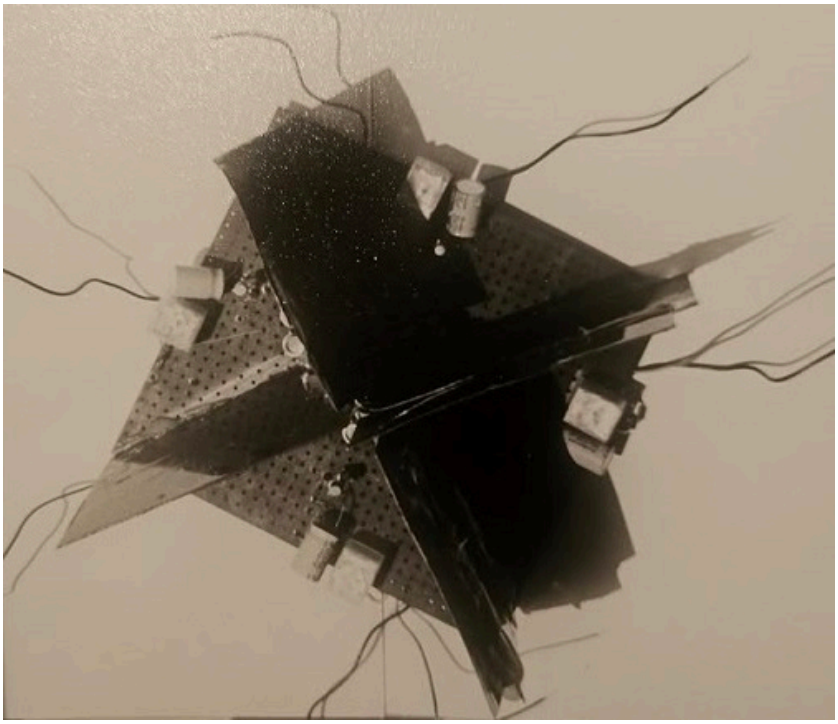


Figure 10. ORIGINAL TESTING OF PHOCELL RESPONSES
TO LIGHT SHADE CONTRON BY LIGHT DIAPHRAGAMS

1.A.3. CURVES OF SOLAR RADIATION MEASUREMENTS [ENERGY].

During testing of the device, lengthy measurements of solar energy yield were taken using appropriate equipment [photovoltaic cells, voltmeter].

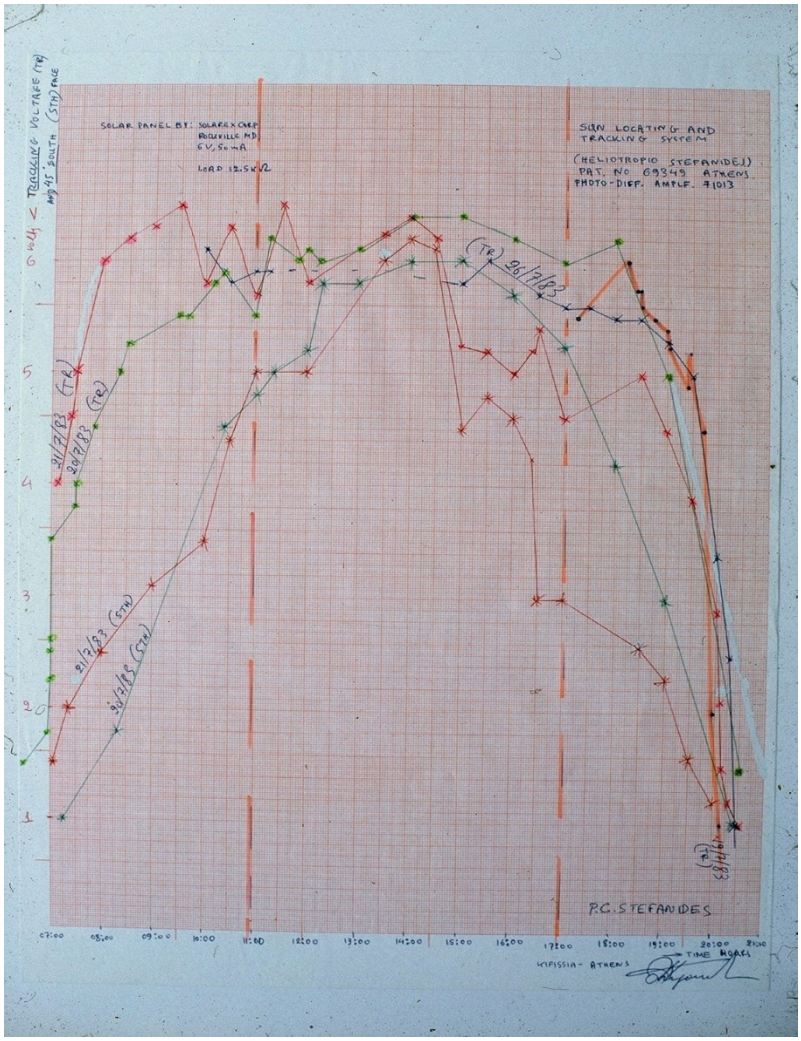


Figure 11. Solar Radiation Measurement Curves [Energy]
TR Curve Comparisons [TRACKING -Tracking, Sun Tracking Frame]
STH [SOUTH -Fixed Photovoltaic Frame with 45-degree Southward Tilt].

2. APPLICATION OF GEOMETRY OF INVENTED SOLID IN A SATELLITE MODEL APPROPRIATELY CONFIGURED FOR OPTICAL MONITORING.

The architecture of a prototype satellite [Figure 5] for optical monitoring has a geometry based on the recently discovered invention of a solid called: "GENESIURGON POLYEDRON NON-REGULAR EIKOSAEDRON".

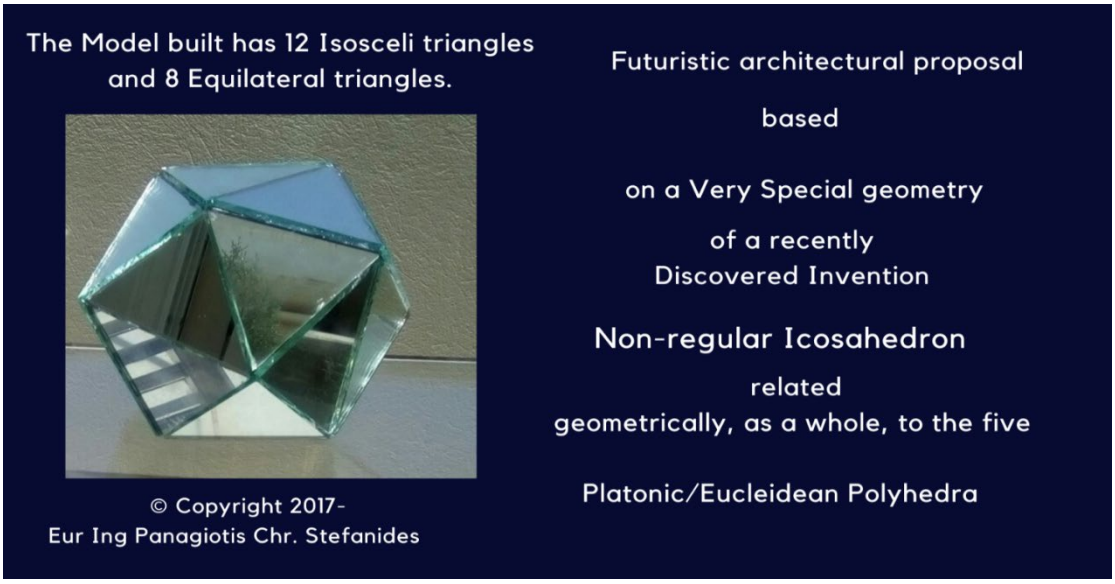


Image 12. Photo: GENESIURGON POLYEDRON [currently located at the National and Kapodistrian University of Athens, Mathematics Department Library Exhibition from 11/12/19].

Its architecture is based on a very special geometry of a recently invented discovery, a non-regular icosahedron, which is fully related geometrically to the five Platonic/Euclidean polyhedra. The constructed [cardboard] model has 12 isosceles triangles and 8 equilateral triangles [all coated with glass light reflectors - mirrors], in the form of a "polyhedron heliostat", and is proposed for use in optical satellite monitoring. In addition to the uniqueness of its geometry, the coding [flickering] of the optical signals received from the reflected radiation from the rotating satellite polyhedral system in space, due to the use of two different types of triangular reflector surfaces, given the peculiarity of the irregularity of the polyhedral geometry of the……The skeleton of this polyhedron, like that of the regular icosahedron and dodecahedron, consists of three rectangular parallelograms perpendicular to each other. The skeletal parallelograms of the generative polyhedron have a side ratio of $4/\pi = \sqrt{\Phi} = 1.27201965..$ each, and an area of 4π, where [π] is the irrational and discrete value of "four divided by the square root of the golden ratio" [$4/\sqrt{\Phi} = 3.14460551..$]. The regular icosahedron also has a parallelogramme skeleton, but based on the Golden Ratio [1.618033989..] and the dodecahedron, similarly, but based on the square of the Golden Ratio [2.618033989..]. Construction: 4X scale theory drawings, dimensions approx. 16X16X16cm. Own construction: dark simulation chamber using photographs and video clips.

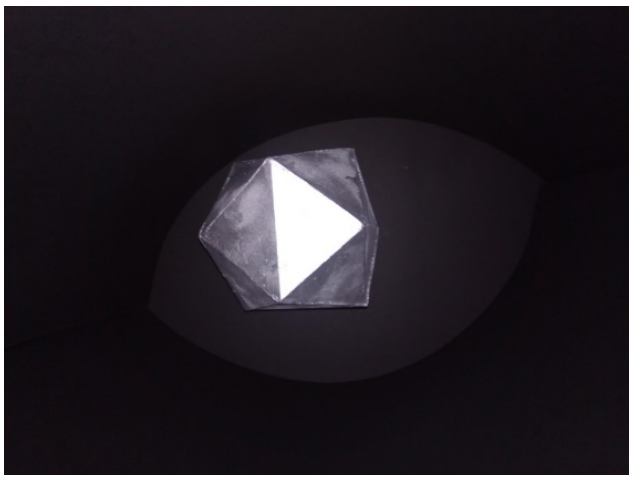


Figure 13. Construction: 4X scale theory drawings, dimensions approx. 16X16X16cm. OWN SHELF construction: Dark Room Simulation using photographs and video clips.

SKELETON VERTEX COORDINATES

A: [+4, 0,+3.14460551],B: [+4, 0, -3.14460551], C: [- 4, 0, -3.14460551],D:[- 4, 0, +3.14460551].E:[+3.14460551, +4, 0],F:[+3.14460551, - 4, 0],G:[-3.14460551, - 4, 0],H:[-3.14460551, + 4, 0].I: [0, +3.14460551,+ 4],J: [0, +3.14460551, - 4],K:[0, - 3.14460551, - 4],L:[0, - 3.14460551, + 4].Coordinates [Scale 2X].

[FURTHER MAKE VECTOR TRIANGULAR CONNECTIONS OF THE VERTICES, BY COMPLETING THE EDGES OF THE POLYHEDRON].

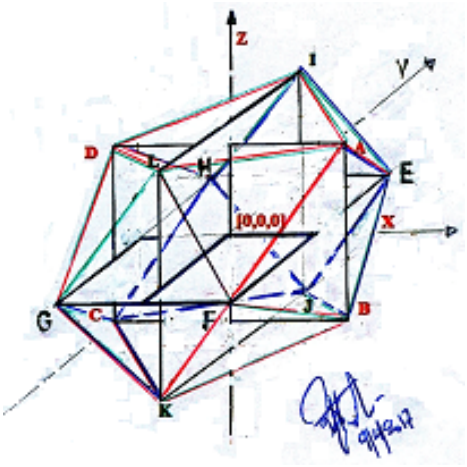
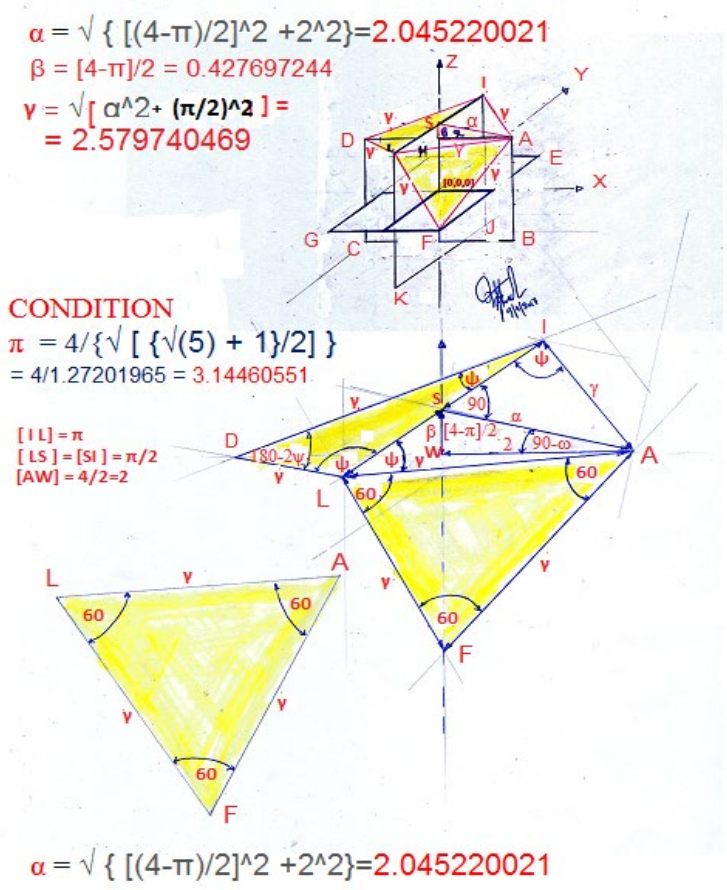


Figure 14. COORDINATES OF SKELETON VERTEXES AND TRIANGULAR CONNECTIONS OF EDGE VECTORS.

TRIANGLES OF THE BASE OF THE TETRAHEDRA OF THE GENERATING POLYHEDRON AND THEIR STEREO-METRIC CALCULATIONS.



α = √ { [(4-π)/2]^2 +2^2}=2.045220021

Tan[ψ] = α/(π/2) = (2.045220021)/(1.572302757) =1.300780027
Ψ = ArcTan[1.300780027] = 52.44801593 deg.
2ψ = 104.8960319 deg.
[180 – 2ψ] = 75.10396814 deg.

Tan[ω] =2/[(4-π)/2]= 4.676205016
ω = ArcTan[4.676205016] = 77.92918912 deg.
[90-ω] = [90 – 77.92918912] = 12.07081088 deg.
2ω = 155.8583782 deg.
[180 -2ω] =24.14162176 deg.

Figure 15. Stereometric Calculations of Generating Polyhedron.

2A. UNIFIED SOLIDS' BINDING GEOMETRIC FORM CONCEPT OF PANAGIOTIS STEFANIDES



PLATOS TIMAEUS AND EPINOMIS 981b

genos" found in Plato's "Epinomis" 981b but, found no reference forthis word of this Plato's work in Liddell and Scott. As I understand it concerns anadditional genus of Polyhedron, a very Special one Ontologically, and this is veryimportant [I understand] : " ..Στερεὰ δὲ σώματα λέγεσθαι χρὴ .... πέντε, ..., τὸ δὲἄλλο γένος ἅπαν ἔχει μορφὴν μίαν· .....ψυχῆς γένος".. [..there are ... five solidbodies....the other total genos , has one form ....the genos of the soul...].Plato, also, states that the composition of soul and body bares a single form [ψυχής καισώματος αποτέκει μίαν μορφήν- Epinomis 981a].5.1. Similarly Plato in Timaeus elaborating on the word "soul- ψυχή" and the7 circles [Ti. 36D]of the Planetary star bodies[Ti.38C-D] , Figure 4 .He makes reference to the solids [σώματα] Ti. 53D-E and also, by the word genos-form [γένος-είδος] Ti.54b.Figure 4. Generator Polyhedron Skeleton Structure 7 Planetary Circles Enhanced[3DForm Georgostathis Computations-Stefanidesa Geometry and vectors' Definition].6. CONCLUDING INTERPRETATION By Panagiotis StefanidesFor the "genos of the soul" geometrical form, the configuration of the "Generator Polyhedron.

5 Solids ... the other ΓΕΝΟΣ ... OF THE SOUL.

Figure 16. UNIFIED SOLIDS A

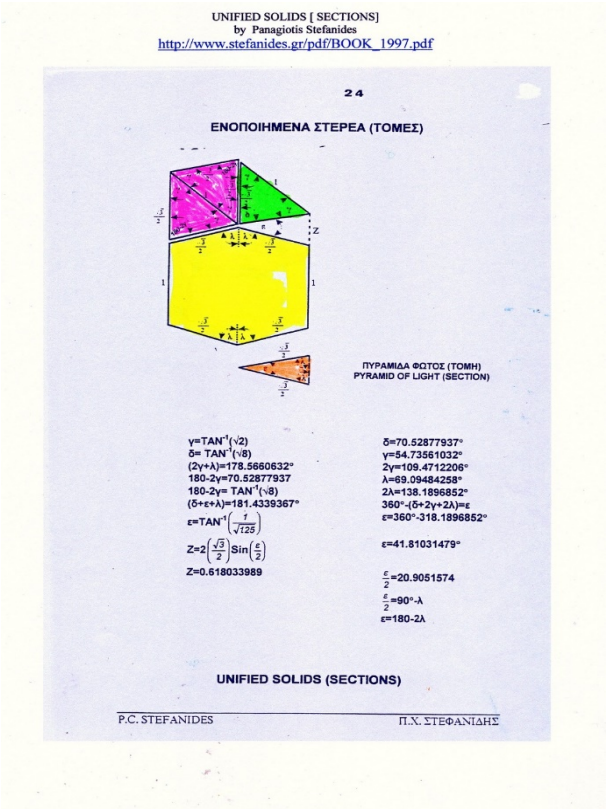


Figure 17. UNIFIED SOLIDS SECTIONS

2B. SIMILAR AND PARALLEL GEOMETRIC STRUCTURES OF SOLIDS AND RELATIONSHIPS WITH LOGARITHMIC SPIRALS [NAUTILUS RELATED TO THE TRIANGULAR DISCRETE GEOMETRY OF THE KALLISTOS PLATONIC TRIANGLE]



Figure 18. Similar Geometric Structures

2C. DESIGN OF A T-SHAPED INCLINOMETER, MEASURING THE INCLINATIONS OF THE FOUR FACES OF THE PYRAMID OF ARGOS ELLINIKO.

Based on information from publications stating that the slope of the faces of this pyramid is 60 degrees, and given that the pyramid has a rectangular parallelogram base, I decided that I should take some measurements myself, knowing that a pyramid of this type must have two slopes.

A simple tool was devised [MORFIS-T] and MEASUREMENTS OF THE SLOPES were taken, despite the difficulties of the ROUGH AND UNEVEN SURFACE OF THE VOLUMETRIC STRUCTURES [under conditions of very high temperatures, July 10 and 19, 2025].

The result was that no slope was detected at 60 degrees. On the contrary, the slope of the eastern front was measured to be 65 degrees, and the other three 70 degrees each. Based on the calculations, a model of the pyramid in question was constructed with an eccentricity invention of the point of the vertical height at the base of the [UNIQUE FEATURE OF THE PYRAMID MODEL THE CENTER OF THE INTERSECTION OF THE DIAGONALS OF THE BASE IS NOT THE SAME AS THE CENTER OF THE VERTICAL HEIGHT -THERE IS ALSO AN INTERNAL ANGLE OF ENTRY INTO THE PYRAMID]. A Theoretical Model of the Pyramid was designed based on the Geometry of Space, the Slopes, and the Vectors involved. A MODEL was printed.



Figure 19. MEASUREMENTS OF THE SLOPES OF THE ARGOS PYRAMID by Panagiotis H. Stefanidis, August 10 and 19, 2025.

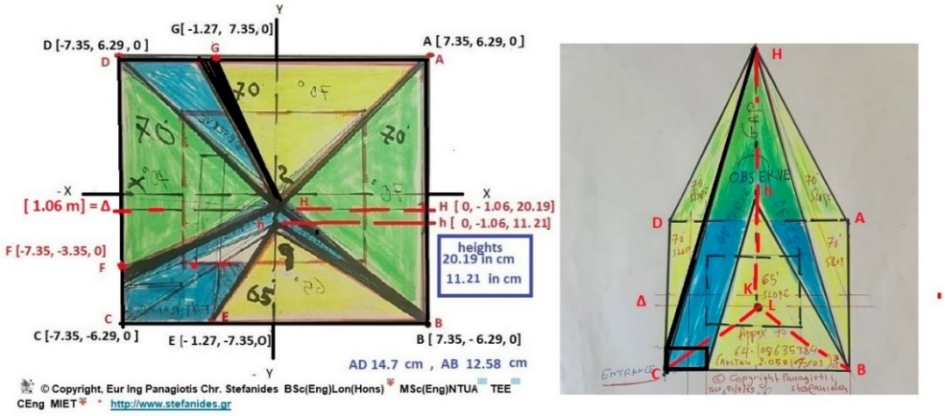


Figure 20. Plan Base and the Proposed Pyramid Template

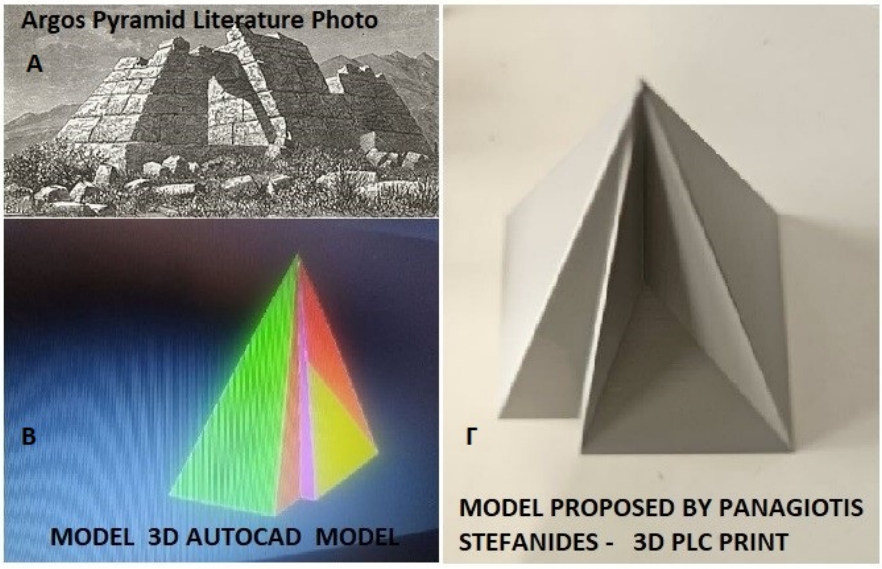


Figure 21. A Pyramid of Publications. B, C, Geometry , Determination of Coordinates and Vectors under P.H. Stefanidis, Auto Cad, by I. Kandylas. C, 3D PLC PRINT by 3D FORM Ap. Georgostathis.

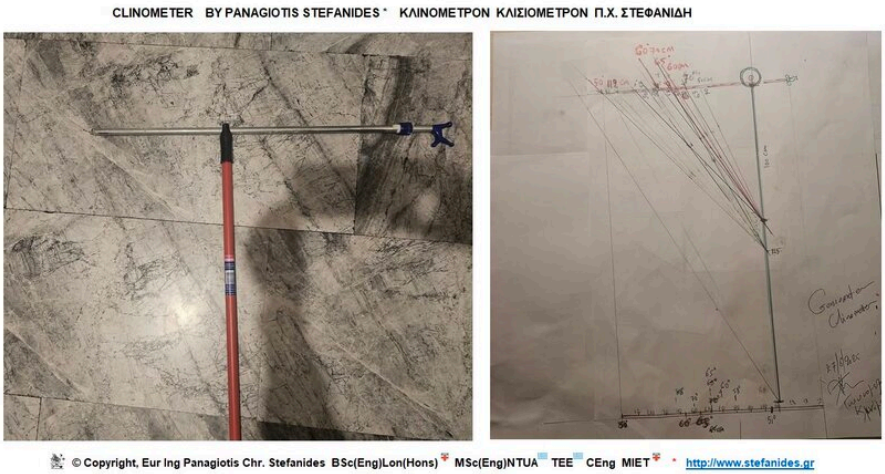


Figure 22. T-CLINOMETER, self-made by P. H. Stefanidis

DOCUMENTATION and AWARDS

The Heliotropic System has been documented through various publications and radio broadcasts and has been awarded by the HELLENIC SOCIETY FOR RESEARCH AND INVENTIONS [Committee for the Awarding of 24 Academics and Scientists of the Greek State, with the Silver Medal "ARCHIMEDES "]. Documentation of the publication of the project "Generator Polyhedron" and its award [Finalist] in an international innovation competition, with the participation of 7 international judges, of the "Institution of Engineering and Technology [IET]" London, entitled "IET Innovation Awards 2017", in the category "Navigation and Surveillance Communications", where the invented discovery of the geometry of the polyhedron, which through its discrete geometry is related to Platonic solids, was proposed as a standard for use in "Satellite Optical Monitoring" applications.

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PHOTO REFFERENCE FOR TESTIMONY OF THE WORK PRESENTED



https://youtu.be/bDt_e7-aK1o?t=5 - https://youtu.be/D2puwgq6r90?t=27

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ZEN PRACTICES FOR HEALING INNER SELF WITHIN MEDITATION SPACES

Izzah Arifin[23], Syazwani Abdul Kadir [24], Mohamad Hanif Abdul Wahab [25]

Abstract
In response to the growing prevalence of stress, anxiety, and burnout in contemporary workplaces, this study explores how Zen principles and meditative design approaches can be integrated into interior environments to support psychological well-being. The research adopts a qualitative methodology grounded in secondary data and extensive literature analysis, drawing from both architectural theory and environmental psychology. Findings from previous studies indicate that creating spaces that foster inner calm requires a fundamental understanding of Zen ideals, which prioritise simplicity, naturalness, harmony, and mindful awareness. Zen-inspired interiors emphasise uncluttered spatial arrangements, the thoughtful use of light, and a restrained selection of materials and furnishings. These elements work together to reduce visual noise and cognitive overload, thereby promoting mental clarity. The incorporation of natural features, such as interior plants, water elements, natural textures, and views toward the outdoors, further strengthens the connection between occupants and the environment. This spatial environment strengthens one's sense of tranquillity and grounding. Additionally, meditative design strategies often include designated quiet zones, contemplative corners, or restorative spaces that allow individuals to pause, reflect, and regulate their emotional states. Overall, the study concludes that Zen aesthetics and meditative design hold significant potential for enhancing healing, presence, and well-being in modern interior spaces. By integrating principles of mindfulness and simplicity into spatial design, interior environments can function not only as places of work or habitation but also as supportive settings for mental restoration. This approach underscores the growing recognition of design's role in addressing psychological stress and fostering healthier, more balanced experiences of space.
Keywords: Zen, Healing, Interior spaces, Well-being

1. Introduction

1.1 Background of Study

Zen is the direct experience of what may be referred to as the actual or uttermost reality, but it is not distinct from the relative or everyday. Realising the non-dualistic, lively, complicated, and linked nature of all existence is possible through the meditation technique known as Zazen. The bonds of the past and the future, as well as the self-imposed and confining barriers that construct around what have been mistakenly believed to be distinct and unalterable identities, can be broken by this straightforward yet profound practice. Zen originates as dhyāna, a form of meditation, in India. When Buddhism arrived in China, it blended with local ideas and became known as Chan. This new form focused less on reading scriptures and more on personal experience and quiet meditation. Later, Chan travelled to Japan, where it became Zen. Zen teaches people to find truth through simple living, quiet sitting (Zazen), and direct experience, rather than through long study or complicated beliefs. Originating in ancient cultures, meditation has been practised for centuries and is becoming increasingly popular in Western society due to its many health advantages.

Employees working in startups and technology companies are under increased stress and are more prone to burnout. This stress affects not only mental health but also their personal life, performance at work (Monzavi, 2020) and especially when pressure, concern, physical, and mental stress are the well-known reasons for numerous illnesses (Gudadhe, 2022). This stressful work culture has become the norm as competition demands that progress must not slow down. Employees often strive to excel in their jobs, prioritising their output over their own needs, which can lead to stress overload and mental, physical, and emotional exhaustion.

Interest in interior architecture and its impact on human well-being, whether positive or negative, has increased. It will seek to explore the special healing potential of interior space in relation to the quality of life and the distinguishing qualities or properties of interior space that support well-being and spirituality. It can function as a standalone healing tool and as an adjunct to therapy in the healing process of an individual. In this way, the visitor is meant to perceive the architectural object as an alternative procedure (Justyna Krokowska, 2021). Meditation offers a range of therapeutic benefits that enhance mental and physical well-

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being. Due to its potential to support healing and well-being, meditation is being increasingly incorporated into design.
Architectural space design not only pays attention to practicality but also increasingly focuses on the design and integration of cultural concepts within the space. Adding cultural background to space design, on the one hand, can enhance the connotation of space, and on the other hand, can achieve cultural heritage. Studies the application of "Zen space in modern architecture, through analysing the scale, shape, texture, color, and other design elements of Zen space in architecture, and summarises the theories and methods used in creating the Zen space, thus explores the significance of Zen space formation" (Ming & Kailong, 2017).

1.2 Problem Statement

Zen meditation has the capacity to promote inner peace, self-awareness, and clarity. Practitioners frequently encounter problems that can be resolved within the therapeutic environment. However, creating inappropriate healing environments for individuals with misunderstandings and irrational expectations is a problem for many meditation centres. However, creating appropriate healing environments for individuals with misunderstandings and irrational expectations is a problem for most meditation centres. There is a lack of documentation of comprehensive studies on Zen and healing in interior spaces, as well as analysis of the healing and spiritual qualities of interior spaces, particularly in meditation rooms and other areas that have the potential to evoke spirituality and well-being, thereby affecting humans in a healing manner (Monzavi, 2020). People often misunderstand Zen as requiring a blank mind or rapid spiritual advancement in the absence of proper instruction and information about Zen meditation, which can result in dissatisfaction, disillusionment, or a separation from life rather than integration. Second, some people experience psychological discomfort or physical alignment issues due to ergonomic and physical discomfort. During meditation, beginner meditators may experience anxiety, physical discomfort, or unusual shifts in their perception.

1.3 Research Objectives

The objectives of the study are to determine the aspects of Zen and healing design strategies in interior spaces and to identify environment variables of Zen in homelike settings, including views of nature, light, noise control, spatial organisation and materials.

Literature Review

The Exploration of Zen Aesthetics

Lee (2022) examines the migration of Zen Buddhism to Japan in the seventh century and its subsequent integration into Japanese culture and spiritual history, to explore the lasting impact of Zen ideas on modern aesthetics in decorative arts and home design. Yūgen (profound depth/ subtlety/ mystery), Datsuzoku (freedom from attachment/ rule/ routine), Seijaku (serenity/ purity/ silence), Fukinsei (asymmetry/ irregularity), Kanso (simplicity/ sparseness), Koko (austere sublimity/ beauty in the aged) and Shizen (naturalness) are the seven pillars developed to evaluate Zen aesthetics.
Davies (2016) explores the significant impact of Zen Buddhism and the natural world's cyclical equilibrium on Japanese aesthetics, supporting traditional design's acceptance of unpredictability. It explores Wabi-Sabi, a Japanese philosophy that significantly influences Japanese visual culture and represents imperfection, impermanence, and incompleteness. It emphasises how difficult it is to translate Wabi-Sabi into English because there is no direct equivalent, hence its specifics must be communicated visually. By comparing it with Western viewpoints, this examination of Wabi-Sabi is placed within a larger framework for comprehending Japanese culture and its distinctive approach to design, "Which juxtaposes Asian and Western cultural perspectives on light and shadow, the author explores the historical function of light in establishing spatial moods" (Yiyang Xu, 2020). The significance of light in architectural space claims that light is inherently connected to the human spirit and is necessary for establishing atmosphere. Yiyang Xu (2020) also discusses how colour affects human emotions, referencing research like colour and emotion: effects of hue, saturation, and brightness and recognising that cultural backgrounds, age, and gender all have an impact on colour emotions.

The Effectiveness of Meditation Enhances Well-Being

Gudadhe (2022) highlights the amount of research on mindfulness and meditation, which has its roots in early Western religious traditions as well as ancient Asian and Middle Eastern philosophies, continuously

emphasising how these techniques promote peace, introspection, and present-moment awareness. To lessen suffering and foster psychological freedom, mindfulness, which is commonly described as the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment, is practised. Mindfulness-based therapies (MBIs) are successful in treating a few mental health issues, such as stress, anxiety, and depression. Meditation is a recognised technique for reducing stress, with even a single session demonstrating positive effects on physiological and psychological indices of stress. It has also been shown to have physiological benefits, including lowering cholesterol and reducing sympathetic overstimulation, highlighting the substantial potential of mindfulness techniques to improve performance and well-being, which is particularly pertinent in high-stress settings such as the workplace. Lomas et al. (2017) stated that these ideas are presented as a framework for understanding and potentially enhancing the health-promoting qualities of mindfulness by incorporating a more comprehensive, culturally and spiritually informed perspective.

DuBose et al. (2018) highlight that investigating the concept of healing places and applying evidence-based design (EBD) concepts to a broader understanding of healing, rather than just health effects. It breaks down healing into its prior elements, such as behavioural, social, psychological, emotional, and functional, through synthesising the available data to show how interior space environmental factors can support various aspects of healing. These significant environmental factors are divided into six categories: safe, individualised control, positive distractions, social support, homelike surroundings, and access to natural views.

Spatial Influence in Zen Culture

Ming & Kailong (2017) emphasise the importance of incorporating cultural ideas into architectural space design to preserve cultural heritage and enhance its significance. It emphasises "Zen" as an essential symbol of Asian culture that has attracted a lot of interest, especially in contemporary architectural applications. To summarise theories and techniques for designing Zen spaces and investigate their significance (Ming & Kailong, 2017), analyse the design aspects of Zen space, including scale, shape, texture, and colour. This is part of a larger movement in modern design to re-examine old cultural norms, providing users with spaces that encourage reflection and align with the goals of current Zen spaces. It most likely encompasses a range of studies examining the benefits of natural light, access to green spaces, spatial arrangement, material selection, and sensory experiences in reducing stress, elevating mood, and promoting overall mental health. To define what "healing architecture" is and how it can be used to address mental health issues in modern urbanism, it may also investigate behavioural typologies in urban settings to comprehend how various architectural interventions can meet a range of human needs and encourage constructive interactions with the built environment (Justyna Krokowska, 2021).

Monzavi (2020) demonstrated that physical settings have a profound impact on psychological and physiological states, and exhibit a considerable, reciprocal association between interior space quality and well-being. The current theoretical frameworks identify components and principles that support healing environments and spiritual experiences, such as the thoughtful use of light, material textures, colour, sound, and spatial organisation, by drawing on architectural theory, philosophy, and historical precedents of sacred spaces. This collection of work emphasises that peaceful, focused, and connected spaces are essential components of effective meditation interiors, which are frequently attained through thoughtful design decisions that encourage spiritual and mindful practices.

Joy Yamada et al. (2021) thoroughly analyse the use of traditional Japanese aesthetics, specifically wabi and sabi, in modern architecture, suggesting that imitations of these styles outside of Japan frequently fall short of a thorough comprehension of their underlying existential and philosophical principles. Zen insights on the nature of material existence, emphasising the depth of philosophy underneath these aesthetic principles. In contrast to shallow Western views, this requires examining how traditional Japanese art forms and architecture comprehend and convey materiality, impermanence, and the core beauty of natural processes. To produce a more authentic and powerful architectural statement, the study thus demonstrates the necessity of a deeper, contextually informed engagement with this aesthetics. Jia et al. (2025) have demonstrated that the deliberate use of negative space can provide contemplative areas where a sizable portion of guests report feeling more focused and emotionally balanced. Although modifications such as parametric voids in place of conventional spaces or modular birch platforms in place of tatami mats have resulted from the globalisation of Zen design, these modifications push the limits of Zen's philosophical integrity.

3. Methodology

The research methodology incorporated in this study is a Systematic Literature Review (SLR), focusing on architectural, psychological, and spiritual perspectives. By merging existing knowledge, theories, and perspectives from various sources, the objective is to explore how Zen practices contribute to healing the inner self within meditation spaces. Data are collected through a synthesis matrix and a triangulation data structure. Organising data for a literature review in tabular form, often referred to as a "literature review matrix" or "synthesis matrix," is an excellent method for efficiently structuring and synthesising your research. This approach makes it straightforward to create a comprehensive and unified literature review by helping to identify issues, gaps, and discrepancies among various studies. Hence, the key information to extract from these comprehensive studies was the author, year of publication, title, problem statement, research objectives, keywords, scope and content, and key findings. The tabulated data were analysed qualitatively and synthesised into a diagram of three phases of data analysis, identifying the aspects of Zen and healing design strategies in interior spaces.

4. Findings

Data collection from literature review comprehension are tabulated in Table 1.

Table 1. Comprehensive data for aspects in Zen based on Literature review synthesis table.

Author	Title	Problem statement	Research Objective/Research Question	Scope/Content
Abhishek Gudadhe (2022)	The Economic, Physiological, and Psychological Benefits of Daily Meditation Practice in a Technology Corporation	Employees in startups and technology companies face increased stress levels, leading to burnout that affects their mental health, personal lives, and work performance.	To provide a possible practice to employees in the technology industry to increase their quality of life and perform more efficiently.	Highlighting the importance of mindfulness and meditation as effective strategies for enhancing employee well-being and organizational performance, supported by a review of literature on mindfulness definitions, neurobiology, stress reduction, and measurable benefits.
T. Lomas, N. Etcoff, W. V. Gordon, and E. Shonin (2017)	Zen and the art of living mindfully: The health-enhancing potential of Zen aesthetics	Concern that the largely secular, "de-contextualized" way in which mindfulness is currently being harnessed in the West is diminishing its potential to improve health and well-being.	To contribute to this re-contextualization by focusing on Zen Buddhism and zen aesthetic principles; To make the case that embodying these principles can help people enhance their levels of psychosomatic wellbeing and come to a truer understanding of the essence of mindful living.	Examines how the seven Zen aesthetic principles can enhance health and well-being by promoting mindfulness, simplicity, and spiritual insight, showing their relevance beyond art to everyday life and mental health.
3. Chen Ming and Ran Kailong (2017)	The Application of Zen Culture in Space Design	There is a need to apply the cultural thought of Zen to space design to express this need and conform to human aesthetic competence. The paper also addresses how to embody the whole beauty and create a peaceful and harmonious atmosphere using Zen concepts during the space design process.	It aims to summarize the theories and methods used in creating Zen space and explore the significance of its formation. The design objective of modern Zen Space is to offer users a place of insight by integrating traditional aesthetics and creating a spatial artistic conception with a strong spirit of Zen.	Explores how Zen culture, rooted in meditation and Eastern aesthetics, influences modern architectural space design by promoting simplicity, natural harmony, and spiritual depth, as illustrated through various case studies.
4. Fatemeh Monzavi (2020)	Meditation Interiors: Exploring Spatial Qualities for Well-Being and Spirituality	There is a gap in understanding how interior spaces, specifically meditation interiors, contribute to well-being and spirituality.	Aims to investigate the connection between interior space and the promotion of well-being through the lens of meditation interiors. It intends to uncover how	Examines how the design of meditation interiors influences well-being and spirituality by exploring the relationship between space and human experience,

			specific spatial qualities contribute to well-being and spirituality in these environments.	incorporating concepts like mindfulness, biophilia, and sensory-responsive design.
5. Justyna Krokowska (2021)	Healing architecture: Exploration of mental well-being in an urban context	How architecture can enhance mental well-being, what spatial elements and characteristics promote mental well-being, and how the interventions are formed by human behaviour.	Context implies a recognition of the importance of the built environment on well-being, especially under stressful conditions.	This degree project investigates "healing architecture" and its impact on mental well- being in urban environments, using a theoretical and methodological framework to propose design interventions.
6. Jennifer DuBose, Lorissa MacAllister, Khatereh Hadi, and Bonnie Sakallaris (2018)	Exploring the Concept of Healing Spaces	Promoting overall wellness, which requires expanding the focus to healing.	Aims to explore how existing knowledge from evidence-based design (EBD) research, which primarily focuses on healing outcomes, can be extended to the broader and more "elusive goal of healing".	Examines how "healing spaces" in healthcare settings support emotional, psychological, social, and functional well-being through environmental factors like nature, privacy, and personal control, advocating for a holistic design approach rooted in the evolution of care practices.
7. Anna Davies (2016)	Cross-Cultural Design: A Visual Approach to Understanding Japanese Wabi-Sabi	Understanding how different cultures approach, devise, and respond to visual design is crucial for igniting cross-cultural communication and enriching Western visual culture.	To offer a discussion of Wabi-Sabi, a Japanese worldview exemplifying imperfection, impermanence, and incompleteness, that strongly influences Japanese visual culture.	Explores the Japanese concept ofWabi-Sabi and its roots in Zen Buddhism and nature, examining its impact on Japanese visual aesthetics and cross-cultural design, and speculating how Western design might evolve if guided by Wabi-Sabi principles.
8. Ronit Lee (2022)	The Influence of Zen on Contemporary Aesthetics in Decorative Arts and Interior Design	Implicitly addresses the need for a deeper understanding of how traditional Zen concepts, deeply rooted in Japanese culture, continue to influence contemporary decorative arts and interior design globally.	To highlight the continued influence of these Zen concepts on contemporary aesthetics in the decorative arts and interior design, both in Japan and globally.	Explores how traditional Japanese Zen concepts—rooted in impermanence, simplicity, and the Tea Ceremony—have shaped contemporary aesthetics in decorative arts and interior design, influencing both Japanese daily life and global design trends.
9. Norbert Michael Krumins (2018)	Curating the Liminal Space: Zen, Being Peace, and the Cultivation of Presence	Inquiry into "zen mind" further suggests a gap in integrating contemplative practices for cultivating presence within these spaces.	To explore the liminal space through theological reflection and contemplative inquiry using "zen mind" or "beginner's mind.	Explores the concept of liminal space in contemplative pedagogy within post-secondary classrooms, using a/r/tography and poetic fragments to examine its transformative, aesthetic, and spiritual dimensions through the lens of Zen mind and artmaking as contemplative practice.
10. Yiyang Xu (2020)	The Use of Natural Light and Colour in Meditation Spaces	1.Argues that there is a crisis of materialism and pragmatism. 2. It identifies a need for architectural design to move beyond mere functionality and address deeper human needs, specifically by creating	To explore meditation and architectural design methodology. To design a meditative space that guides people's thinking, combining theories of art, aesthetics, psychology, philosophy, and other	Explores a meditation-based design methodology informed by aesthetics, psychology, and philosophy, culminating in a proposed meditation.

		spaces conducive to meditation and guiding people's thinking.	"architecture and spatial context" with data analysis.	
11. Yan Jia, Muhammad Firzan Abdul Aziz, & Rongrong Sun (2025)	Transcultural Zen design frameworks for enhancing mental health through restorative spaces and user experience	Aims to bridge this gap by exploring the practical application and impact of transcultural Zen design.	Investigate the potential expression of the traditional Japanese aesthetics of Wabi and Sabi in contemporary architecture. Examine Zen observations about the characteristics of material being to reveal the original meaning and reinterpretation capacity of Wabi and Sabi.	Explores how the traditional Japanese aesthetics of Wabi and Sabi, rooted in Zen Buddhism, can be meaningfully expressed in contemporary architecture by emphasizing their deep philosophical foundations and material sensitivity rather than superficial interpretation.
12. Charissa Joy Yamada	Architecture and the Nature of Materiality	Lack of understanding of the deeper, underlying philosophical realizations (largely derived from Zen Buddhism) that this aesthetics were originally intended to express about the nature of being. Without this understanding, Wabi and Sabi lose much of their meaning and their capacity for genuine reinterpretation.	Investigate the potential expression of the traditional Japanese aesthetics of Wabi and Sabi in contemporary architecture. Examine Zen observations about the characteristics of material being to reveal the original meaning and reinterpretation capacity of Wabi and Sabi.	Explores how the traditional Japanese aesthetics of Wabi and Sabi, rooted in Zen Buddhism, can be meaningfully expressed in contemporary architecture by emphasizing their deep philosophical foundations and material sensitivity rather than superficial interpretation.

4.1 Data 1: The exploration of Zen aesthetics

Research objectives - To determine the aspects of Zen and healing design strategies in interior spaces.

The exploration of Zen aesthetics reveals its profound impact, extending beyond traditional art, and has greatly influenced modern decorative arts and interior design worldwide by emphasising fundamental ideas such as Wabi-Sabi, simplicity, nature, and peace. By promoting mindfulness and spiritual awareness, these aesthetic concepts have been demonstrated to enhance health and well-being, underscoring their relevance to both mental health and daily living. Previous researchers have also examined how Zen aesthetics can create places that are transforming and meditative, frequently influencing design approaches based on meditation and shaping people's thoughts through strategic interior and architectural design decisions.

4.2 Data 2: The effectiveness of meditation enhances well-being

Research objectives - To determine the aspects of Zen and healing design strategies in interior spaces.

The effectiveness of enhancing well-being through interior healing spaces is a successful method of improving overall well-being, primarily by increasing concentration. Researchers have shown that it has a significant positive impact on stress reduction, particularly for workers in corporate settings who are under considerable stress. According to previous research on mindfulness, clarifications, neurobiology, and observable advantages, meditation also enhances mental health, having a positive effect on both individual lives and the performance of organisations.

4.3 Data 3: Spatial influence by Zen culture

Research objectives - To identify environment variables of Zen in homelike settings, views of nature, light, noise control, spatial organizations, and materials.

The spatial influence of Zen culture has a significant impact on architectural space design, particularly when it comes to creating settings suitable for meditation and healing spaces. A strong emphasis on simplicity, natural harmony, and the cultivation of spiritual depth within designed spaces characterises this influence. Spatial influence by Zen culture refers to how Zen ideas shape the layout, ambience, and use of spaces, particularly in indoor settings, to promote spiritual well-being, awareness, and simplicity.

Simplicity (Kanso) - Zen interiors encourage minimalism, eliminating clutter to create clarity, ensuring spaces are clean, moderate, and purposeful.
Natural materials - Wood, stone, paper, sand, and other organic materials create an earthy texturized feeling and calming atmosphere that connects interiors with nature.
Asymmetry (Fukinsei) - Zen spaces often avoid perfect symmetry, embracing irregularity to reflect the imperfections of life and evoke a natural balance.
Empty Space (Ma) - The use of void or negative space is central. It allows the mind to rest, focus and breathe at ease, it is essential for meditation and contemplation.
Connection to nature (Shizen) - Openings, such as shoji screens, interior gardens, or courtyards, provide a seamless flow between inside and outside, reinforcing the Zen value of harmony with nature.
Soft lighting - Indirect or dim lighting stimulates a serene, introspective mood, reducing over-stimulation.
Spatial flow - Zen design emphasizes slow and mindful movement through spaces.
Quiet and stillness - Acoustic considerations like soft materials and water elements enhance silence, allowing for deeper meditation and awareness.

5. Discussion

5.1 Relation 1: Principle of simplicity, naturalness, and tranquility

Zen principles emphasise a harmonious and mindful approach to life and design. Simplicity (Kanso) advocates for the removal of all non-essential elements, focusing on clarity and directness to cultivate a calm and uncluttered mind and environment, allowing for a deeper appreciation of the fundamental. Naturalness (Shizen) embodies authenticity, spontaneity, and the inherent beauty of the organic world, rejecting artificiality and embracing imperfections to cultivate a genuine connection with one's surroundings. Tranquillity (Seijaku) seeks a state of peaceful stillness and inner calm, achieved by integrating mindfulness and quiet contemplation into daily life and designing spaces that promote serenity through soft aesthetics and a lack of distraction.

5.2 Relation 2: Create conducive environment that fosters mindfulness and tranquility

By creating conducive environments that stimulate mindfulness and tranquillity, it embodies the fundamental ideas of naturalness, simplicity, and tranquillity to create surroundings that are conducive to personal growth. These ideas serve as a guide for designing clutter-free environments, which often incorporate natural materials, subdued lighting, and a minimalist aesthetic. By reducing distractions and promoting a sense of quiet, these settings naturally foster mindfulness, enabling individuals to concentrate on the present moment and cultivate inner peace through a deep appreciation of simplicity.

5.3 Outcome: Zen principle is fundamental in creating environment that cultivates inner peace

The Zen principle is fundamental in creating environments that cultivate inner peace by emphasising simplicity, naturalness, harmony, and mindfulness. Through minimalist design, connection to nature, and intentional spatial arrangement, Zen-inspired spaces reduce distractions and foster clarity of mind. The use of natural materials, balanced compositions, and the acceptance of imperfection (wabi-sabi) invite a calming atmosphere that encourages reflection and emotional balance. Ultimately, these principles work together to create a serene environment that supports stillness, presence, and inner well-being. The overall synthesis is presented in the following Figure 1.

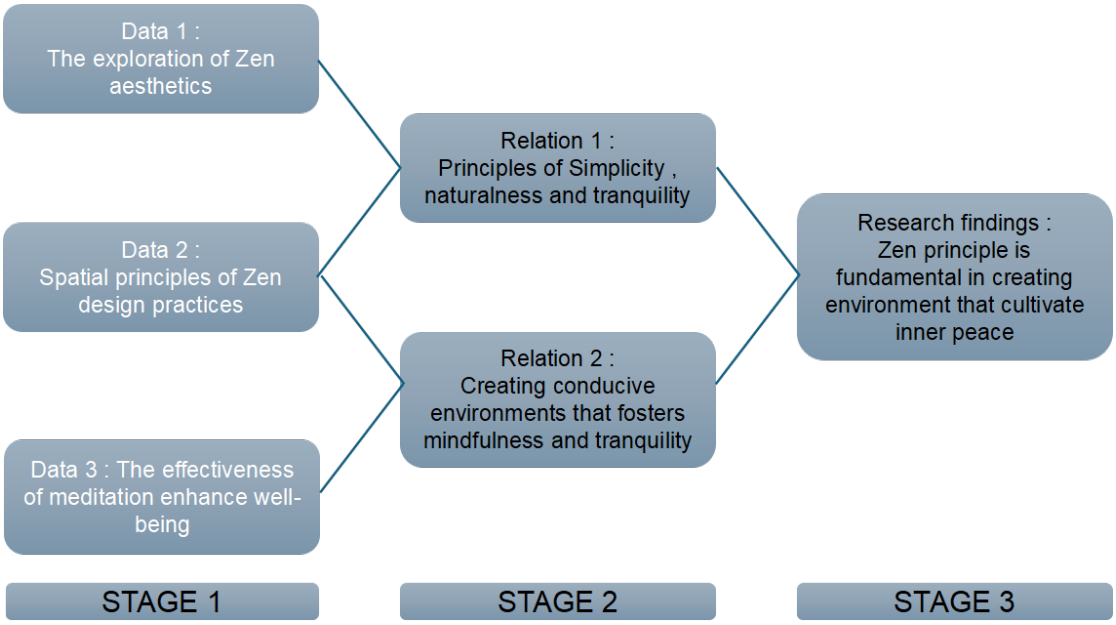


Figure 1. Diagram of Zen and healing design strategies in interior spaces

6. Conclusion

In conclusion, aspects of the Zen principle in creating a meditation healing space genuinely stimulate inner peace and well-being. This conclusion is based on three interlinked primary findings. The exploration of Zen aesthetics demonstrates its far-reaching impact, extending globally through design and core ideas like Wabi-Sabi, ultimately enhancing health by encouraging meditative and transformative spaces. The documented effectiveness of meditation in improving well-being underscores its direct and measurable positive impact towards users and practitioners. Hence, the spatial influence of Zen culture is evident in architectural and interior design, where a strong emphasis on Zen principles informs the creation of spaces conducive to meditation and healing. When these elements unite, they actively reduce distractions, promote clarity of mind, and create a serene atmosphere that encourages reflection and emotional balance. Thereby, proving the fundamental role of aspects in Zen supports stillness, presence and overall well-being in meditation spaces.

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CULTURAL AND ARTISTIC CONNECTIONS BETWEEN IRAN AND THE OTTOMAN EMPIRE IN THE ILLUSTRATION OF THE MEETING OF LAYLA AND MAJNUN IN THE KHAMSA OF NIZAMI AND FUZULI, 16TH CENTURY CE

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Abstract
Illustrated manuscripts of Layla and Majnun by Fuzuli produced in the Ottoman realm display striking similarities to the Iranian miniature tradition in terms of style and visual elements. However, it remains unclear to what extent these affinities resulted from the direct transmission of Iranian models or were shaped by broader cultural and artistic interactions between Iran and the Ottoman Empire. The aim of this study is to examine the cultural and artistic connections between Iran and the Ottoman world and to analyze how the Iranian miniature tradition influenced the illustrations in Fuzuli's manuscripts. To this end, through a comparative study of the scene depicting the meeting of Layla and Majnun in the Khamsa of Nizami and Fuzuli, the authors seek to answer the following question: which visual and stylistic features of Iranian models were adopted in the illustration found in Fuzuli's manuscript?
The present research employs a descriptive–analytical method based on documentary sources. The findings indicate that the illustration of the meeting of Layla and Majnun in Fuzuli's manuscript was influenced by Iranian miniature painting in terms of pictorial conventions, figure representation, color application, types of costume, and narrative composition. It can be argued that the illustration under study in these two manuscripts reflects both the direct transmission of styles and the sustained flow of artistic relations between artists and manuscript workshops in Iran and the Ottoman Empire, aimed at preserving and expanding a shared visual language.
Keywords: Layla and Majnun (Fuzuli), Ottoman manuscript art, Iranian miniature painting, Iranian–Ottoman art

Introduction

In the 10th century AH, the land of Iran underwent significant political transformations. Following various upheavals during this period, many Iranian artists migrated to neighboring countries in search of artistic workshops. In western Iran, the Ottoman Empire, which sought to enhance its cultural and artistic achievements after the conquest of Constantinople and its establishment in Istanbul, organized art workshops influenced by Iran, which was at the time a leading center of culture and art. The Ottoman sultans' interest in art created favorable conditions for the migration of Iranian artists to Anatolia. Due to the sultans' patronage, many Iranian painters were employed in the royal workshops of Istanbul. Moreover, as a result of conflicts between the two countries, Sultan Selim transferred many artists to Istanbul after capturing Tabriz. Additionally, the Battle of Chaldiran and the refuge of some Iranian princes at the Ottoman court further contributed to the flourishing of Istanbul's workshops. Subsequently, numerous valuable works and manuscripts of the Iranian painting schools entered the Topkapi Palace treasury (Farahfar et al., 2012: 20). Thus, a suitable environment emerged for the development of Ottoman miniature painting, based on the models and achievements of Iranian artists.
In this study, the authors aim to answer the following question: How did cultural and artistic interactions between Iran and the Ottoman Empire influence the style and visual characteristics of Ottoman miniature painting? To this end, the scene depicting the meeting of Layla and Majnun in Nizami's Khamsa and Fuzuli's manuscript is examined comparatively.
Research Methodology: This study is qualitative in nature and employs a descriptive–analytical approach. The data were collected through documentary research.

Life of Fuzuli

In the preface of his work *Matla'u'l-İ'tikād*, Fuzuli introduces himself as Muhammad ibn Sulayman. His father was from the Aras region of Azerbaijan and belonged to Iranian Turkmens, who migrated to Iraq with their

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family during the Timurid era. The reasons for Sulayman's migration to Iraq and his permanent residence there remain unclear (Musharraf, 2001: 100). Fuzuli of Baghdad is classified within the Indian literary school, although he is among the least recognized founders of this style. He was a multilingual poet living in the 10th century AH, originally from Azerbaijan, though born in Iraq (Safa, 1986: 282). Fuzuli composed his works in Turkish, Persian, and Arabic, all of which were spoken in Baghdad at the time. Although he was Sunni, he showed great respect for Shi'a beliefs, and his works reflect his attention to Shi'a thought (Milstein, 1990: 3). He played a key role in the development of the Azerbaijani language, and his works are highly valued for elevating Azerbaijani poetry and language (Berengian, 1988: 19). His Turkish Divan includes *Shah and Beggar*, *Layla and Majnun*, *Mesnevi of Beng and Wine*, *Rūze*, *Hadīqatü's-Sa'ādā*, *Sohbetü'l-Asmar*, *Letter of Complaint*, and *Treatise on Riddles*. His Persian works include *Divan*, *Rind and Zahid*, *Health and Disease*, *Anīs al-Qalb*, *Sāqī-nāma* (Seven Cups), *Rūh-nāma* (Journey of the Soul or Beauty and Love). His Arabic works include *Matla'u'l-İ'tikād*, an Arabic Divan, and philosophical and linguistic treatises. Fuzuli was a contemporary of Safavid Shah Tahmasp and dedicated one of his works, *Beng and Wine*, to Shah Ismail (Jafari Dehkordi, 2019: 87).

The Influence of Iranian Miniature Painting on the Istanbul School

When Ismail ascended the throne in Tabriz in 1501 CE / 907 AH, he initially only controlled the Azerbaijan region; it took him ten years to conquer the rest of Iran. He also captured Baghdad, but the city remained under Safavid control for a limited period (Siyouri, 2006: 33).

Shah Ismail's conquest and plundering of Herat in 1507 CE / 912 AH was one of the factors that facilitated the transfer of cultural and artistic elements from Central Asia to the Ottoman lands. He relocated the Herat library, its staff, and the painter Behzad to Tabriz. However, in 1514 CE / 920 AH, during the Battle of Chaldiran, Tabriz fell to Sultan Selim I. The Turkish forces looted the city, transferring the library and several of its painters to Istanbul. These painters later had a significant impact on the development of Turkish painting, and thus, in a short period, the Ottoman court inherited an artistic school that had flourished in Central Asia during the 15th century CE / 9th century AH (Aghashe, 2001: 34).

Subsequent invasions in 940, 944, and 953 AH led to the transfer of many Iranian royal treasures to Turkey, including manuscripts and illustrated books, most of which are still preserved in the Topkapi Palace. With the help of painters such as Shah Mansur, Vali-Jan, and Siavash Bey's student, the 10th-century AH Ottoman painting school was established (Bahari, 2015: 294).

The most influential painter of the Tabriz school in Istanbul was Shah Qoli, who, from 933 AH / 1526 CE onward, trained 29 painters and 12 assistants in the royal workshops (Blair & Bloom, 2002: 613; Karimzadeh Tabrizi, 1997: 237). His most notable students were Qarami Chelbi, Mazhab Ali-Jan, and Moheb Ali Tabrizi (Mahir, 1987: 117; Shabani & Dinparast, 2010: 68).

At the Ottoman court, support for artists was combined with the sponsorship of wealthy patrons who maintained art workshops, and the sultan himself acted as a primary supporter. Unlike other regions, Ottoman artists and craftsmen did not face the need to switch patrons repeatedly, and the centralization of the government in Istanbul ensured the safety of the large royal library (Shayestehfar, 2005: 160).

Studies of Ottoman miniature painting indicate that most sultans were not only conquerors but also patrons of knowledge. Sultan Mehmed the Conqueror, Sultan Suleiman the Magnificent, and Sultan Murad III were among the greatest supporters of manuscript art, making their reigns pivotal for Ottoman art (Shayestehfar & Khazaei, 2021: 255). Early Ottoman miniatures clearly show similarities to the Tabriz school, including the use of rich and varied colors, golden skies, diverse court scenes, meticulous attention to interior architectural details, and natural landscapes. This style was introduced into Ottoman art through illustrations in literary works, tracing a path from Herat and Shiraz to Tabriz and eventually Istanbul (Pinder, 1969: 8).

The Manuscript of Layla and Majnun

Layla and Majnun (Azerbaijani: *Leyli və Məcnun*) is an epic poem written in Azerbaijani by the 16th-century poet Fuzuli. Composed in rhymed couplets (mathnawi), it narrates the story of a young man named Qays who falls in love with a girl named Layla. Due to his obsessive love, he earns the epithet *Majnun*, meaning "mad" (Gutsche, Weber, & Rollberg, 1987, p. 77). Considered the pinnacle of Fuzuli's literary creation, the poem comprises 3,096 couplets and was dedicated to Övüs Pasha, the Ottoman governor of Baghdad. In 1908, Aziz Haji-Beyov adapted this work to create the first opera in the Islamic world based on Fuzuli's poem (Macit, 2013).

The Tahmaspi Khamsa

From early times, painting and literature in Iran have been inseparable from its culture and art, as both reflect the artist's perception of the imaginative world. Iranian poets composed verses inspired by the imagery of their words, and painters manifested poetic themes in their artworks. Among Iranian literary works, Ferdowsi's *Shahnameh* and Nizami's *Khamsa* received particular attention from artists across historical periods. The themes of Nizami's *Khamsa* served as inspiration for artistic creation in the Herat and Tabriz schools during the Timurid and Safavid periods.

The illustrated manuscript of the *Tahmaspi Khamsa* is a unique and invaluable work whose elegance and beauty have long attracted the attention of art scholars. Now held in the British Library (Or. 2265), it was created in the second Tabriz school. The manuscript consists of 808 folios in small imperial format and contains all five of Nizami's poems. The Safavid Tabriz painting school represents the convergence of three artistic currents: the Turkmen tradition in Tabriz, the Herat school (linked to Turkmen commercial networks in Shiraz), and some lesser-known schools of Samarkand beyond the Syr Darya (Robinson, 2011: 50).

Every page of the manuscript is adorned with intricate motifs, including floral, animal, inanimate, and fantastical creatures. Each page features a unique composition, adding vitality and dynamism to the work (Welch, 1972: 145). The manuscript measures approximately 360 × 250 mm. It was copied by Shah Mahmoud Nishapuri, known as Zarrin Qalam, between 945–949 AH. The five poems include seventeen illustrations, fourteen of which were executed by renowned artists of the second Tabriz school, such as Sultan Muhammad, Aqa Mirak, Mir Sayyid Ali, Mirza Ali, and Muzaffar Ali. Three additional illustrations, added in the 11th century AH in the Isfahan style by Muhammad Zaman, reveal a mixture of styles.

In these illustrations, one can observe a blending of Herat and Tabriz styles. The landscapes, color schemes, and figure modeling reflect the Tabriz school, while the balanced and harmonious compositions correspond with the Herat style. Everyday activities of people are depicted throughout (Ajand, 2015: 96). The scenes of this manuscript represent the peak of the Tabriz school during the Safavid period, in which rational and emotional elements are perfectly balanced. In the *Tahmaspi Khamsa*, first-generation masters (Sultan Muhammad and Aqa Mirak) and second-generation masters (Mirza Ali, Mir Sayyid Ali, and Muzaffar Ali) each demonstrated their technical mastery and creativity in their own distinctive ways (Ashrafi, 1988: 98).

The Miniature of Majnun Reaching Layla's Tent in the Khamsa of Tahmaspi (Figure 1)

The story depicted in this miniature shows an old woman dragging a man in chains, intending to beg. Majnun asks the old woman to take him instead of that man. The old woman agrees and brings him to Layla's tent. The miniature captures the turning point of the story, namely the moment Majnun reaches Layla's tent. This work is attributed to Mir Sayyid Ali, one of the painters of the royal workshop in Tabriz.

The miniature contains both literary and visual texts. The poems, written in Nasta'liq script, are inscribed symmetrically in panels at the top of the figure. In this work, spatial composition is achieved by dividing the frame into three levels, while the main and secondary events of the story are simultaneously depicted through numerous figures, including fourteen women, four men, and four children. The entire composition is filled with detailed landscapes and decorative motifs.

The first level, which occupies the largest part of the miniature, depicts colorful tents, black tents, and scenes of everyday nomadic life. In the lower right corner, Layla is shown inside a white tent adorned with floral decorations. Opposite her, Majnun and the old woman holding his chain are positioned. Majnun's emaciated and semi-nude figure expresses his pitiable state. In front of Layla's tent, a white dog barks, showing its protest at Majnun's approach. Nearby, three children are throwing stones at Majnun; however, he remains indifferent to their scolding and the dog's attack, absorbed in watching Layla with a gesture of devotion.

The second level of the miniature shows a black tent with two women, two shepherds, and flocks of sheep. One woman is playing the flute (ney), another leans on a staff, and a woman is depicted milking a goat.

In the third level, the indigo sky is shown with white clouds, a bird on a dead tree, and two birds on a flowering tree, subtly expressing Majnun's solitude and longing for Layla. The melancholic sound of the ney further emphasizes the emotive aspect of the scene.

Through the careful selection of visual elements and the logical relationship among human figures, animals, objects, and the environment, the painter successfully conveys the story's theme. Despite the numerous perspectives and varied figures, the miniature maintains remarkable cohesion and harmony. The artist employs visual means such as form, color, composition, rhythm, and contrast to place the central character, Majnun, at the focal point of the narrative.

The composition of the first level follows a spiral structure, with Majnun's face as the center of rotational movement. The choice of a vertical rectangular frame adds depth and space to the work, while breaking the

frame and extending some elements beyond it broadens the viewer's perspective. The arrangement of the tents and the color contrast among them enhances the dynamism of the scene, guiding the viewer's gaze across the figure.

The creation of multi-dimensional space, depiction of different events in separate sections, use of color differentiation to separate areas, and breaking the frame all contribute to the visual flow. By using contrasting colors, particularly the interplay of black and white throughout the composition, the artist generates visual movement and rhythm.

Overall, the painter skillfully renders the gestures and postures of human and animal figures and decorative motifs, creating a conceptual spatial composition that aligns with the narrative. Despite the complexity of relationships and the multi-level structure, the miniature maintains aesthetic cohesion and visual harmony.



Figure 1. Majnun brought in chains by the old woman to Layla's tent, Persian miniature from the *Khamsa of Nizami*, painted by Mir Sayyid Ali (1510–1572), gouache on paper, 1539–1543, British Library, Or. 2265, fol. 157v., URL1

The Layla and Majnun of Fuzuli, Ottoman/Azerbaijani School (Figure 2)

This miniature, from an Ottoman manuscript of Fuzuli's *Layla and Majnun*, depicts a scene from Majnun's captivity and is one of the prominent examples of illustrating Majnun's love within the Turkish–Azerbaijani pictorial tradition. The structure of the miniature consists of both literary and visual components. The verses are written in Nasta'liq script within four panels. These textual elements, as the most explicit signifiers, not only convey the narrative but also create an interaction between literature and painting. The placement of part of the literary text within the figure directs meaning toward a specific interpretive focus. In other words, the artist conveys the main theme of the story through both visual and textual means.

The positioning of the panels at the top and bottom of the figure creates a symmetrical, geometric structure in the pictorial space, with vertical axes between the upper and lower panels dividing the space into two balanced halves. There is a precise proportion and harmonious rhythm between the written text and the illustrated elements. By framing the scene within a defined border, the artist compresses the image's multiple elements and dense figures, organizing the composition into two levels.

The first level, occupying the majority of the miniature, depicts the main event. It includes nineteen human figures of men and women wearing diverse, colorful garments in the Safavid style. Women are depicted with white head coverings, men with turbans resembling Safavid headgear, and some with hats. The figures are arranged in pairs or trios around the scene they witness, engaging in conversation or observing with expressions of surprise. The artist carefully arranged the figures, giving each distinct facial expressions and postures, and differentiated them socially according to their placement within groups.

At the bottom of the figure, two tents—golden and white—adorned with symmetrical decorative motifs are depicted. Inside these tents, women are portrayed, presumably Layla's attendants. Above the tents, two black tents decorated with motifs are visible. The artist links the characters to their environment and depicts details of daily life. The tents serve as narrative space, enabling the characters' actions to unfold within them. A single cypress tree rising from a rocky outcrop divides the scene into two symmetrical halves.

The second level depicts a golden sky with white clouds. Through composition, color interplay, and contrast, the artist creates a close relationship between different sections of the miniature and establishes visual movement. At the center of the composition stands Majnun: a frail, semi-nude figure. The arrangement of figures continuously draws the viewer's gaze back to him. His elongated, thin, vulnerable body, with arms raised and chained by an old man, conveys submission and helplessness. His body alone breaks the repetitive rhythm of the surrounding figures, and his relative nudity emphasizes the fragility of love.

The artist uses Majnun's visual depiction to highlight the story's turning point. His facial expression and posture evoke compassion and empathy in the viewer. His purple robe with golden motifs, bare feet, and exposed shoulders convey poverty, purity, and an almost ascetic, mystical quality. The old man holding Majnun's chain symbolizes social order—the voice of the tribe and tradition attempting to restrain Majnun's passionate love. His firm, covered figure contrasts with the slender, semi-nude lover, establishing the semantic core of the miniature: the conflict between external power and inner suffering.

On the other side, Layla's tent, with dark panels decorated in gold, acts as an alluring but impenetrable barrier. Women behind the curtains, with calm faces and semi-hidden gazes, define the female domain—beautiful, idealized, but forbidden. Their silent presence evokes the gendered structure of tribal society: the woman is visible yet unattainable, while the male lover is bound and separated from direct contact.

The background, with purple mountains and soft vegetation, creates an emotional, non-realistic space. This type of backdrop, common in the Ottoman school, reflects the characters' inner states rather than the external landscape. The predominance of purple signifies grief, illumination, and Majnun's inner world. Since the love between Layla and Majnun is free from carnal desire, in their final encounter divine light fills Majnun's heart, granting mystical insight. The artist subtly conveys this spiritual content through the single tree, whose trunk rises from the earthly ground and whose branches reach the golden sky—symbolizing the boundary between material and spiritual worlds.

In this miniature, love is not liberating; rather, it separates the individual from social structures, leading to asceticism, disorientation, and captivity. Overall, the figure symbolically represents the tension between unrestrained love and the strict order of tribal society. Majnun, in the midst of this scene, is not only captive to men but also to his own love, which distances him from masculine power and brings him closer to Layla's delicate but inaccessible domain.

Through the use of expressive colors, carefully formed figures, and uniform facial types, the artist constructs a world in which love, suffering, beauty, and prohibition coexist in poetic balance—a world entirely consistent

with the visual language of the Ottoman school and the poetry and worldview of Fuzuli. Consequently, the miniature not only visually translates the literary text but also conveys hidden meanings and the narrative's symbolic layers. The artist's creative approach to representing the story's inner meaning enriches the visual experience of the figure.

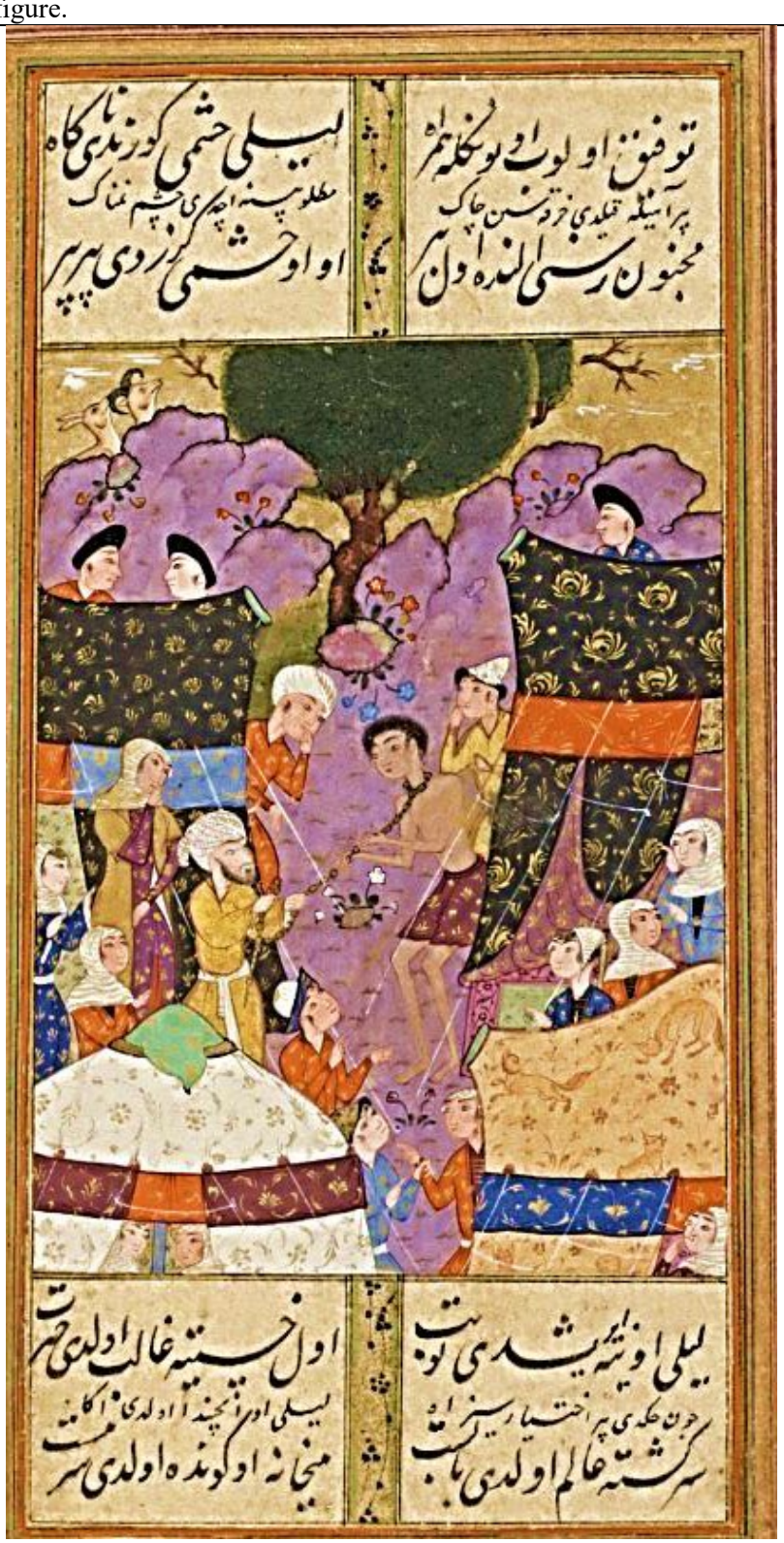


Figure 2. The Meeting of Layla and Majnun, Ottoman manuscript of Fuzuli's *Layla and Majnun*, gouache and gold on paper, ca. 16th–17th century, approx. 32 × 22 cm, Turc 316, fol69v, Bibliothèque nationale de France (BnF), Paris. URL2

Conclusion

Over the centuries, Iranian painting, due to its unique characteristics, was able to attract the attention of the rulers and monarchs of other regions. The art-loving Ottoman sultans, as patrons of the arts, facilitated the growth and development of painting in the Istanbul school. The migration of Iranian painters to Anatolia and their valuable contributions in the imperial workshops marked a turning point in the history of Ottoman art. The employment of Iranian artists in Ottoman workshops, along with their emulation of exquisite manuscripts preserved in the Topkapı Palace treasury, played a significant role in the cultural and artistic development of the Istanbul school.

The influence of the Tabriz (Safavid) school on Ottoman painting is clearly recognizable. A study of the miniatures of Layla and Majnun in the Khamsa of Tahmaspi and Fuzuli's version shows that, despite their differences, both miniatures derive from a common source and model—the Tabriz school. Indicators of this influence include the style of facial design and postures of figures, the costumes of the central character (Majnun) and other figures, the accurate placement of figures and their logical relationships, the structure of rocks, skillful use of color, wide color palette, use of gold in the sky, attention to decorative motifs, refinement in depicting women, compositional cohesion, intelligent arrangement of figures and other visual elements, the multiplicity of human figures, multi-dimensional spatial organization, focus on the central character and narrative climax, simultaneous depiction of main and secondary events, and the interaction of human figures with objects and the environment. All these elements indicate adaptation from a shared model.

Overall, it can be concluded that the miniatures examined in these two manuscripts reflect the direct transmission of styles and the sustained artistic exchange between Iranian and Ottoman manuscript workshops, contributing to the preservation and expansion of a shared visual language.

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FROM MONSTER TO FEMALE DIV: THE CONTINUITY OF AJA'IB AL-MAKHLUQAT IMAGERY IN QAJAR TILEWORK (CASE STUDY: LOUVRE MUSEUM TILES)

Nahid Jafari Dehkordi[28]

Abstract
The visual tradition of *Aja'ib al-Makhluqat* from the medieval period to the Qajar era represents one of the most enduring sources of inspiration in Iranian art. This study addresses the question of how the representation of "monsters" and the "female div" in Qajar tilework, particularly in examples held at the Louvre Museum, reflects the continuity and transformation of the *Aja'ib al-Makhluqat* visual tradition. The main research question is: How do depictions of monsters and the female div in Qajar tilework embody the continuity and evolution of the *Aja'ib al-Makhluqat* visual tradition? The primary objective of the study is to identify and analyze the methods through which this visual tradition was adapted, reinterpreted, and transformed in Qajar tilework, considering the cultural and aesthetic context of the period.
The study employs a comparative visual analysis between manuscript illustrations of *Aja'ib al-Makhluqat* and Qajar tiles, archival research, and stylistic and semiotic examination of the imagery. The findings indicate that many motifs, bodily structures, and symbolic elements from earlier manuscripts were preserved, yet Qajar tile artists reinterpreted these images through vivid and contrasting color schemes, exaggerated feminine characteristics of the div, and dynamic compositional arrangements. These adaptations reveal a deliberate effort to create more theatrical and narrative-rich representations, aligning the imagery with architectural ornamentation, aesthetic preferences, and social-cultural functions of the period. The study demonstrates that Qajar tilework was not a mere reproduction of earlier traditions, but a creative arena where the imagery of monsters and the female div was redefined, reflecting a dynamic interaction between premodern visual heritage and the cultural, social, and artistic demands of the Qajar era.
Keywords: Aja'ib al-Makhluqat, Qajar Tilework, Female Div, Monster Imagery, Cultural Adaptation

Introduction

The visual tradition of *Aja'ib al-Makhluqat* (Wonders of Creation) has had a significant impact on Iranian art from the medieval period through the Qajar era, serving as a rich source of motifs, symbols, and narrative imagery. This tradition, which includes fantastical creatures such as monsters and female divs, appeared in earlier manuscript illustrations and other media, reflecting the cultural beliefs and values of their respective periods. Awareness of this historical context is essential for understanding the changes and innovations that occurred in the Qajar era.
Qajar tilework represents a particularly important medium for the reinterpretation of this tradition. Beyond their decorative function, tiles conveyed cultural and social meanings, enabling the reinvention of motifs and narratives within architectural spaces. Despite extensive scholarship on manuscript illustration, relatively few studies have addressed the adaptation and transformation of these motifs in Qajar tilework. This research is necessary because examining these changes provides deeper insight into artistic innovation, transformations in form and color, and the representation of monsters and female divs during the Qajar period.
The aim of this study is to examine two Qajar tiles and analyze how monsters and female divs are represented, with a focus on the continuity and transformation of the *Aja'ib al-Makhluqat* visual tradition. The central research question is: How do depictions of monsters and female divs in Qajar tilework reflect the continuity and evolution of earlier visual traditions?
To address this question, the study employs comparative visual analysis, stylistic examination, and semiotic interpretation. The research process includes identifying motifs, comparing them with earlier examples for historical context, and analyzing composition, form, color, and symbolic features. This approach allows for a precise tracing of the reinterpretation of visual traditions in the two Qajar tiles, highlighting both continuity and innovation.

Methodology

This study aims to examine two Qajar tiles and analyze the representation of monsters and female divs. The primary approach is qualitative and descriptive-analytical, focusing on visual and stylistic analysis of the artworks.

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The research process consists of the following steps:
Selection and identification of samples:
Two representative Qajar tiles from the Louvre Museum collection were selected. These samples exemplify artistic features, coloration, composition, and motifs related to the *Aja'ib al-Makhluqat* tradition.
Comparison with earlier traditions:
To investigate the continuity and transformation of the visual tradition, motifs and forms in the tiles were compared with earlier examples from manuscripts and historical illustrations.
This step facilitates the identification of changes, innovations, and reinterpretations in the Qajar period.
Visual and stylistic analysis:
Examination of composition, form, color, and motif details to understand the artistic techniques and creativity of the tile-makers.
Semiotic analysis to identify symbolic meanings, cultural references, and social representations within the artworks.
Research procedure:
Observation and documentation of visual features for each tile.
Comparative analysis with earlier examples to highlight continuity and changes in the tradition.
Classification of motifs and visual-symbolic features to provide a coherent analysis.
This methodology enables a precise identification of the reinterpretation and innovation in Qajar tilework and allows for a scientific analysis of the transformation of the *Aja'ib al-Makhluqat* visual tradition during the Qajar era.
Div: Concept, Historical Transformations, and Morphology

1. Definition of Div
A div is generally considered a supernatural being, which in Iranian and Indo-Iranian cultures and religions, represents forces opposing order and human-centered norms. In the past, divs played dual roles as both guardians of nature and representatives of destructive and unknown forces. In early mythological texts, they were sometimes intertwined with nature deities and controlled wind, rain, floods, and disease (Brandon, 1970: 25; Yahaghi, 2019: 201).
With the emergence of Zoroastrianism, the concept of the div shifted, becoming a negative and malevolent entity opposed to the forces of good (Ahura Mazda). At this stage, the div no longer merely represented natural forces but also symbolized falsehood, corruption, and human misguidance (Afifi, 1995: 45; Yahaghi, 2019: 201).
In Iranian literature, besides their destructive role, divs also appear as obstacles for heroes and as symbols of moral and spiritual trials (Ferdowsi, 2007: 7/290). These transformations indicate that the div is a dynamic concept, evolving alongside social and religious changes.

2. Attributes and Characteristics of Divs
The characteristics of divs in texts and myths can be categorized into several dimensions:
Supernatural Power: Divs have the ability to shape-shift, move instantaneously, cause natural disasters, and dominate other beings (Mehtadi [Sobhi], 1965: 2/143).
Moral and Psychological Influence: Divs often represent evil, deception, and moral corruption, leading humans astray (Akbari Mafakher, 2010: 239).
Connection with Nature: Divs symbolize natural forces, including wind, rain, fire, and earth. At times, their wrath manifests as natural disasters (Zolfaghari, 2015: 600).
Magical and Transformative Power: Divs can deceive humans, affect them in dreams or visions, and assume various forms (Omidsalar, 2011: 428).

3. Morphology and Appearance of Divs
The morphology of divs is diverse and often frightening:
Size and Stature: Divs are usually described as large and powerful, sometimes comparable to giants or dragons (Massé, 1969: 352).
Facial and Bodily Features: Deivs often have terrifying faces, with long teeth and nails, and glowing eyes. Some sources also describe them with horns, tails, or wings (Zolfaghari, 2016: 599).
Variety in Form and Color: The skin and clothing of divs vary in color, ranging from black and red to green and blue (Asadi Tusi, 1975: 80).

The div is a multi-layered concept, ranging from a protector of nature to a symbol of evil and moral corruption, playing diverse roles in the intellectual and literary history of Iran. Studying their attributes, morphology, and historical transformations not only aids in understanding myths but also provides profound insights into Iranian society's perceptions of nature, morality, and supernatural forces.

Dīv Imagery and the Representation of Mythical Beings before the Qajar Period

In pre-Qajar art, divs were depicted as entirely abnormal and unnatural beings, yet often based on the male human body. To emphasize their savagery and brutality, artists incorporated features of aggressive and harmful animals from the Iranian natural environment. These features included limbs and organs of carnivorous creatures, but paradoxically, traits of non-carnivorous animals were also added. For example, a div might combine wolf-like claws (or those of other predators) with buffalo horns and boar teeth, all within the form of a wild, disheveled man. These divs were consistently portrayed as male, a fact often explicitly emphasized by artists (Figures 1 and 2).



Figure 1: The dīv throws Rustam into the sea. Shāhnāmeh, 1500 CE, No. 2019714668, 19 × 21 cm, watercolor, Library of Congress (URL1).



Figure 2: Rustam and Akvān Dīv, Shāhnāmeh, 1457 CE, No. 16040430, 15 × 24.5 cm, watercolor, National Library of France (URL2).

In epic paintings, such abnormal, alien, and transgressive features made divs ideal adversaries for heroes (Figures 3 and 4). Although terrifying to audiences of epic or folkloric narratives, conceptually, their defeat by the hero was inevitable. They represented the dangerous aspects of the natural world, yet their limited intelligence, constrained physical forms, and stereotypical behaviors rendered them powerless compared to a strong and courageous human. For instance, they lacked the power of flight, and extraordinary abilities such as dragon-like fire, spirit possession, or invisibility—common in other supernatural beings—were never attributed to them.

Powerful limbs, broad shoulders, the aggressive gesture of the hands, and a white, mask-like face, along with long, pointed horns, transform the dīv into a hybrid being: part human and part animal. This structural similarity between the hero and the dīv follows a well-established visual logic in Shāhnāmeh illustration: the dīv functions not only as an external adversary but also as the embodiment of the dark, instinctual, and uncontrolled forces within the hero (Jafari Dehkordi, 2005: 214).



Figure 3: Battle of Rustam and the Dīv, Shāhnāmeh of Ṭahmāspī, 1600 CE, No. AKM427, watercolor, Aga Khan Museum (URL3).



Figure 4: Battle of Tahmūrth and the Dīvs, Shāhnāmeh of Ṭahmāspī, 1525 CE, No. 1970.301.3, 18.6 × 28.3 cm, watercolor, by Sultan Muḥammad, Tabriz, Metropolitan Museum of Art.

Scientific and Artistic Description of Male Demon-like Figures in Qajar Tiles preserved in the Louvre Museum.

1. Body and Limbs

The male figures are spotted and resemble the human naked body, with detailed skin features. Their hands hold clubs shaped like honey spoons, symbolizing power and dominance. All the clubs point upwards, and one of them has a semicircular form, representing extraordinary ability. The abdomen is round and full, the waist is narrow, and there is a small protrusion on the heel of the back, indicating mobility and magical capability. The thighs are muscular and large, and the legs are shown in profile while the body is depicted frontally. This is a performative and symbolic style, aimed at highlighting the mythological attributes and power of the figures. The chest and navel are clearly detailed, and the nipples are also depicted; these details emphasize "corporeality" and underscore the boundary between human and non-human. Due to its supernatural nature, the figure also possesses a simple tail.

2. Head and Face

The eyes are elongated, almond-shaped, with triangular eyelids, looking directly forward. The nose is broad. The head is bald and has crescent-shaped horns. The ears are hanging, smaller than the horns, and point downward. The mustaches are wide, long, curly, and dense, protruding from the face. The combination of horns, ears, and mustaches gives the figure a legendary and monstrous appearance, while simultaneously maintaining roots in Islamic illustrative art.

3. Clothing and Ornamentation

A simple circular necklace with linked rings hangs around the figure's neck, likely indicating a higher status. The lower garment is a green skirt with slits, decorated with circular motifs inside the slits, and features a wide border. The figure's attire and ornaments reinforce the contrast between human and mythological aspects. The dotted patterns and wide borders of the skirt serve both aesthetic purposes and may symbolize power or supernatural/social distinction.

4. Color and Composition

The background is dark blue, with white and green colors on the body and garments creating high contrast. The body and arms are raised upward, the legs are shown in profile, and the face is front-facing; this composition enhances the performative and symbolic nature of the figure.

5. Artistic and Symbolic Analysis

These figures combine reality and imagination. The human-like body and anatomical details, alongside the horns, hanging ears, and massive mustaches, display the stature and power of the beings. The clubs symbolize strength and dominance, while the skirt and necklace indicate status and prominence. The spotted body details and small variations in clubs and limbs convey vitality and dynamism, enhancing the lifelike and active impression of the figures.



Figure 5: Dīvs with pitchforks, 19th century, tilework, 26.7 × 26.5 cm No. MAO 1192, Musée du Louvre (URL1)

Scientific and Artistic Description of Female Demon-like Figures in Qajar Tiles preserved in the Louvre Museum.

1. Body and Limbs

The female figures have clearly defined breasts, marking their unmistakable "feminization." The exposed navel emphasizes "corporeality" and highlights the boundary between human and non-human. Their legs are hoofed, which is the most prominent indicator of their monstrous nature. In the Iranian demonology tradition, non-human legs are almost always depicted for malevolent beings. The bodies are free of spots or skin decorations, likely due to mold constraints and color limitations in Haft-rang tiles, as well as to improve the legibility of the form. The hands are placed on the chest or crossed, creating a ritualistic, submissive, or ceremonial posture.

2. Head and Face

The hair is curly, voluminous, and free-flowing, reflecting the natural, untamed state of the beings. The eyes are almond-shaped, with triangular, upward-pointing eyelids, forming the classic appearance of non-human, demonic entities. The head-to-body ratio is larger than normal, emphasizing the symbolic and unnatural nature of the figures.

3. Clothing and Ornamentation

The skirts are short, slit, and pleated, with small circular patterns between each slit and along the lower hem. This style of dress derives from the tradition of mythological beings and accentuates the boundary between humans and legendary creatures. The short, semi-covering skirt is simple and symbolic, emphasizing the semi-human, semi-mythical state of the figures.

4. Color and Composition

Bright, contrasting colors such as white and green separate the figures from the dark blue background. A pale green glaze is also visible on the skirt surface. Surrounding the figures are white flowers and foliage, creating an "imaginary garden" that conveys a combination of malevolence and beauty.

5. Artistic and Symbolic Analysis

These female figures, positioned between human and mythical forms, have a liminal identity. Body details, hair form, eye posture, and floral framing highlight the boundary between human and fantastic. The figures convey power, grandeur, and symbolic meaning, exemplifying the fusion of Iranian tradition, global illustrative motifs, and mythical elements within the Haft-rang tile technique.



Figure 6: Feminine dīv, 19th century, tilework, 26.2 × 27.2 cm, MAO 1194, Musée du Louvre (URL2)

Analysis of Two Qajar Tiles with Emphasis on Gendered Figures

The two examined Qajar tiles, while rooted in the longstanding Iranian demonological tradition, display clear gender-specific distinctions in body form and composition, differentiating male and female dīv representations. These differences shape both visual presentation and narrative meaning.

1. Form and Anatomy

Male Dīv:

Legs and thighs are muscular and robust; the body is large, with broad shoulders.

The pleated, semi-covering skirt with decorative layers and borders renders the figure more performative, visible, and somewhat humanized.

Despite the powerful, imposing body, it is not overtly terrifying or monstrous.

The gestures and posture emphasize symbolic strength and dominance rather than savagery.

Female Dīv:

Legs are slender and hoofed, the most prominent indicator of her monstrous nature.

The body is smaller and delicate, with a short skirt and fine pleats, emphasizing her semi-human, semi-mythical identity.

Hands are often placed on the chest or crossed, creating a ritualistic, submissive, or ceremonial posture.

The head-to-body ratio is larger, and hair is curly, voluminous, and free-flowing, reflecting a natural, untamed quality.

2. Color and Composition

Both tiles employ bright, contrasting colors such as dark blue backgrounds, green, white, and yellow to clearly separate the figures from their backgrounds.

The colors enhance the visual narrative and aesthetic appeal without evoking fear or horror.

Male Dīv's composition is upright and imposing, with raised arms and horns emphasizing power and dominance.

Female Dīv's slender legs and delicate form highlight her liminal, semi-human, semi-mythical state, maintaining focus within the tile's visual space.

3. Meaning and Narrative

Male Dīv: Represents strength, authority, and a performative, narrative-driven character rather than a source of terror.

Female Dīv: Emphasizes a semi-human, semi-mythical nature through hoofed legs and delicate form, marking the boundary between human and mythical.

Both figures serve the Shahnameh narrative, illustrating the hero's confrontation with mythical beings, but in a performative, popular style distinct from classical manuscript depictions.

4. Analytical Conclusion

Gender distinctions are clearly evident in body form, legs, skirts, volume, and overall gestural design.
Qajar tiles reinterpret dīvs as narrative and performative characters, avoiding the intense fear or horror of earlier depictions.
The Shahnameh narrative in this period transitions from courtly epic to a public, urban-friendly spectacle.
Emphasis on form and gender-specific traits reflects the tile artisans' careful attention to role differentiation and meaning within the technical constraints of Haft-rang tilework.

Conclusion

The male and female demon-like figures in Qajar-era tiles represent a prominent example of Iranian illustrative art, successfully conveying a complex combination of reality and fantasy, human and mythical beings. In these figures, the precise anatomical details, the positioning of the hands and feet, and specific elements such as horns, tails, drooping ears, cloven hooves, and hair forms not only express the supernatural nature and powers of these beings but also symbolically emphasize the boundary between human and non-human entities.
Male figures, with muscular bodies, symbolic maces raised upwards, and dynamic postures, focus on displaying the beings' power, grandeur, and magical abilities. In contrast, female figures, with clearly defined breasts and navels, cloven hooves, and curly hair, embody a semi-human, semi-mythical identity, which reinforces both their aesthetic appeal and their monstrous symbolic traits. Skirts, ornaments, and necklaces, in addition to their decorative role, signify the social or supernatural status of the figures.
The use of contrasting and bright colors such as white and green against a dark blue background highlights the figures' forms and readability, while the surrounding flowers and shrubs create a fantastical, garden-like space that juxtaposes evil and beauty, human and mythical qualities. These compositional choices demonstrate that Qajar artists successfully combined decorative value, aesthetic appeal, and symbolic and cultural significance in a single artwork.
From a cultural and mythological perspective, these figures reflect the Iranian society's perceptions of supernatural forces, morality, spiritual trials, and the concept of power. The role of divs and mythical beings in these artworks recalls ancient mythological and religious concepts, demonstrating that even in decorative art, narrative and symbolic values held significant importance. Overall, these figures exemplify the integration of Iranian tradition, global illustration practices, and mythical elements within the medium of seven-color tilework. Studying them provides deep insight into the artistic, social, and cultural perspectives of the Qajar period.
Figure 5 can confidently be considered a comprehensive example of the transformation of divs in Qajar art. In the illustration, the divs hold clubs resembling a row of ceremonial implements rather than conventional weapons. Their standing posture is seductive and non-combative, bearing no resemblance to the physical form of warriors. Nonetheless, there is no doubt that these beings are rendered within an Iranian artistic framework, as evidenced by their clothing, which replicates Qajar women's tunics (tanbans) with all ornamental details. The clubs given to the divs also diminish their intimidating presence and clearly do not correspond to typical martial weapons.
For analyzing gender transformation, we have access to a unique complementary example: another work from the same museum and collection depicting a group of female divs (Figure 6). These female divs, like their male counterparts in the previous illustration, have humanoid forms but are characterized by animalistic legs and distinct eyes. Comparing the two images reveals that gender boundaries among divs are blurred, with both male and female divs taking on human-like forms closely aligned with feminine human anatomy. Both genders wear similar clothing, and their bodily forms are nearly identical. The only distinguishing feature between them is the male mustache. Without this element or access to the complementary example, no clear criteria would exist to determine the gender of these beings.
This study demonstrated that Qajar tile artists, while preserving the visual and symbolic elements of earlier traditions, reinterpreted and reinvented the depictions of "monsters" and the "female div" in ways that aligned with the architectural context and aesthetic preferences of the period. The findings highlight the dynamic interaction between premodern visual heritage and the cultural, social, and artistic demands of the Qajar era.
For future research, it is recommended to:
Conduct comparative analyses of tiles from other periods (e.g., Safavid or Zand) to examine the evolution of imagery and symbolism.

Explore the role of gendered transformations and symbolic characteristics of the female div in Iranian visual art.
Utilize digital techniques for reconstructing and simulating historical images to study changes in color and form.
Investigate the influence of these images on contemporary Iranian art and compare them with other Islamic visual traditions.

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THE IMPACT OF SOIL SWELLING ON SOIL-STRUCTURE INTERACTION

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Abstract
In engineering practice, proper analysis of soil–structure interaction, particularly for multi-storey buildings and structures of medium or high importance, is often neglected or carried out inadequately. When such analyses are performed, they are typically motivated by concerns that the foundation soil is highly compressible, leading to significant settlements. Conversely, the issue of soil swelling and its impact on building stability or foundation design tends to receive much less attention. Soil swelling is a phenomenon that occurs when cohesive soils, primarily clays, come into contact with water and expand in volume. Unlike settlement, foundation heave due to soil swelling is more challenging to incorporate into structural analyses. In some cases, swelling soils are simplistically treated as non-subsiding materials, assuming zero deformation (no settlement or heave), which can result in inappropriate foundation designs. This paper aims to provide a concise overview of the soil swelling phenomenon and its underlying mechanisms. Through a case study, it evaluates the influence of soil swelling on foundation deformation analysis and design considerations.
Keywords: Soil swelling, Soil-structure interaction, Foundation design

1. Introduction

Soil swelling is a phenomenon that occurs in expansive soils after wetting. Such soils have a high potential for swelling and shrinkage and can greatly affect the stability of foundations and the structure itself. It occurs mainly in clays with a high content of montmorillonite, which is a highly active mineral in terms of swelling/shrinkage. Since the problem of soil swelling consists of whether the swelling pressure or the foundation pressure on the soil is greater, problems from soil swelling appear mainly in light objects or in parts of the foundations where vertical stresses are relatively small, except in cases where the swelling pressure reaches very high values, which can cause problems even in multi-story buildings. In general, in addition to the high montmorillonite content, two other conditions must be met for structural problems to be expected from soil swelling, and they are: the amount of soil moisture to be close to its plasticity limit and that there is some source of water that would cause the necessary increase in moisture (Holts & Kovacs, 1981). The activity of soils towards swelling/shrinkage is usually expressed as follows (Skempton, 1953):

$$A_c = \frac{PI}{\%\text{ by weight finer than } 2\mu m} \tag{1}$$

Where:

A_c -swell/shrinkage activity,

PI -plasticity index.

Table 1: Potential soil volume changes and Atterberg limits (Bowels, 1988)

Potential for volume change	Plasticity index, PI (%)	Shrinkage limit, SL (%)	Liquid limit, LL(%)
Low	<18	>15	20-35
Medium	15-18	10-15	35-50
High	25-41	7-12	50-70
Very high	>35	<11	>70

Several studies have been conducted to evaluate the influence of various parameters on the swelling pressure. Chen (1988) after several consolidation tests of remolded samples, concluded that the swelling pressure is not affected by inudation pressure, sample thickness, degree of saturation and initial moisture content. He observed that the swelling pressure increases with the increase in the dry unit weight of the samples.

Table 2: Summary of factors influencing swelling pressure and percent swell by Chen (1988)

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Increased parameter	Range of parameter tested	Swelling pressure	Percent swell
Inundation pressure	48-335 kPa	Constant	Decrease
Initial degree of saturation	61-93%	Constant	Decrease
Samples thickness	1.28-3.81 cm	Constant	Constant
Initial water content	5.84-19.37%	Constant	Decrease
Initial dry density	1.51-1.90 Mg/cm^3	Increase	Increase

The assessment of swelling potential is usually done by one-dimensional consolidation tests in the oedometer, which is a conventional geotechnical test and easy to perform; the same applies to the determination of Atterberg limits. A practical way of estimating the swelling pressure of soils is the double oedometer method (Jennings & Knight, 1957), which consists of placing as identical samples as possible in two different oedometers: in the first case, soil sample is saturated in water and the swell deformation is then determined; in the second case, the specimen is fully saturated in water and the same load increments are applied. The swelling pressure is defined as the pressure required for the soil sample to return to its initial volume (initial pore volume or initial sample height). The main disadvantage of this method is that it makes it impossible to determine in situ stresses (or the OCR). To avoid this problem, the swelling pressure can be estimated in an oedometer by so called constant volume method; the swelling pressure in this case is the maximal required pressure to maintain the constant volume of the sample. The determination of swelling pressure with an oedometer is described in this section since the one-dimensional consolidation test with an oedometer is a conventional test that is performed in mostgeotechnical testing laboratories. Typical results obtained according to the methods described above are shown in Figure 1, where σ_s represents the swelling pressure, while e_0 and e_s represent the intial pore ratio, and the pore ratio after the maximal swell deformation respectively.

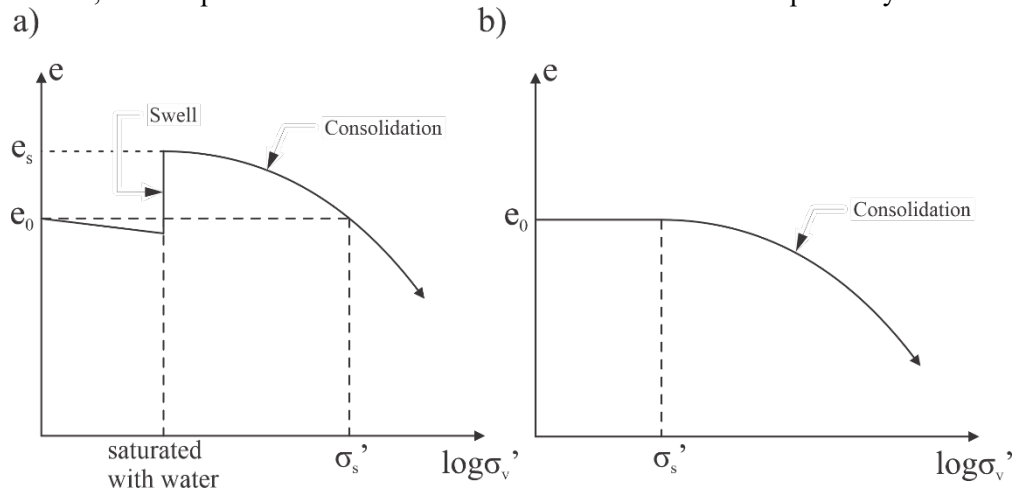


Figure 1. a) consolidation-swell method, b) constant volume method

As shown in Figure 1, the swelling pressure determined by the consolidation-swell (a) method is significantly higher than that determined by the constant volume method (b). This is because in the case of consolidation-swell, in order to reach the initial volume of the sample, the pore water that has been allowed to enter must also be removed, while in the constant volume method this is not allowed to happen. Nelson, et al. (2006) proposed a relationship between σ_{vs}' and σ_{cs}' as follows:

$$\sigma_{sv}' = \sigma_i' + \lambda\left(\sigma_{sc}' - \sigma_i'\right) \quad (2)$$

Where:

σ_{sv}' -swelling pressure determined by the constant volume method,

σ_{sc}' - swelling pressure determined by the consolidation-swell method,

σ_i' -initial surcharge,

λ -constant.

Nelson, et al. (2006) showed that an appropriate value for λ is in the general range of 0.5 to 0.7. In our case, the initial pressure in the oedometer consolidation test is 25 kPa; the value of $\lambda = 0.6$ has been adopted.

To assess foundation heave on swelling soils, it is of primary importance to know the depth of the active zone and the depth of potential heave. The active zone represents the depth at which the change in the water content occurs during different seasonal periods, while the depth of the potential heave zone is defined as the depth at which the vertical stresses (geostatic stresses and foundation stresses) are equal to the swelling pressure. The depth of this zone can be determined in the field by measuring the water content at certain time intervals and determining the suction of the surface soil layers. In cases where the soil is not uniform with depth, or if several strata exist, the differences in soil type can be compensated for by plotting either water content divided by plasticity index (w/PI) or by liquidity index [(LL-w)/PI). Depth at which the diagram becomes constant represents the active zone (Nelson & Miller, 1992).

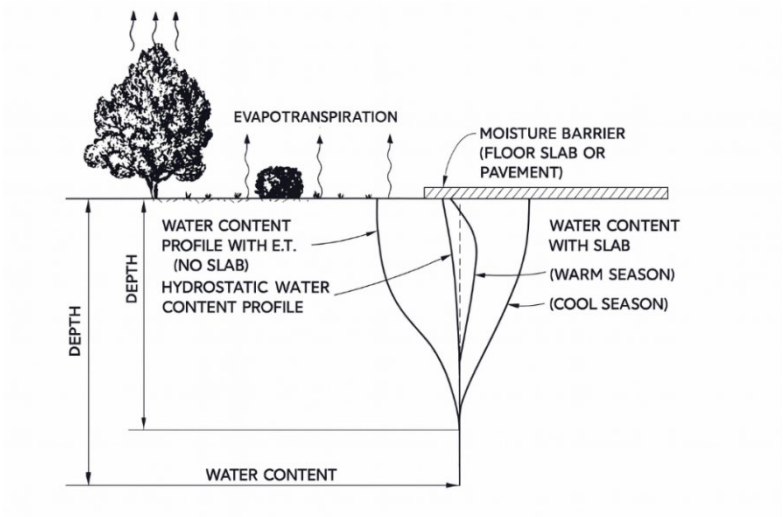


Figure 2. Water content profiles in the active zone (Nelson & Miller, 1992)

2. Methodology

A characteristic geotechnical profile of a terrain with almost homogeneous geological structure is considered. The sampling location is located in the city of Pristina, Kosovo. A total of 5 geotechnical borings from 15 to 20 meters depth were made. The coordinates of borehole 1 are 42°37′53.66″ N, 21°09′22.42″ E. In tables 3 and 4 the geotechnical parameters of the soil layers obtained by laboratory tests are given. Soil consolidation tests were performed in oedometers and oedometric curves and common parameters (C_c, C_s, e_o, etc.) were obtained. From the oedometric curves the swelling pressure was geometrically determined. A 2D model of a 3-storey building with columns at an axial distance of 6 m, founded on a mat foundation of thickness h=0.4 m, was considered. The columns of the building have dimensions b/h=0.3/0.3 m. Floors slabs are 0.20 m thick. Under the foundation, a 0.3 m cushion layer with an oedometric modulus of E_{oed}=40 MPa was taken into account. The linear-elastic model was used for the structure and the foundation, and a modulus of elasticity of $E_{cm}=3.1x10^7$ MPa (C-30/37). Only the permanent loads are considered.

The Hardening Soil model was considered in the analysis. The main parameters required for this model such as E_{50}^{ref}, E_{oed}^{ref} and E_{ur}^{ref} are automatically calculated by the software based on the parameters of the oedometric curves, (Cc, C_s, e_0).

Table 3: Granulometric content and Atterberg limits of the soil layers

Soil layer	H (m)	Gravel (%)	Sand (%)	<0.075 mm (%)	W (%)	Sr (%)	LL (%)	PL (%)	PI (%)
CH-brown color	11.0	0.33	10.88	88.79	19.7	96.0	59.7	27.08	32.58
CH-biege color	9.0	0.13	11.78	88.08	18.5	97.0	62.2	35.43	26.79

Table 4: Physical and mechanical parameters of the soil layers

Soil layer	H (m)	γ (kN/m^3)	c' (kPa)	phi (^{0})	C_{cs}	C_{ss}	e_0	ν	σ_s (kPa)
1. CH-brown color	11.0	20.2	42.0	23.0	0.088	0.031	0.55	0.33	331.74
2. CH-biege color	9.0	20.2	48.0	21.0	0.090	0.033	0.49	0.33	626.28

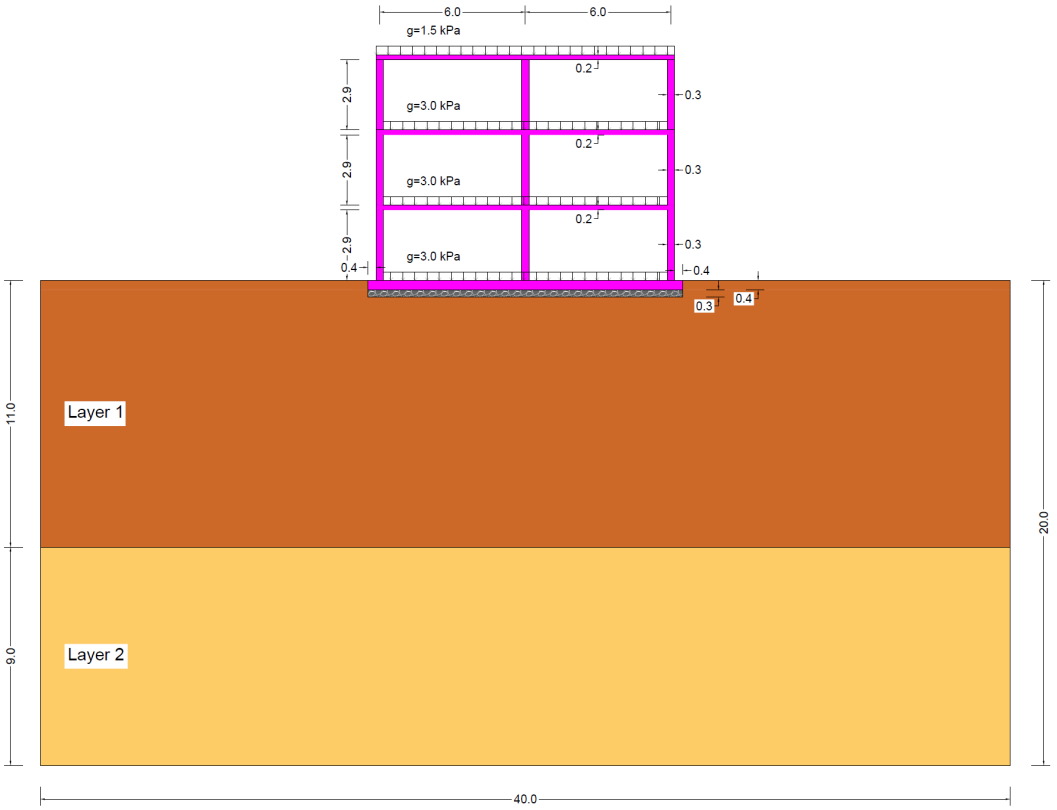


Figure 3. Geotechnical 2D soil profile with the superstructure

In order to capture the most critical effect of the soil swelling on the structure, the calculation of foundation settlements is done in the following stages: 1. initial stresses, 2. soil excavation, 3. cushion layer installation, 4. loading from the structure, and 5. soil swelling; so, we have assumed that soil swelling occurs a "relatively long" time after the construction of the structure. The swelling of the soil under the foundation is modeled as a vertical volume strain which is calculated as follows:

$$\varepsilon_v = \frac{\sigma_s^{'}}{E_{ur}} \quad (2)$$

Where:

$\sigma_s^{'}$ -swelling pressure,

E_{ur} -unload/reload modulus of the soil.

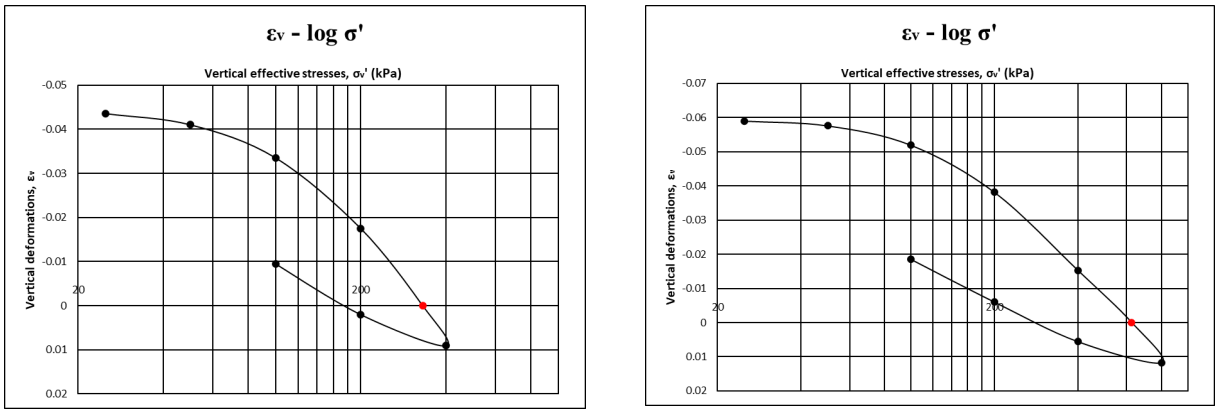


Figure 4: Oeodmetric curves of the first and the second soil layers-red dots represent the swelling pressure

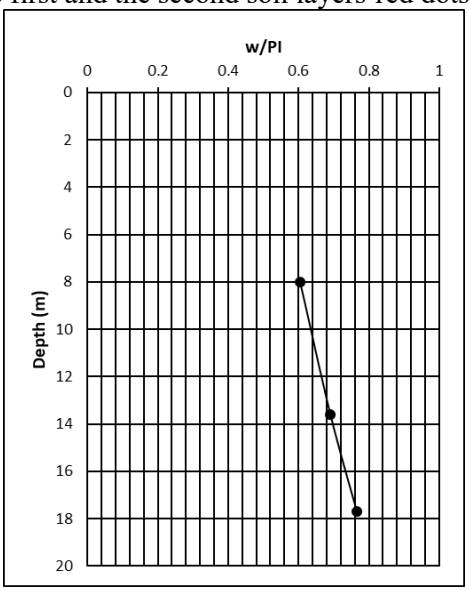


Figure 5. Variation of w/PI along depth

The free-field swelling pressures and the corresponding volume strains of the first and the second soil layers are as follows:

Layer 1:

$$\sigma_{sv}^{'} = \sigma_{i}^{'} + \lambda\left(\sigma_{sc}^{'} - \sigma_{i}^{'}\right) = 25 + 0.6(331.74 - 25) = 209.04 \text{ kPa} \quad (3)$$

$$\varepsilon_v = \frac{\sigma_{sv}^{'}}{E_{ur(400-100)}} = \frac{209.04 \text{ kPa}}{16130 \text{ kPa}} = 1.26\% \quad (4)$$

Layer 2:

$$\sigma_{sv}^{'} = \sigma_{i}^{'} + \lambda\left(\sigma_{sc}^{'} - \sigma_{i}^{'}\right) = 25 + 0.6(626.28 - 25) = 385.77 \text{ kPa} \quad (5)$$

$$\varepsilon_v = \frac{\sigma_{sv}^{'}}{E_{ur(400-100)}} = \frac{385.77 \text{ kPa}}{12450 \text{ kPa}} = 3.10\% \quad (6)$$

As can be seen from Figure 5, the w/PI values do not become constant at least down to a depth of approximately 18 m. For this reason, in our case analysis we have assumed that the depth of the active zone extends at least as far as the height of the geotechnical model (20.0 m). The vertical effective stresses at the depth of approximately 18.5 m from the ground level equal the maximum swelling pressure of 385.77 kPa (second soil layer), so we assumed the depth of potential heave zone to be also 20.0 m.

3.Results

The results of the calculation using the finite element method are presented below. The maximal foundation settlement is 7.8 cm, while the maximal foundation heave is 17.8 cm.

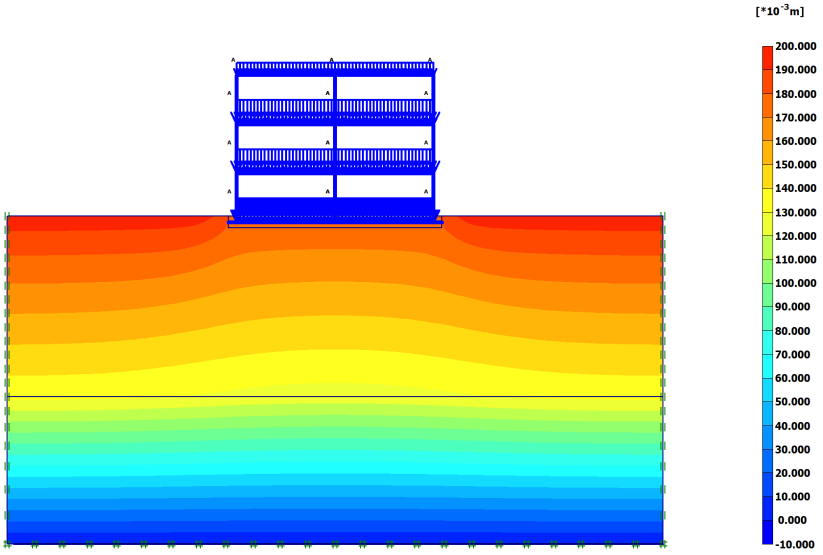


Figure 6. Vertical deformations after the soil heave (volume strain)

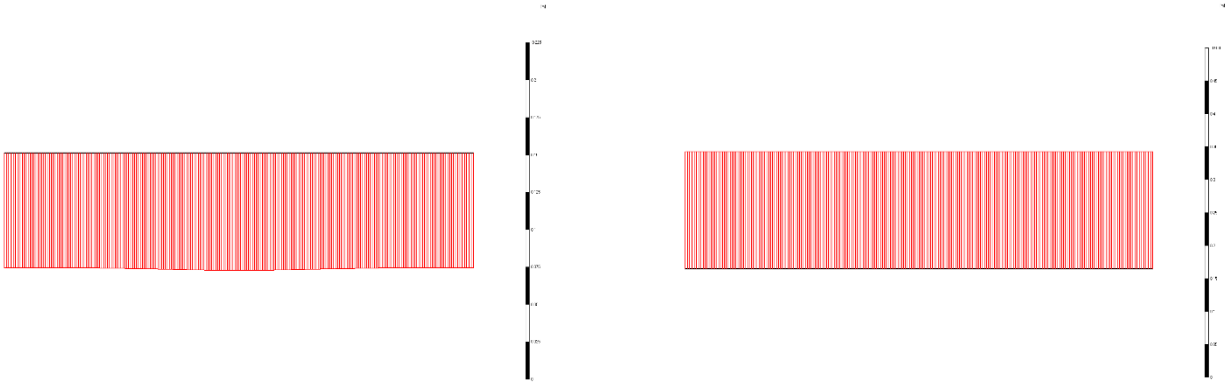
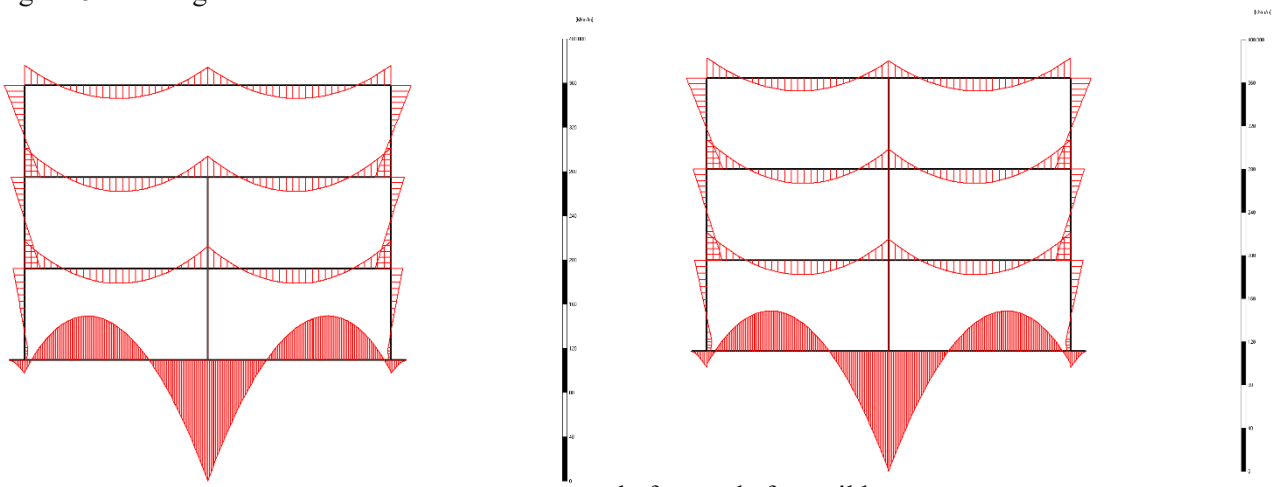


Figure 7. Vertical deformations of the foundation slab before and after soil heave

Figure 8. Bending moments in the structural elements



before and after soil heave

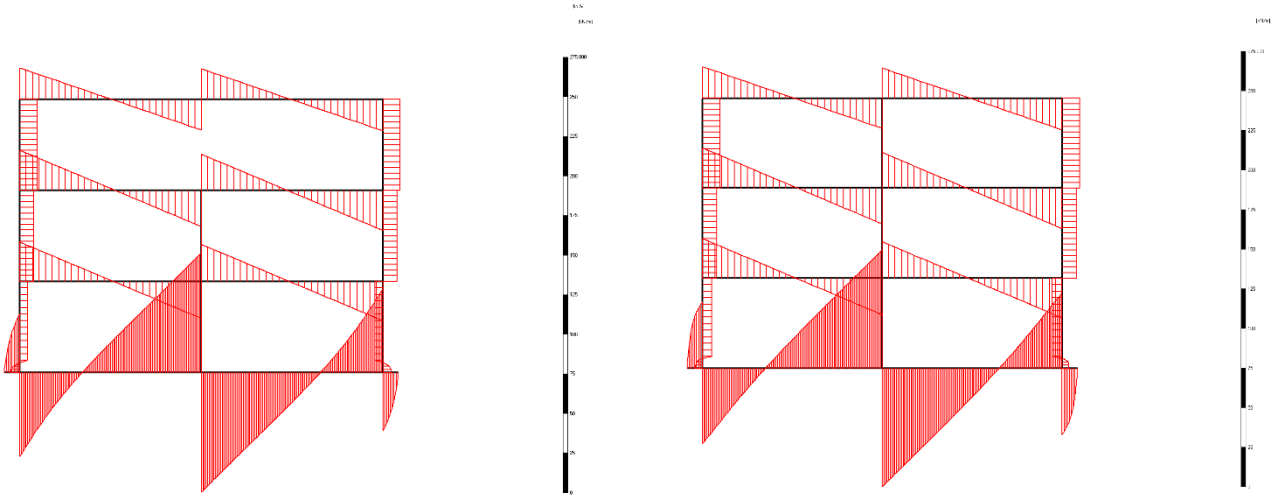


Figure 9. Shear forces in the structural elements before and after soil heave

Figure 10. Axial forces in the structural elements before and after soil heave

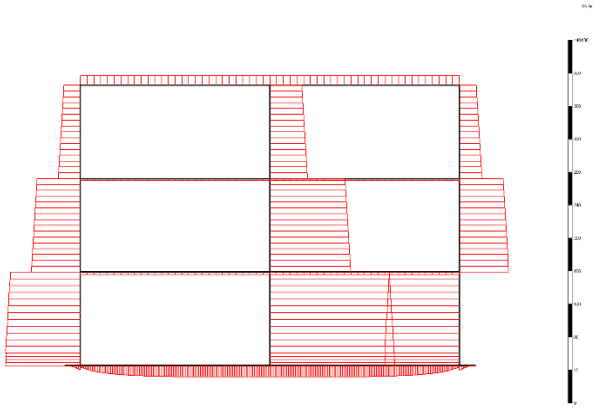


Table 4. Internal forces in the structural elements before soil heave

Structural elements	M_{max} (kNm/m)	V_{max} (kN/m)	N_{max} (kN/m)
Foundation slab:	-109.55 / 40.15	75.38	-28.03
Middle column			
Storey	0.00 / 0.00	0.00	-150.77
Storey	0.00 / 0.00	0.00	-97.49
Storey	0.00 / 0.00	0.00	-45.21
Floor slab:			
Storey	-13.36 / 20.85	-24.85 / 20.43	3.82
Storey	-12.99 / 26.80	-25.24 / 19.38	2.03
Storey	-11.65 / 18.40	-19.77 / 19.23	-10.93
Right side column:			
Storey	-1.51 / 10.58	-5.38 / 5.08	-89.66
Storey	-14.27 / 12.43	8.90	-58.51
Storey	-14.38 / 18.40	10.93	-26.52

Table 5. Internal forces in the structural elements after soil heave

Structural elements	$M_{min/max}$ (kNm/m)	V_{max} (kN/m)	N_{max} (kN/m)
Foundation slab:	-110.64 / 37.17	74.73	13.69
Middle column			
Storey	0.00 / 0.00	0.00	-149.46
Storey	0.00 / 0.00	0.00	-96.69
Storey	0.00 / 0.00	0.00	-44.84
Floor slab:			
Storey	-13.37 / 25.64	-24.99 / 23.00	2.94

Storey Storey	-13.06 / 27.41 -11.70/18.92	-25.42 / 18.72 -19.95 / 19.04	2.28 -11.24
Right side column: Storey Storey Storey	 -3.38 / 11.37 -14.27 / 12.61 -14.80 / 18.91	 -4.19 / 6.03 8.96 11.24	 -89.75 -58.90 -26.71

As a second alternative, we have defined the swelling pressure as a constant uplift pressure under the foundation equal to the free-field swelling pressure of the first layer.

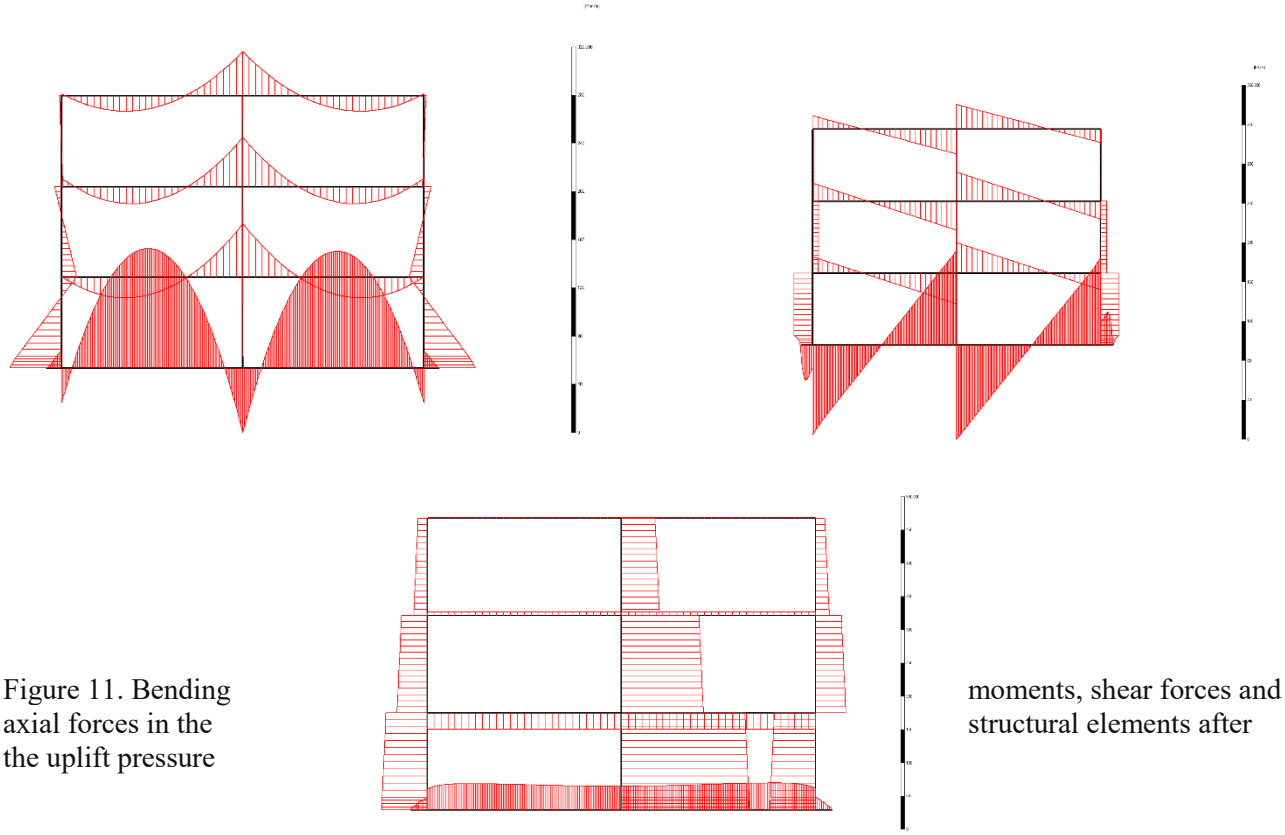


Figure 11. Bending moments, shear forces and axial forces in the structural elements after the the uplift pressure

Table 6. Internal forces in the structural elements after soil heave as uplift pressure under the foundation

Structural elements	$M_{min/max}$ (kNm/m)	V_{max} (kN/m)	N_{max} (kN/m)
Foundation slab:	-53.28 /	96.93	-40.87
Middle column Storey Storey Storey	 0.00 / 0.00 0.00 / 0.00 0.00 / 0.00	 0.00 0.00 0.00	 -192.79 -123.41 -57.36
Floor slab: Storey Storey Storey	 -16.93 / 44.30 -14.00 / 40.94 -12.56 / 36.69	 -16.70 / 31.30 -18.35 / 29.69 -13.70 / 25.30	 24.96 -5.12 0.00
Right side column: Storey Storey Storey	 -11.86 / 43.05 -12.34 / 5.96 -1.06 / 1.87	 -18.86 6.10 0.00	 -68.64 -45.54 -20.45

4. Discussion

If we compare the parameters of the two soil layers with the results of one-dimensional consolidation tests (tables 2, 3; figure 4), it appears that the plastic properties of clay soils are a good indicator of the swelling potential of soils, a confirmed by Bowels (1988). Since the swelling pressure is obtained according to the consolidation-swell method, the Nelson (2006) formula is logical and practical for the evaluation of free-field swell pressure, a pressure that should be taken into account in foundation heave analyses. Since the

determination of the active swelling zone and the potential swelling depth is a long-term process, the use of the w/PI ratio variation diagram along the depth (Nelson and Miller 1992) may be an acceptable alternative to be used in analyses to assess the impact of soil swelling on the foundation and the structure (figure 5).
Although the physical properties of the two soil layers are very similar, the swelling pressure obtained from one-dimensional consolidation tests in the oedometer of the second layer is almost twice that of the first layer. The swelling pressure obtained from consolidation tests can be up to three times or more greater than that in the field. Al-Shamrani and Dhowian (2003) suggest that for the most accurate determination of the swelling pressure, a triaxial apparatus should be used in which the influence of lateral deformation (swelling) can be taken into account, unlike the oedometer.
From the analysis of a three-story building, when the swelling of the soil under the foundation is considered as volume strain, the change in internal forces is very small, unlike the other case, when the swelling is considered as pure pressure under the foundation. However, the distribution of internal forces seems to change very little in both cases. The 0.40 m thick foundation slab seems to help the rigid behavior of the building. Applying swelling pressure as foundation pressure according to the so-called rigid design methodology is expected to give less flexible support and reduce the chances of cracks and damage. The design approach is easy to apply and can be revised to consider variables not applicable in particular sites. The rigid design is recommended for sites indicating a swelling pressure of less than 300 kPa (Dafalla et al., 2012). The use of rigid slab foundations or other types of stiffened rafts has also been recommended by other authors (Nelson & Miller, 1992, 1997; Chen, 1988).

5. Conclusion and Recommendations

In the case study, the impact of the swelling of the soil under the foundation on the structural elements (foundation slab, floor slabs and columns) of a three-story building was considered, following a relatively simple and fast approach: the swelling pressure of the two soil layers that make up the almost homogeneous geology of the terrain in question, obtained from one-dimensional consolidation tests in the oedometer, was considered in the geotechnical model in two ways: as volume strain and as the pure pressure under the foundation. Before activating the swelling of the soil under the foundation, the settlements of the building from permanent loads were first calculated. In the case of defining soil swelling as volume strain, we can observe a very small changes of the internal forces in structural elements, while we observe a considerable change in the case of defining swelling as pure pressure under the foundation. In the first case, volume strain acts uniformly under the foundation, causing an almost rigid behavior of the object and is not greatly affected by the local stiffness of its structural elements. In the second case, when swelling acts as pure pressure under the foundation, the stiffness of the structural elements plays a greater role in its distribution. It is suggested that additional research be conducted to better understand the developing mechanics of soil swelling under such objects, whose behavior is between elastic and rigid, in order to simplify its application in everyday analyses of soil-structure interaction.

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MIGRATION INTENTIONS OF CREATIVE YOUTH IN A SHRINKING CITY: THE CASE OF ERZURUM

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Abstract
This study investigates the migration intentions of university students in Erzurum, a mid-sized city in eastern Türkiye that has been experiencing long-term population decline. Framed within the theoretical context of shrinking cities, the research focuses on students enrolled in architecture, design, and fine arts programs. These individuals represent the emerging creative class—key actors in shaping future urban transformation—and are often considered indicators of a city's cultural and economic vitality. The data were collected through a structured questionnaire administered to 742 students at [Blinded for Review] University. The study employs a combination of factor analysis, logistic regression, and correlation techniques to identify the major determinants influencing students' intentions to either stay in or leave the city upon graduation. The findings reveal that limited employment opportunities, low income expectations, and the inadequacy of cultural and recreational amenities significantly increase the likelihood of outmigration. Conversely, strong family ties, social cohesion, and a sense of personal safety emerge as factors that encourage students to remain in the city. Among these, economic concerns—especially unemployment and income insecurity—stand out as the most decisive motivators, while social and emotional factors serve as important moderators when a minimum level of economic security is present. This paper contributes to the growing literature on urban shrinkage in the Global South by offering insights from a demographic segment often underrepresented in migration research: creative youth. It emphasizes the need to address both push and pull factors in an integrated manner. Furthermore, the study recommends targeted smart shrinkage strategies to retain young talent, including strengthening the creative economy, improving urban quality of life, and fostering inclusive, youth-centered development policies.
Keywords: Shrinking Cities, Youth Migration, Creative Class, Urban Planning, Erzurum

1. Introduction

Urban shrinkage has become a defining challenge of contemporary urban studies, reflecting sustained population loss, declining economic opportunities, and weakened social structures. Scholars have documented how globalization, demographic shifts, and economic restructuring produce long-term contraction in cities, especially in Europe and North America (Oswalt & Rieniets, 2006; Haase et al., 2013). In these cases, urban shrinkage has often been linked to industrial decline, suburbanization, and disinvestment, resulting in abandoned neighborhoods, deteriorating infrastructure, and persistent unemployment.

In recent years, the debate has expanded beyond deficit-oriented perspectives to consider shrinkage as a potential opportunity for adaptive planning and sustainable regeneration. Concepts such as "smart shrinkage" highlight the importance of inclusive governance, resilience, and quality of life rather than traditional growth-oriented policies (Hospers, 2013; Sandmann et al., 2025). Yet, most studies still emphasize post-industrial metropolitan regions, leaving smaller and mid-sized cities—particularly in the Global South—underexplored (Martinez-Fernandez et al., 2012; Xu et al., 2025).

Erzurum, a mid-sized city in eastern Türkiye, exemplifies this gap. Historically a regional center of administration, education, and culture, Erzurum has experienced steady population decline over the last two decades. Official statistics indicate that its population decreased from around 785,000 in 2007 to approximately 750,000 in 2023, largely due to the outmigration of younger cohorts (Turkish Statistical Institute, 2024). Despite hosting two major universities and attracting large numbers of students, the city struggles to retain its graduates, many of whom relocate to larger metropolitan areas in search of better opportunities.

This study approaches Erzurum's demographic challenges from the perspective of the emerging creative class. Florida (2002) identifies creative professionals as key drivers of innovation, competitiveness, and urban vitality. However, the literature has primarily focused on creative class dynamics in global cities, while their role in shrinking, mid-sized contexts remains limited (Reckien & Martinez-Fernandez, 2011). By analyzing

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university students in fields such as architecture, urban planning, design, and fine arts, this research positions them as future contributors to the creative economy, whose stay-or-leave decisions carry long-term implications for the city's resilience.

The aim of the study is to identify the economic, social, physical, and personal factors shaping the migration intentions of creative youth in Erzurum. In doing so, it contributes to filling both a conceptual and geographical gap in the shrinking cities literature, demonstrating how the challenge of urban contraction in the Global South is strongly linked to youth outmigration rather than deindustrial decline.

Literature Review

The study of shrinking cities has grown substantially over the last two decades, as scholars and policymakers have sought to understand the drivers and consequences of urban population decline. Early research emphasized deindustrialization and suburbanization in Europe and North America as the primary mechanisms behind shrinkage. In these contexts, the loss of industrial jobs, the outmigration of middle-class households, and the decline of urban tax bases created a downward spiral of disinvestment and social marginalization (Oswalt & Rieniets, 2006; Haase et al., 2013). Such cities became emblematic of economic stagnation and spatial decay, prompting scholars to treat shrinkage as an anomaly to be reversed through growth-oriented interventions.

Over time, however, the conceptualization of shrinkage has broadened. Rather than defining shrinking cities solely as sites of crisis, recent work reframes them as laboratories for adaptive urban futures (Hospers, 2013). This perspective introduces concepts such as urban resilience, degrowth, and inclusive governance, suggesting that demographic contraction can open new pathways for sustainable redevelopment (Sandmann et al., 2025). Vacant land can be repurposed for green infrastructure, social participation can strengthen governance structures, and shrinking populations may even enjoy higher quality of life under conditions of reduced congestion. These insights have enriched the literature by recognizing that shrinkage is not only a symptom of economic failure but also an opportunity for spatial justice and innovation.

A second line of literature emphasizes the role of the creative class in urban transformation. Florida (2002) famously argued that cities thrive when they attract individuals working in knowledge-intensive and cultural fields, as these groups drive innovation, entrepreneurship, and cultural vibrancy. Subsequent studies reinforced this view, linking the presence of creative professionals with competitiveness, global visibility, and economic growth. Yet most of these analyses focused on large metropolitan centers—places like Barcelona, Berlin, or New York—where creative economies flourished. The question of how the creative class interacts with shrinking, mid-sized cities has remained relatively marginal in the debate (Martinez-Fernandez et al., 2012; Reckien & Martinez-Fernandez, 2011).

In contexts like the Global South, this gap is particularly significant. Cities such as Erzurum are not losing population because of industrial collapse but rather due to the outmigration of young, educated residents. This form of shrinkage demands a different conceptual lens. Rather than viewing young people simply as economic actors, research increasingly highlights the role of place perception, quality of life, and personal development opportunities in shaping their migration decisions (Chen et al., 2025). For creative youth, the attractiveness of a city depends not only on wages and job availability but also on whether the city provides cultural amenities, supportive networks, and opportunities for self-growth.

The push–pull migration framework remains a useful analytical tool in this context. Push factors such as unemployment, limited housing options, or lack of cultural life can accelerate outmigration, while pull factors—such as vibrant social environments, creative industries, and affordable living costs—can help retain residents. However, recent studies argue that these categories are interdependent and cannot be reduced to purely economic determinants (Brown et al., 2003). For example, while affordable housing may be a pull factor, it cannot offset the absence of professional opportunities in creative sectors. Similarly, strong family ties may encourage retention, but without cultural vibrancy and professional development platforms, many young people still choose to leave (Mellander et al., 2011).

The literature also points to the importance of place attachment and social capital. Individuals are more likely to stay in cities where they feel emotionally connected, where they have established friendships, or where they can envision raising families. Yet these social anchors are often undermined by broader structural conditions. In shrinking cities, declining economic opportunities and inadequate services can weaken social cohesion and erode attachment, making it difficult to counterbalance migration pressures (Reckien & Martinez-Fernandez, 2011).

For Erzurum, these insights suggest that shrinkage cannot be explained solely by labor market limitations. Instead, it is the interaction of economic, social, physical, and personal factors that drives migration intentions. While limited employment opportunities in creative sectors act as a strong push factor, equally important are the perceptions of limited cultural activities, social isolation, and restricted professional development. Theories of the creative class emphasize that young talent seeks environments of openness, connectivity, and cultural vibrancy (Florida, 2002; Chen et al., 2025). In their absence, migration to larger metropolitan areas becomes almost inevitable.

The conceptual contribution of this study lies in bridging these strands of scholarship. It combines the shrinking cities literature with the creative class framework and the push–pull migration model to analyze how young, educated individuals evaluate their future in a shrinking city of the Global South. By applying this integrated framework, the study highlights that migration decisions among creative youth are not simply a reaction to economic conditions but also reflect perceptions of urban life, cultural participation, and personal growth. This perspective not only deepens the understanding of youth outmigration but also opens new avenues for designing policies that embrace smart shrinkage strategies tailored to mid-sized, demographically challenged cities (Wiechmann & Pallagst, 2012; Xu et al., 2025).

2. Methodology

The research was carried out among students of the Faculty of Architecture and Design and the Faculty of Fine Arts at Atatürk University in Erzurum. A total of 742 students aged 18–24 participated in the survey, representing a key segment of the city's potential creative class. Data were collected both through face-to-face interviews and online forms.

The questionnaire was designed to capture the influence of economic, social, physical, and personal factors on students' migration preferences, based on push–pull migration theory and creative class frameworks (Florida, 2002; Reckien & Martinez-Fernandez, 2011). Items were rated on a 5-point Likert scale, and the instrument was refined through a pilot test and expert review.

To analyze the data, factor analysis, correlation analysis, and logistic regression were employed. Factor analysis identified the latent dimensions of push and pull factors, while logistic regression determined which variables significantly predicted stay-or-leave intentions. Reliability scores (Cronbach's alpha > 0.95) confirmed the robustness of the scale.

3. Findings

The survey of 742 students from the Faculties of Architecture, Design, and Fine Arts at Atatürk University revealed a clear and consistent pattern. The majority of Erzurum's creative youth do not envision their long-term future in the city. When asked directly about their post-graduation intentions, 76.7% of respondents stated that they plan to leave, only 21.2% expressed a desire to stay, and a very small share (2.2%) reported being undecided. This overwhelming inclination toward migration highlights the severity of Erzurum's youth retention problem and illustrates how shrinking cities in the Global South are driven not by natural population decline, but by the continuous loss of young and educated cohorts.

Economic Drivers of Migration: Economic considerations emerged as the most frequently cited determinants of outmigration. Students consistently emphasized unemployment, low wages, and insufficient opportunities in creative industries as their primary concerns. For many, the mismatch between their chosen fields—architecture, design, fine arts—and the limited employment opportunities available locally created a strong push to relocate. These findings align with broader research indicating that job prospects and income expectations are among the most decisive factors influencing mobility in shrinking cities (Haase et al., 2013; Martinez-Fernandez et al., 2012).

The logistic regression analysis confirmed the weight of these economic push factors. Low income potential and the perception of limited professional opportunities significantly increased the probability of migration. However, economic factors were not the only, nor even the strongest, predictors of student decisions.

Personal Development and Social Life: Perhaps the most striking result of the regression model was that two non-economic variables exerted the strongest influence on migration intentions. The first was the perception of limited opportunities for skill enhancement ($\beta = -1.4$). Students who felt that Erzurum lacked platforms for personal development, professional networking, or creative growth were far more likely to consider leaving. The second was the belief that Erzurum was "not a good place to meet people" ($\beta = +1.4$). This variable, reflecting dissatisfaction with social connectivity and cultural vibrancy, was as decisive as economic hardships in shaping migration plans.

These findings underscore that young talent evaluates cities not only through the lens of employment but also through broader urban experiences. Opportunities for cultural participation, social networking, and professional growth were seen as essential. Without them, even students with family ties in Erzurum expressed intentions to move elsewhere. These results are consistent with recent studies on the creative class, which highlight the importance of social engagement and cultural vitality as retention factors (Florida, 2002; Chen et al., 2025).

Social and Cultural Dimensions: Survey data also highlighted widespread dissatisfaction with Erzurum's cultural and social infrastructure. Students frequently mentioned the absence of diverse cultural activities, limited nightlife, and a lack of recreational opportunities. Many respondents described the city as "inactive" or "isolated," especially compared with larger metropolitan centers. For female students in particular, perceptions of limited safety and restricted social freedom contributed to higher migration intentions.

Correlation analysis revealed strong relationships between social cohesion indicators (such as sense of community and mutual support among neighbors) and the decision to stay. Students who reported strong local ties or community support networks were more likely to consider remaining in Erzurum, even when economic opportunities were limited. This highlights the dual role of social factors: while weak cultural life pushes students away, strong personal connections can mitigate migration pressures (Brown et al., 2003; Mellander et al., 2011).

Physical and Environmental Factors: While less influential than economic and social dimensions, physical and environmental conditions also shaped migration intentions. Students expressed dissatisfaction with inadequate transportation infrastructure, poor environmental quality, and the city's harsh climate. Concerns over air pollution, urban disorder, and decayed neighborhoods were frequently noted as negative aspects of life in Erzurum. The lack of accessible green spaces and recreational facilities further diminished the city's attractiveness.

Nevertheless, some students cited physical advantages as reasons for staying, particularly Erzurum's clean air compared with larger cities, its proximity to winter tourism areas, and lower living costs. These findings suggest that physical factors operate as secondary variables: they rarely act as decisive reasons to stay or leave, but they can reinforce or weaken the impact of economic and social drivers.

Family and Community Ties: Despite the predominance of push factors, certain anchors encouraged retention. Family ties emerged as one of the strongest motivators for staying. Students who were born or raised in Erzurum, or who had close relatives living in the city, demonstrated higher levels of attachment and were more likely to consider remaining after graduation. Similarly, those with established friendships and a strong sense of community expressed greater willingness to stay. These findings resonate with place attachment theory, which emphasizes the emotional and social dimensions of urban residency (Brown et al., 2003; Mellander et al., 2011).

Factor analysis grouped push factors into five categories (economic hardships, built environment challenges, social difficulties, personal constraints, and cultural limitations) and pull factors into six categories (economic opportunities, built environment quality, social cohesion, cultural amenities, personal attributes, and accessibility).

Correlation analysis demonstrated that personal attributes and social cohesion were positively associated with the decision to stay, while economic hardships and built environment challenges were strongly correlated with the decision to leave.

Logistic regression showed that the most powerful predictors of migration were: (1) limited opportunities for skill development, and (2) the perception that Erzurum is not a good place for socializing. Economic concerns such as unemployment and low wages also increased migration probability, but were secondary to these attitudinal factors.

Taken together, the findings indicate that Erzurum's creative youth are influenced by a complex interplay of economic, social, physical, and personal considerations. While limited job opportunities are central to their migration decisions, equally decisive are perceptions of urban vitality and opportunities for growth. The fact that non-economic variables emerged as the strongest predictors suggests that addressing shrinkage requires a holistic approach that goes beyond employment policies. Without improvements in cultural life, social infrastructure, and platforms for professional development, Erzurum is likely to continue losing its most educated residents to larger cities.

4. Discussion

The findings confirm that Erzurum's shrinkage is primarily driven by the outmigration of young and educated residents, rather than by industrial decline. This distinguishes it from the classical cases of shrinking cities in Europe and North America, where deindustrialization has been the dominant factor (Pallagst, 2010; Wiechmann & Pallagst, 2012). In Erzurum, the challenge lies in retaining university graduates who represent the potential creative class.

Consistent with broader literature, economic opportunities remain the strongest determinants of migration decisions (Haase et al., 2013; Florida, 2002). Yet this study also shows that non-economic dimensions—such as opportunities for self-development and social interaction—carry decisive weight. This supports recent perspectives that reframe shrinkage not only as a crisis of employment, but also as a question of spatial justice and urban quality of life (Hospers, 2013; Chen et al., 2025).

Retention is closely linked to family ties and community belonging, echoing research on the role of place attachment in shrinking cities (Brown et al., 2003; Mellander et al., 2011). However, social ties alone are insufficient when not supported by stable employment and vibrant cultural life. As the results suggest, a lack of cultural amenities, limited leisure opportunities, and perceived social isolation accelerate the decision to migrate.

These dynamics highlight the need for "smart shrinkage" strategies that combine economic diversification with cultural and social development (Hospers, 2013; Sandmann et al., 2025). Strengthening creative industries, expanding cultural events, and improving urban infrastructure could not only reduce youth outmigration but also contribute to sustainable regeneration in Erzurum.

In conclusion, this case demonstrates that shrinking cities in the Global South face complex retention challenges. For Erzurum, policies that integrate economic incentives with measures to enhance social connectivity and cultural vitality will be essential for keeping young talent and fostering long-term resilience.

5. Conclusion and Recommendations

This study has examined the migration intentions of Erzurum's creative youth, a group whose choices are central to the city's demographic and economic trajectory. The findings demonstrate that migration decisions are shaped by a multidimensional set of factors. Economic concerns—particularly unemployment, low wages, and limited prospects in creative sectors—emerge as powerful push factors. Yet, perhaps more striking is the weight of non-economic determinants, such as the lack of opportunities for skill development and the perception that Erzurum is not conducive to building social networks. These results underscore that young people's evaluation of cities is holistic: they consider not only job prospects but also whether their environment supports personal growth, social connection, and cultural engagement.

The study also reveals important anchors to the city, notably family ties, community attachment, lower living costs, and a secure environment. These factors, while insufficient on their own, highlight that there is a foundation upon which retention strategies can be built. Strengthening social and cultural infrastructure, diversifying professional opportunities, and enhancing platforms for creative industries could transform these anchors into stronger incentives for staying.

From a policy perspective, the findings suggest that traditional growth-oriented approaches are inadequate for addressing shrinkage in mid-sized cities. Instead, strategies must be guided by the concept of smart shrinkage, which emphasizes adaptive planning, inclusive governance, and improvements in quality of life (Hospers, 2013; Sandmann et al., 2025). For Erzurum, this means developing creative sector initiatives, supporting student entrepreneurship, investing in cultural and recreational amenities, and ensuring that urban planning integrates the needs of young and educated residents.

Ultimately, the case of Erzurum illustrates a broader challenge facing many Global South cities: retaining human capital in the face of persistent outmigration. By placing creative youth at the center of urban policy, cities can transform shrinkage from a passive process of decline into an opportunity for resilient and inclusive regeneration.

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GIS-BASED COMPARATIVE ANALYSİS OF URBAN FLOOD RISK IN MEDITERRANEAN CITIES: A CASE STUDY OF IZMIR AND NAPLES

Floriana Zucaro[36], Gizem Dinç [37], Atila Gül [38]

Abstract
Climate change, urbanization, and land use transformations significantly influence hydrological processes, increasing flood susceptibility in metropolitan areas. This study presents a comparative analysis of flood hazard patterns in two Mediterranean cities, İzmir (Turkey) and Naples (Italy), by integrating topographic, precipitation, and land-use datasets within a GIS-based hydrological modeling framework. Digital Elevation Models (DEMs) were used to derive flow direction and accumulation layers, which were combined with CHIRPS precipitation data to identify potential water accumulation zones. Land-use data from the 2018 Copernicus Urban Atlas were reclassified according to impermeability, generating a flood susceptibility raster. Combined hydrological and land-use analysis revealed that İzmir exhibits extensive and continuous high-risk areas shaped by rapid urban expansion, whereas Naples displays more localized high-risk zones constrained by steep topography. Medium-risk areas in İzmir are widespread across urban-agricultural transition zones, while in Naples they are confined to valley floors and depressions. These differences underscore the critical role of urban form–topography–precipitation interactions in shaping flood risk. The proposed methodology provides a scalable framework for multi-city flood susceptibility assessments and highlights the importance of integrating high-resolution topographic, rainfall, and land-use data for urban flood risk management. The findings offer valuable insights for planning both structural and non-structural mitigation strategies, emphasizing adaptive approaches under future climate change scenarios.
Keywords: Flood susceptibility, Urbanization, GIS-based hydrological modeling, Land-use change

1. Introduction

Climate change significantly affects global temperatures and weather patterns, leading to more frequent and intense extreme weather events such as floods and droughts (Dinç, 2023; Pizzorni et al., 2024; Ziari et al., 2025). In this context, the impacts of climate change on the hydrological cycle, particularly when combined with urbanization process and land use transformations, represent key dynamics that increase flood susceptibility in metropolitan areas. Land use/cover (LULC) changes, especially the expansion of impervious surfaces, reduce natural infiltration of precipitation and enhance surface runoff; this not only disrupts the hydrological balance of river basins but also substantially increases flood risk (Hung et al., 2018; Hsu et al., 2000; Kamali et al., 2017; Khalaj et al., 2021; Shuster et al., 2005; Sillanpää & Koivusalo, 2015). Increased surface runoff accelerates the transport of pollutants and pathogens into the environment (Phillips et al., 2018; Pitt & Jr, 2001; Qin et al., 2016) and, moreover, due to insufficient drainage capacity, causes significant economic losses and infrastructure damage in urban areas resulting in a decrease of urban livability and quality of life(Chen et al., 2009; Chen et al., 2018; Hammond et al., 2015; Jamali et al., 2018; Khalaj et al., 2021; Ndulue et al., 2015; Oo & Humphries, 2025; Price & Vojinovic, 2008; Sajikumar et al., 2015; Tingsanchali, 2012).

Urban transformation process needed to satisfy inhabitants' living standards have substantially increased anthropogenic pressure on land surfaces, resulting in the degradation of over 80% of natural areas, a phenomenon that is particularly pronounced in densely urbanized regions (Seyam et al., 2023). By 2050, approximately 75% of the global population is expected to reside in cities, reinforcing projections that unplanned urban growth will increase flood vulnerability and further exacerbate ecosystem fragility (Liu et al., 2021).

Within the context of climate change, interest in understanding the evolution of floods across different regions is steadily increasing. The sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC) (Ali et al., 2022) indicates that flood trends in Mediterranean countries are heterogeneous, with some areas experiencing increases while others show decreases, and generally low confidence in attributing these changes

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to climate change (Tramblay et al., 2023). This highlights that the spatial and temporal distribution of floods may vary considerably depending on local hydrometeorological conditions and urban morphology.

Historical gauge-based studies have long demonstrated that urban transformation process increases both the magnitude and frequency of floods (Feng et al., 2021). These findings are further reinforced by recently developed non-stationary flood frequency models (Villarini et al., 2009; Prosdocimi et al., 2015). Advances in computational power have enabled many studies to employ various hydraulic and hydrological modeling tools to more realistically characterize the relationship between rainfall–runoff processes and urban flooding (Lee, 2018; Li et al., 2009; Radice et al., 2017; Khalaj et al., 2021). In addition, advances in Geographic Information Systems (GIS), hydrological modeling integrating in GIS environment and high-resolution remote sensing data, have facilitated the production of flood susceptibility maps through the integrated analysis of topography, precipitation, and land use data (Verbeiren et al., 2013; Berezowski et al., 2012; Feng et al., 2021).

Previous studies have highlighted the determining role of topography, precipitation intensity, and surface permeability in flood occurrence, while also demonstrating that the interactions among these factors vary considerably according to the different characteristics of cities, such as the physical and geo-morphological. High population density, concentration of services and activities, extended infrastructure in urban areas further increase vulnerability to flood hazards (Deepak et al., 2020). Therefore, holistic approaches that combine hydraulic modeling outputs with urban characteristics and expert judgment provide critical decision-support tools. Existing research emphasizes that accurately mapping urban flood hazards, estimating flood depths, and developing effective risk reduction strategies require such integrated approaches (Khalaj et al., 2021). Countries around the world are increasingly focusing on ecosystem sustainability and the development of resilient cities to reduce the risks associated with climate change, disasters, and pandemics (Dinç, 2024).

In this study, the spatial distribution of flood susceptibility in the cities of Izmir and Naples was assessed by integrating hydrological flow models with land use data. Despite being located in the Mediterranean climate zone, the two cities exhibit significant differences in topographic structure, urban form, and spatial scale; consequently, hydrological responses during high-precipitation events vary markedly. Flow direction and accumulation layers derived from Digital Elevation Models (DEMs) were correlated with CHIRPS precipitation data to identify potential water accumulation zones, while Urban Atlas land use classes were reclassified according to impermeability and structural characteristics. The integration of these two components in a GIS environment enabled the calculation of low, medium, and high flood hazard levels. The influence of geomorphology and land use on flood generation processes in the two cities was examined. The results highlight both the comparative risk structures of the two cities and the potential of a standardized methodological framework applicable to multi-city flood susceptibility studies.

Furthermore, this study reveals why two Mediterranean cities with similar hydroclimatic conditions can exhibit different flood susceptibility patterns, emphasizing the critical role of the urban form–topography–precipitation interaction in flood processes. The proposed approach provides a scalable and applicable modeling framework by jointly evaluating DEM-derived hydrological indicators and LULC-based impermeability indices. In this respect, the study not only investigates the risk differences between the two cities but also contributes to the development of a standardised flood susceptibility assessment approach that can be applied in different territorial contexts.

2. Study Area

This study assesses the spatial distribution of flood susceptibility in İzmir and Naples by integrating topographic, rainfall, and land-use datasets within a GIS-based hydrological modelling framework. İzmir and Naples are two Mediterranean coastal cities that differ markedly in their geomorphological settings, urban structures, and development histories (Zucaro et al., 2024). Both cities face increasing environmental pressures driven by climate change and urbanization, making them appropriate case studies for investigating spatial patterns of flood susceptibility (Figure 1). The study area was defined based on the spatial overlap between the Urban Atlas land-use dataset and the DEM data obtained from USGS. This approach ensured spatial consistency among the input datasets and allowed all analyses to be conducted within a comparable geographical framework.

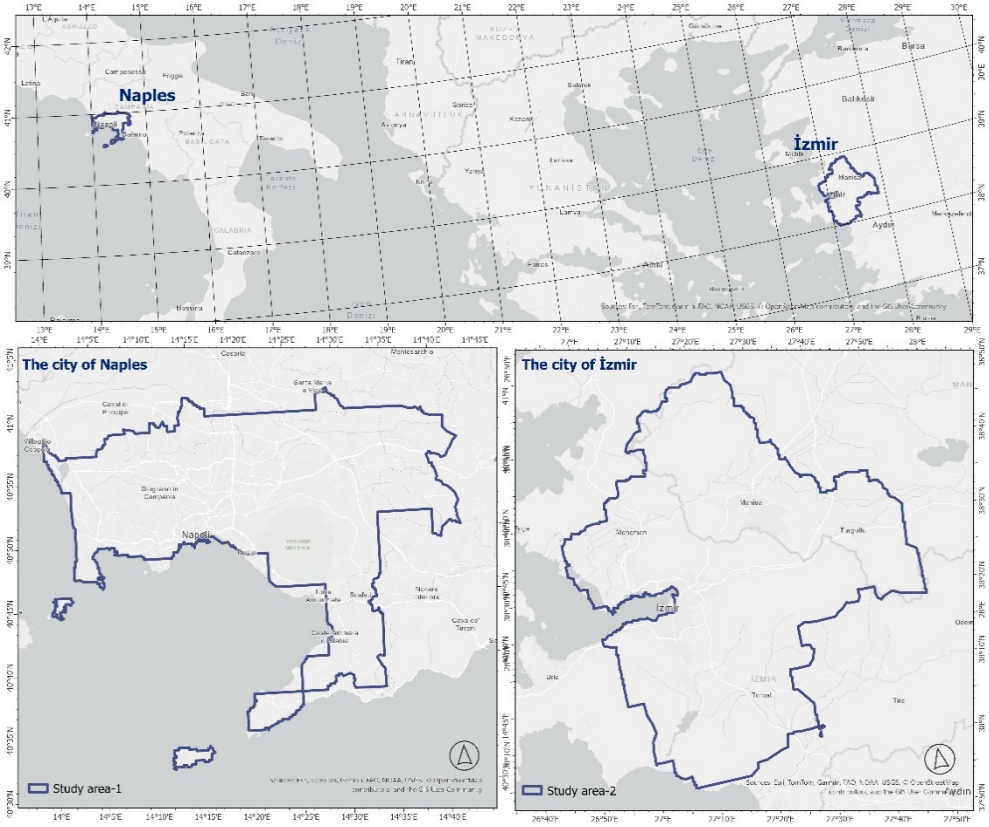


Figure 1. Geographical location of the study areas in the Mediterranean Region. Naples study area refers to the built-up and consolidated part of the city; Izmir study area includes the central districts of the city.

İzmir is located on the western coast of Turkey along the Aegean Sea and represents one of the country's largest metropolitan areas, under the influence of a Mediterranean climate (Figure 1). The study area includes the central districts of Balçova, Bayraklı, Bornova, Buca, Çiğli, Gaziemir, Karabağlar, Karşıyaka, Kemalpaşa, Konak, Menderes, Menemen, Narlıdere, and Torbalı, with a total population of approximately 3.56 million (TSI, 2023). İzmir's urban structure is strongly shaped by natural constraints, as the city is surrounded by mountainous terrain, agricultural land, and forested areas. These physical boundaries have directed urban growth into a basin-like settlement pattern and have significantly limited horizontal expansion (Aydın et al., 2020). Rapid urbanization, particularly along coastal zones, together with continuous rural-to-urban migration, has resulted in spatially uneven and increasingly dense urban development (Yıldırım & Savgan, 2022). According to the Inverse Distance Weighting (IDW) interpolation method, the mean annual temperature is 16.8 °C, while the average annual precipitation is relatively low at 627.9 mm (TCTOB, 2019; Demircan & Sılaydın, 2024).

Naples is located on the southwestern coast of Italy along the Tyrrhenian Sea and lies within a complex geomorphological setting influenced by the volcanic systems of Mount Vesuvius and Campi Flegrei. Covering an area of approximately 117 km², Naples is one of the most densely populated large cities in Italy, with a population of about 913,000 in 2021 (ISTAT, 2021). The city's urban form is constrained by steep hills in the northwestern sectors and relatively flat low-lying areas in the east, resulting in a compact and topographically restricted settlement pattern. Historical urban development processes, combined with high population density and limited land availability, have contributed to structural pressures on the city's spatial organization and infrastructure (Zucaro et al., 2024). Naples is characterized by a typical Mediterranean climate with a pronounced seasonal variability in atmospheric and marine conditions. The most critical hydro-meteorological processes occur during autumn and winter (November–February), when low-pressure systems frequently generate intense storms accompanied by strong winds, elevated wave heights, and heavy precipitation. During this period, significant wave heights can reach up to 4–5 m, and storm surges combined with intense rainfall substantially increase coastal flooding and erosion risk, particularly in low-lying and densely urbanized coastal plains (Mattei et al., 2021).

The contrasting spatial configurations, topographic conditions, and urban growth patterns of İzmir and Naples provide a robust basis for comparative analysis of flood susceptibility in Mediterranean urban environments.

3. Methodology

The methodological framework of this study is designed to measure the spatial distribution of potential surface water accumulation and flood hazard through the integration of digital elevation data, precipitation patterns, and land-use characteristics within a GIS-based hydrological modelling approach. All spatial analyses were performed using ArcGIS Pro 3.x ArcPy Spatial Analyst. The workflow consists of three core components: (i) preprocessing of the Digital Elevation Model (DEM) and precipitation data, (ii) hydrological surface flow modeling, and (iii) combined flood–land-use risk analysis.

First, 1 arc-second resolution DEM tiles obtained from USGS were mosaicked into a continuous elevation surface for each study area. Before hydrological processing, artificial sinks were removed using the Fill tool to ensure a hydrologically correct surface. Flow pathways were derived through Flow Direction, and accumulated surface runoff potential was quantified using Flow Accumulation. These layers represent topography-controlled water movement and identify natural depressions and convergence points where surface water is likely to accumulate.

Second, monthly CHIRPS v3.0 precipitation data for January 2025 (0.05° resolution) were resampled and aligned with the DEM. Rainfall values were integrated into the hydrological framework by multiplying them with the Flow Accumulation raster, producing a Water Accumulation layer according to:

$$WA_i = FA_i x\ R_i$$

WA_i : potential water accumulation in cell i

FA_i: flow accumulation in cell i

R_i: rainfall amount in cell i

This surface represents the combined effects of topography and rainfall intensity on potential water accumulation. The Water Accumulation raster was reclassified into three susceptibility levels (Table 1). Each pixel was assigned a value of 1 (low), 2 (medium), or 3 (high) based on these thresholds.

Table 1. Threshold values used for the classification of flood risk levels

flood risk level	**threshold range**
low	≤ 0.2
medium	0.2–1.0
high	> 1.0

Third, the 2018 Copernicus Urban Atlas dataset was converted into a raster format and assigned flood susceptibility scores based on land-use characteristics. Highly impervious and infrastructure-dominated classes (e.g., continuous urban fabric, industrial areas, ports, airports, major roads) received the highest susceptibility scores, while permeable surfaces such as forests, green areas, and permanent crops were assigned the lowest (Table 2).

Table 2. Land-Use flood risk scores (Urban Atlas 2018)

urban atlas class	*flood risk level*
Continuous urban fabric (11100)	3
Discontinuous urban fabric (11210–11240)	3
Discontinuous very low density urban fabric	1
Isolated structures (11300)	2
Industrial, commercial, public units (12100)	3
Fast transit roads & associated land (12210)	3
Other roads & associated land (12220)	2
Railways & associated land (12230)	2
Port areas (12300)	3
Airports (12400)	3
Mine, dump & construction sites (13100)	2
Mineral extraction & dump sites (13300)	2
Green urban areas (14100)	1
Sports & leisure facilities (14200)	1
Arable land (20000)	2
Permanent crops (21000)	1

Pastures / Grasslands (22000)	1
Complex cultivation patterns (23000)	2
Forests (30000)	1
Wetlands (40000)	2
Water bodies (50000)	3
Open spaces with little or no vegetation (beaches, dunes, bare rocks, glaciers)	2

The Water Accumulation raster and the land-use-based flood risk raster were systematically integrated using the Combine function in ArcGIS Pro. This process ensured that each raster cell retained both hydrological (water accumulation) and anthropogenic (land-use) attributes, enabling a comprehensive assessment of combined flood susceptibility. The resulting combined raster generated nine unique classes, each representing a distinct combination of accumulation and land-use risk levels. To facilitate practical interpretation and communication of flood hazard, these nine classes were further aggregated into three overarching categories: low, medium, and high hazard. This hierarchical classification provides a clear framework for identifying areas of varying flood vulnerability while preserving the multi-factorial nature of urban flood risk. The logic underlying this combined classification scheme is summarized in Table 3.

Table 3. Classification of combined raster into flood risk categories

	class	accumulation risk	land-use-based risk
	1	1	2
low	2	1	1
	3	1	3
	4	2	2
medium	5	2	1
	6	2	3
	7	3	2
	8	3	3
high	9	3	1

Finally, area statistics were extracted from the combined raster to quantify the total extent of low, medium-, and high-hazard zones in each city. These values were aggregated into hectares and used to compare flood susceptibility patterns between İzmir and Naples.

4. Findings

The integrated hydrological and land-use analysis revealed clear contrasts in the spatial distribution of flood hazard levels between İzmir and Naples. Figure 2 illustrates the distribution of flood hazard zones in Naples and İzmir, highlighting the contrasting patterns of risk influenced by differences in geomorphological, physical and land-use characteristics.

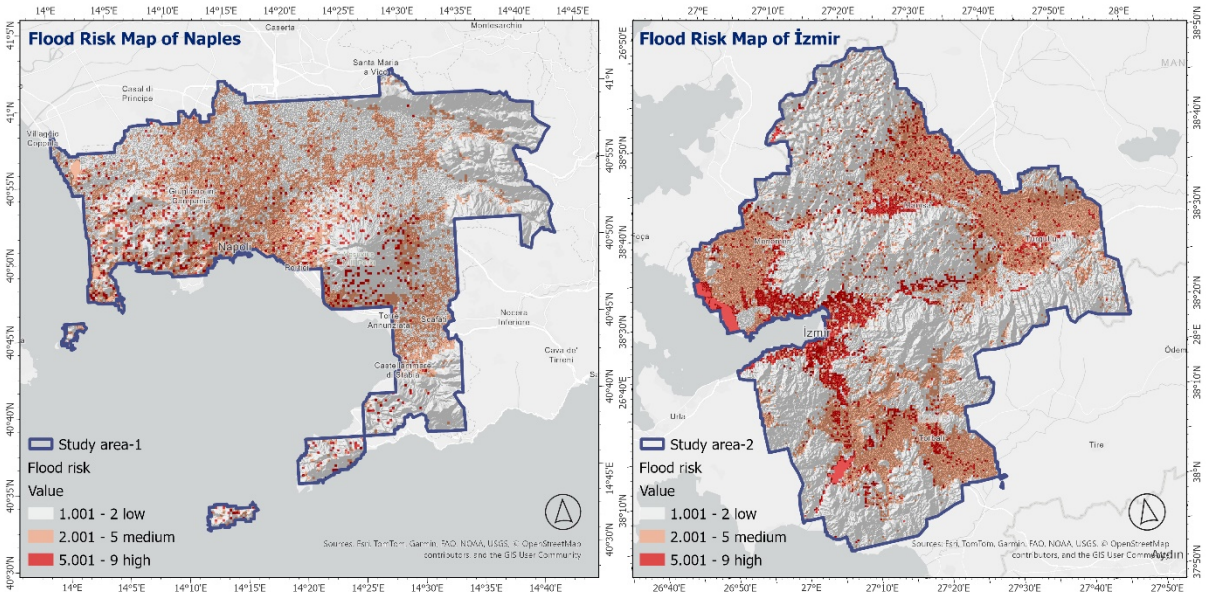


Figure 2. Spatial distribution of flood hazard zones in İzmir and Naples

Although İzmir covers a much larger administrative area, the proportional distribution of hazard zones offers meaningful insights into the differing geomorphological and urban structures of the two cities (Table 4).

Table 4. Flood hazard areas (ha) in İzmir and Naples

		İzmir(ha)	Naples(ha)
	1	278992	32256
low	2	26816	50814
	3	145104	37233
	4	6608	2133
medium	5	1712	2403
	6	1888	2592
	7	42000	405
	8	9104	567
high	9	432	594

Low-hazard zones constitute the largest share in both cities (İzmir: 305,808 ha; Naples: 83,070 ha). In İzmir, these areas correspond primarily to gently sloping rural terrain and permeable surfaces that efficiently disperse runoff. Naples, constrained by its compact morphology and steep relief, exhibits a smaller but still significant proportion of low-hazard land.

Medium-hazard areas (İzmir: 180,240 ha; Naples: 92,583 ha) are more spatially extensive in İzmir, distributed across transition zones surrounding urbanized districts and agricultural plateaus. In Naples, medium-hazard surfaces form tighter clusters aligned with local depressions and narrow valley floors. When normalized conceptually for spatial extent, the medium-hazard class appears proportionally more prominent within Naples, reflecting the strong influence of geomorphology on runoff behavior in the city.

The most substantial contrast appears in high-hazard zones (İzmir: 53,424 ha; Naples: 4,158 ha). İzmir's high-risk areas are broad and contiguous, shaped by coastal lowlands and rapidly urbanizing basins that collectively promote widespread water accumulation under intense rainfall. By contrast, Naples' territory, characterized by steep gradients and rapid drainage, limits high-risk zones to localized depressions and geomorphological traps. Although smaller in area, these hotspots may produce intense flash-flood conditions typical of Mediterranean hillside and high-densely built cities.

Overall, İzmir exhibits a flood hazard structure defined by extensive and continuous susceptible surfaces, whereas Naples displays localized but topographically constrained risk patterns. If both cities shared comparable spatial extents, İzmir would still be expected to sustain a broader distribution of high-hazard zones due to its geomorphology and land-use configuration, while Naples' risk would remain concentrated in discrete zones shaped by slope dynamics (Figure 3).

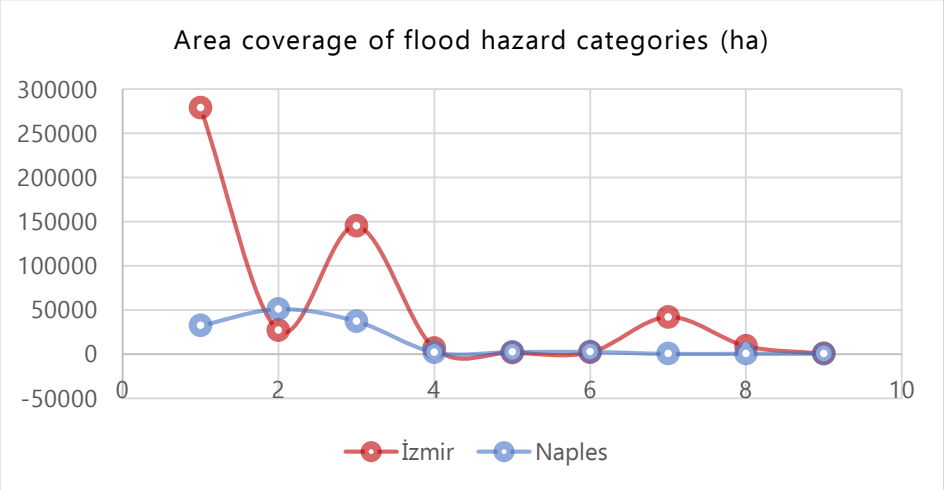


Figure 3. Area comparison of flood hazard classes (ha) in İzmir and Naples

5. Result and Discussion

The comparative analysis of flood hazard patterns in İzmir and Naples provides valuable insights into the interactions between geomorphology, land use, and urban form that shape flood risk in Mediterranean cities. The results clearly show that İzmir exhibits a broader and more continuous distribution of high-risk areas, whereas Naples has high-risk zones that are more localized and topographically constrained in specific parts of the city. These differences can largely be attributed to the geomorphological characteristics and urban development patterns of the two cities, as well as their distinct climatic settings. In the case of İzmir, the prevailing climatic conditions, when combined with projected climate change impacts, increase the vulnerability of water resources and elevate the risk of hydrological extremes, including floods (Demircan & Sılaydın, 2024). In Naples, the high number of impermeable surfaces, the hilly terrain, and the infrequent maintenance of drainage infrastructure significantly contribute to making the city vulnerable to flood risk covering extended parts of the city.

The prevalence of low-risk areas in both cities highlights the role of permeable surfaces and gently sloping rural terrain in mitigating surface runoff. However, the spatial distribution of medium-risk areas underscores the importance of transitional zones between urban and agricultural areas. In İzmir, these areas display a wider spatial extent, reflecting the tendency for runoff accumulation across urban expansion and moderately sloped terrains under relatively low but increasingly variable precipitation regimes. In Naples, medium-risk areas are confined to narrow valley floors and local depressions, emphasizing the strong influence of topography on flood dynamics.

These findings offer important implications for urban planning and flood risk management. In İzmir, the extensive and continuous nature of high-risk areas necessitates flood mitigation strategies that encompass large-scale and interconnected zones. This includes both structural measures, such as retention basins and improved drainage infrastructure, and non-structural measures, such as zoning regulations and early warning systems. In Naples, by contrast, localized and focused interventions are required in areas where geo-morpghological constraints concentrate surface runoff, particularly along low-lying coastal plains exposed to combined fluvial and marine processes.

Furthermore, the study highlights the importance of integrating high-resolution topographic, precipitation, and land-use data in flood risk assessments. The combination of flow direction and accumulation layers derived from DEM, CHIRPS precipitation data, and Urban Atlas land-use classes provides a robust framework for evaluating flood hazard patterns in diverse urban contexts. This integrated approach is particularly relevant for Mediterranean coastal cities such as Naples, where recent climate-change-related trends indicate an increase in the frequency and intensity of extreme storm events, including medicane-type systems, which exacerbate the combined effects of intense rainfall and marine forcing and thereby amplify flood hazard along the coastline (Mattei et al., 2021).

Finally, although this study focuses on current conditions, it also underscores the necessity of considering future climate change scenarios in urban flood risk assessments. The frequency and intensity of extreme precipitation events are expected to increase in Mediterranean cities, potentially amplifying existing vulnerabilities and altering hazard distributions. Detailed hazard mapping and adaptive urban planning that explicitly account for local geomorphological and climatic contexts are therefore critical for enhancing urban resilience and minimizing socio-economic impacts.

6. Conclusion

This study provides a comparative assessment of urban flood susceptibility in two Mediterranean cities, İzmir and Naples, by integrating high-resolution topographic, precipitation, and land-use datasets within a GIS-based hydrological modeling framework. The results reveal pronounced differences in flood hazard patterns: İzmir exhibits extensive and continuous high-risk areas, shaped by rapid urban expansion and lowland topography, whereas Naples displays more localized high-risk zones constrained by steep slopes and compact urban form. Medium-risk areas in İzmir are distributed across urban–agricultural transition zones, while in Naples they are restricted to valley floors and depressions. These findings underscore the critical role of the urban form–topography–precipitation interplay in shaping flood risk and provide valuable insights for both structural and non-structural mitigation strategies in Mediterranean urban contexts.

The study's methodology offers a robust and scalable framework for multi-city flood susceptibility analysis. More importantly, the explicit delineation of risk zones based on both hydrological flow and anthropogenic land-use attributes (impermeability) provides the foundational data necessary for developing effective Decision Support Tools (DSTs). For Mediterranean cities, which are highly exposed to increasing hydro-meteorological extremes due to climate change, DSTs are crucial for:

Mitigation of Flood Risk: DSTs can integrate hazard maps, vulnerability data, and infrastructural capacity to immediately identify high-priority areas for investment in structural measures (e.g., retrofitting drainage, building retention structures) and inform urban zoning laws that restrict or regulate development in high-risk zones (Gargiulo et al., 2025; Mora-Esteban et al., 2025).
Adaptation to Urban Transformations: By evaluating the impact of proposed land-use changes—such as new infrastructure or urban densification—on surface impermeability and runoff accumulation, DSTs allow urban planners to actively govern transformations in a flood-resilient manner. This proactive planning is essential to foster resilient cities and ensure the long-term sustainability and quality of life in densely populated Mediterranean coastal areas (Gargiulo et al., 2025a and 2025b).
Despite these contributions, several limitations should be acknowledged. First, integrating datasets of different types and resolutions required preprocessing, including projection and resampling adjustments, which may introduce minor uncertainties. High-resolution DEM and precipitation data are not always readily available in open-access databases, limiting the potential for fully detailed spatial analyses. Second, while the proposed method is computationally efficient and allows for rapid flood susceptibility mapping, urban flood risk is inherently multi-dimensional, involving hydrodynamic, socio-economic, and infrastructural factors that were beyond the scope of this study. Consequently, more comprehensive modeling approaches that incorporate dynamic runoff simulations, detailed drainage networks, and socio-economic exposure metrics could further refine flood hazard assessments (Chen et al., 2009; Khalaj et al., 2021; Oo & Humphries, 2025).
Nevertheless, the methodology presented here offers a robust and scalable framework for multi-city flood susceptibility analysis, enabling policymakers and urban planners to identify critical areas at risk, prioritize mitigation measures, and develop adaptive strategies under future climate change scenarios. The study demonstrates that even with simplified modeling assumptions, integrating topography, rainfall, and land-use data provides meaningful insights into spatial patterns of flood risk and highlights the value of GIS-based approaches for urban flood management.

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IDENTIFICATION AND REPRESENTATION OF THE "BEY" DOLL AS AN ANCESTRAL–RITUAL ICON IN IRANIAN CULTURE

Nahid Jafari Dehkordi[39]

Abstract
Dolls in Iranian culture are more than mere toys; they play a significant role in transmitting values, teaching social roles, and representing cultural rituals. In some regions, dolls, especially for girls, function as ritual companions, conveying concepts such as protection, fertility, and connection with ancestors. One prominent example is the "Bey" doll from Dezful in Khuzestan province, which was used by girls during childhood to reenact all stages of wedding ceremonies, serving as a confidant and companion for the bride in her marital home. The aim of this study is to identify and represent the "Bey" doll as an ancestral–ritual icon and to analyze its visual and symbolic features, including form, tattoo patterns, and attire, within the framework of Iranian culture. This study seeks to answer how the "Bey" doll functions as a carrier of symbols and a representation of wedding rituals, and what visual and symbolic characteristics distinguish it from other dolls. The research is descriptive–analytical and is based on fieldwork and document analysis. The study population comprises ritual dolls of Iran, and the sample was purposefully selected; in this study, the "Bey" doll from Dezful was examined. The collected data were analyzed qualitatively to identify and interpret the doll's visual, symbolic, and ritual characteristics. The "Bey" doll is made of fabric and cotton and features tattoos under the chin and faded tattoos on the body. These markings and its local attire signify its connection to women's and ancestral traditions, protection of the bride, and the representation of wedding rituals including engagement, henna night, bridal procession, and patakhti ceremonies. Play with the doll constitutes a form of ritualized play, through which children experience and practice cultural rituals and values. The doll also served as a confidant, playing an important emotional and social role in the bride's life. The results indicate that the "Bey" doll is a unique cultural–ritual object that, through the combination of form, tattoos, and clothing, carries collective memory, represents wedding rituals, and reflects women's social and gender roles in Iranian society. Studying this doll provides deeper insight into the interaction between play, ritual, and cultural symbols in visual arts and visual anthropology.
Keywords: Iranian culture, ritual dolls, ancestral icon / ancestral representation, Dezful wedding ceremonies, female tattooing, "Bey" doll

Introduction

Doll-making has a long and ancient history, with evidence traceable to early human civilizations. While in contemporary contexts dolls are largely regarded as children's toys and educational tools, historically they fulfilled far more complex ritualistic and psychological functions. Across various regions of Iran, numerous indigenous dolls exist whose associated folklore and oral traditions are now at risk of disappearing. As such, these cultural artifacts merit scholarly investigation as part of Iran's intangible cultural heritage.

Exploring the domain of doll-figures and their role in human life—particularly in relation to women—reveals deep-rooted connections to the beliefs, needs, and worldviews of indigenous societies. In traditional contexts, dolls functioned as psychological mediators and symbolic outlets for emotional expression, embodying aspects of feminine identity and experience. Consequently, analyzing dolls within specific temporal and geographical frameworks offers valuable insights into the social history of women and their culturally assigned roles, a central concern of the present study.

The anthropomorphic indigenous dolls of Khuzestan Province can be understood as remnants of nomadic and tribal life in the region. Despite the influence of modern social transformations, these dolls have undergone minimal changes in terms of materials, production techniques, and visual form. Created primarily by women, these handicrafts reflect enduring beliefs, collective memory, and aesthetic perspectives toward creativity and art. Within local communities, such objects have traditionally served as symbolic carriers and practical tools for experiencing, rehearsing, and transmitting cultural rituals.

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Dezful, a historic city located in southwestern Iran, is distinguished by its rich local traditions, particularly in relation to wedding ceremonies and ritualized forms of play. This cultural context makes Dezful an especially significant site for the study of ritual dolls. The present research focuses on the ritual dolls used by girls in Dezful, with particular attention to two representative examples: the female "Bey" doll and its male counterpart. Both dolls are examined as symbolic embodiments of marriage rituals and traditional performative play.

The aim of this study is to identify and analyze the visual and symbolic characteristics of female and male ritual dolls in Dezful and to examine their role in representing wedding rituals and transmitting cultural values. Accordingly, the main research question asks: How do the female and male ritual dolls of Dezful visually and symbolically represent wedding rituals and cultural–social roles through their form, symbols, and local attire?

The significance of this research lies in several key aspects: first, the documentation and analysis of local cultural objects that have received limited scholarly attention; second, the exploration of the relationship between children's play and the transmission of cultural values and rituals; and third, the provision of an academic foundation for future interdisciplinary studies in visual arts, visual anthropology, and Iranian cultural studies.

This study employs a descriptive–analytical qualitative methodology. Data were collected through fieldwork and document analysis, and the research population includes Iranian ritual dolls selected through purposive sampling. The analysis focuses on two primary examples—the female "Bey" doll and the male doll—in order to identify and interpret their visual, symbolic, and ritual characteristics.

Methodology

This study adopts a qualitative research approach and examines the "Bey" doll in the Dezful region through documentary sources, field interviews, and direct observation of rituals associated with this tradition. The research data were collected through content analysis as well as an examination of the lived experiences and beliefs of local people regarding the Bey doll in Dezful. Using descriptive and analytical methods, the study seeks to analyze the cultural and social impacts of this tradition, particularly its role in fostering social cohesion and strengthening the relationship between humans and their surrounding environment. From this perspective, the research can be considered a fundamental (basic) study.

The research population includes Iranian ritual dolls associated with traditional practices related to fertility, blessing, and ritual symbolism across different regions of Iran. These dolls are commonly used in cultural and religious ceremonies and are created as symbolic mediators of prosperity and continuity. From among this broad group, the pair of Bey dolls from the cultural context of Dezful was purposefully selected as the main sample of the study. This selection was based on the dolls' distinctive features and their close connection to the social, cultural, and religious beliefs of the local community of Dezful.

The Function of Ritual Dolls in Folk Culture

Dolls hold a prominent and deeply rooted presence among Iranian ethnic groups and constitute an integral part of social life. Beyond this, they occupy a special position within cultural myths and maintain a profound connection with popular beliefs. For children, dolls act as obedient companions and constant friends, fostering emotional bonds. In traditional rituals, dolls appear both as symbols of benevolence and as representations of malevolent forces, assisting individuals in experiencing and reinforcing ritual connections (Jafari Dehkordi & Rezaei, 2025: 55).

More than mere physical objects, dolls acquire life and meaning within human imagination. This quality has led to their recognition across cultures not only as toys but also as ritual, artistic, and social symbols. Human interaction with dolls thus transcends their material dimension, reflecting collective beliefs, dreams, and cultural narratives. As scholars have noted, "the doll comes to life through human engagement and attains existence in the imagination; as humans project themselves onto the doll and compel it to follow their commands, they simultaneously submit to it, allowing the doll to acquire an independent presence" (Bird, 2002: 18; Jurefkowsky, 2014: 20).

The hypothesis that the word "doll" derives from "idol" offers an intriguing perspective for analyzing the conceptual transformation of ritual objects into everyday dolls (Kauppinen, 2000: 14). This process suggests a gradual shift in function and meaning from sacred and symbolic attributes to decorative or entertaining purposes. Within this framework, prehistoric figurines, such as small Venus statues, serve as key examples. Certain features of these objects, including the detailed hair of the Venus of Willendorf (Fig. 1) and the depiction of clothing in the

Venus of Lespugue (Fig. 2), bear notable similarities to dolls, indicating a gradual transition from prehistoric ritual objects to later anthropomorphic representations.

In this context, the conceptual role of Venus figurines as intermediaries between idols and dolls contributes to a deeper understanding of humanity's emotional relationship with anthropomorphic figures throughout history. However, questions remain regarding the specific magical, shamanistic, totemistic, or fetishistic functions of these figurines. As Williams argues, "in their ritual position, dolls carry archetypal or collective memory and are shaped in human form through a form of magical power" (Williams, 2007: 119–120). Furthermore, numerous scholars have identified Venus figurines as symbols of fertility (Neal, 1992: 19; Hartt, 1976: 26).

Indigenous dolls, as elements of ethnic art, clearly express distinct geographical and cultural identities, differentiating them from other traditional dolls. These handcrafted objects serve as direct reflections of their cultural origins, as ethnic art articulates the collective thoughts and needs of a community for its audience (Fischer, 1989: 191). Additionally, in many cultures, dolls are employed in protective, sacrificial, and blessing rituals, further underscoring their symbolic and ritual significance (Boehn, 1932: 36, 42).



Figure 1. Venus of Willendorf, ca. 30,000 BCE, Natural History Museum, Vienna. URL1

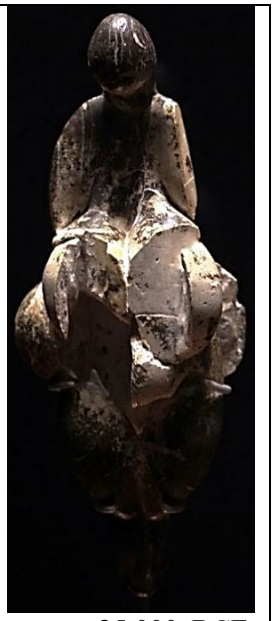


Figure 2. Venus of Lespugue, ca. 25,000 BCE, Musée de l'Homme, Paris.URL2

The "Bey" Doll in Dezful Folk Culture

1. Sample Introduction

The "Bey" doll, in the local dialect of Dezful, means "bride." This doll was traditionally part of girls' dowries and, in some families, this practice continues to the present day. The "Bey" doll acted as a confidant for girls, allowing them, through play, to become familiar with patriarchal and mother-in-law-dominated family structures (Mahmoudi, 2021, February 15).

2. Types and Structure of the Doll

According to field observations, the "Bey" doll existed in two types:

The first type: made from fabric pieces called "Lal."

The second type: the "Bey" doll (Fig. 2), accompanied by the "Dumalak" doll (symbolizing the groom) (Fig. 3), mainly used to reenact wedding ceremonies.

One respondent explained: "During childhood, the entire wedding process of a girl and boy—from courtship to the wedding and the morning after—was fully enacted" (Mohammadi, 2021, January 17).

3. Physical Features and Attire

Observations indicate that the "Bey" doll:

Possesses realistic female anatomy, including breasts and natural body contours.

Displays colorful and geometric tattoos from the face to the feet, likely representing cultural and social symbols of Dezful women.
Shows detailed stitching and coloration on the wrists, ankles, and calves, connecting the doll to the traditional attire of local women.
The "Dumalak" doll's clothing aligns with local male dress and, together with the "Bey" doll, was used to perform wedding rituals (Pourizadi, 2021, February 15).

4. Symbolic and Psychological Roles
The "Bey" doll embodies the ideal woman and desired masculinity within the local community. Girls, through emotional engagement with the doll, can:
Practice psychological and social maturity.
Learn the skills necessary for performing the roles of wife and bride in society.
Gain early experiences in social rituals and family structures.
The tattoos and anatomical details provide a realistic representation of Dezful women for the girls, transforming the doll from a mere toy into a cultural and educational tool.

5. Representation of Wedding Ceremonies in Play
Based on interviews with, a native woman from Dezful, wedding ceremonies in this city constitute a continuous series of rituals from the decision to marry until the days following the wedding. These rituals are not only part of Dezful's cultural heritage but are also indirectly reproduced through children's play. Girls regard the "Bey" doll as equivalent to a real bride and enact all stages of marriage. Early stages include:
"Davāt" (formal invitation)
"Qesseh-konun" (initial family conversation)
"Deloli" (courtship)
"Kadkhodui" (determining dowry and bride price)
In these plays, girls assign roles, choose doll clothing, and rehearse the rituals. Later stages include:
"Neshun-vonun" (engagement)
"Bandoon" (bride's makeup)
"Mar Borun" (official wedding contract)
"Dast-Razon" or Henna Night
Ceremonies such as "Jahāz-boron", "Khuncheh-Bey", and "Bride Escort (Bey-boron)" are also reenacted in simplified forms. Post-wedding rituals such as "Sobhi", "Se-shabeh (Rigshoon)", and "Hafteh-Bararon" are reflected in these plays as well (Zahraei, 2025, October 12).

6. Cultural Significance
In children's play, the "Bey" doll not only represents a real bride but also embodies collective memory, wedding rituals, and Dezful's cultural values. These games allow girls to become familiar with female roles, wedding rituals, and social structures, providing symbolic experiences of social and cultural life (Zahraei, 2025, October 12).
The doll also symbolizes the "ideal groom" of the tribe—brave and noble. Through emotional interaction with the doll, girls prepare psychologically and socially for the role of an ideal bride, aligning with the characteristics of this imaginary groom.



Figure 3: "Bey" doll, from the collection of Iranian ritual dolls, curated by Nahid Jafari Dehkordi



Figure 4: "Dumalak" doll, from the collection of Iranian ritual dolls, curated by Nahid Jafari Dehkordi.

The Groom Doll and Its Cultural Significance in Dezful

In the traditional society of Dezful, it is natural to expect dolls representing brides, complete with names, appearances, and adornments. Alongside them, dolls representing grooms also exist. Although these groom dolls are directly related to marriage and fertility rituals, they are likely intertwined with the social and historical role of princes. This connection can be observed in the Persian term "Shah-Damad" (Royal Groom). As noted by Dehkhoda in his dictionary under the entry for Shah-Damad, citing a poet named Fekri:

"The one whose character is like that of a royal groom
From my favor, becomes known in the city and land."
(Dehkhoda, 1998, vol. 2: 14072)

Across Iran, numerous female dolls are recognized with prefixes such as "Beh" or "Bay." Some creators or owners interpret these names as derived from the Persian word *beh*, meaning "good" or "better" (Jafari Dehkordi, 2022: 238). However, these names should be understood in light of the ancient Iranian word *Bagh*, meaning lord, master, god, or esteemed, which was widely used in Old Iranian languages. In the Indo-Aryan tradition, "Bhagé" was a deity of marital happiness, promoting harmony between husband and wife (Davodi Hamuleh, 2020: 306).

Based on research, these dolls not only embody and recall the groom or bride and associated wedding rituals, but also carry historical and psychological meanings, which can be interpreted as the concept of "success in life and the world." Historical evidence repeatedly supports this understanding. Numerous examples in Persian literature convey this idea:

"I asked the Bride of Time, what is your treasure?
She replied, 'Your joyful heart is my treasure.'"
(Khayyam, 1992: 60)

"The evil age gives birth to nothing but misfortune
This pregnant one brings forth no other but calamity."
(Ghabadiani, 1999: 285)

"Do not seek the faithfulness of the unstable world,
For this old woman is the bride of a thousand grooms."
(Hafez Shirazi, 1998: 54)

It can be inferred that, ritually, the land belongs to women, and both men and women play roles in the continuity and creation of generations. Nature is perceived by the people as a maternal presence (de Beauvoir, 2001, vol. 1: 120). The production of bride and groom ritual dolls expresses the relationship between humans and nature, as

well as the human perspective on life. A prevalent belief held that sexual and territorial fulfillment both stem from the same source—a notion that continues to exist.

A bride doll achieves completeness only when paired with a groom doll, and the feminine life space is fully realized only in their joint presence. Similar perspectives can also be found in religious and hadith literature. For instance, Ibn Abbas reports that on Judgment Day, the world will be represented as an old, unattractive woman, and people will seek refuge in God, illustrating the unconscious association of woman with earth and the link between female sexuality and royal power (Waram, 2005: 118).

Furthermore, in Achaemenid beliefs, emphasis on masculine power reflected the pleasure derived from conquering cities and lands. In many mythological cultures, sexual desire and political power were closely linked. In Mesopotamia, kingship and fertility were ritually guaranteed through sacred marriage with a goddess or divine female figure (Bahar, 1996: 423). Ethnographic studies of Armenians also indicate that in ritual weddings, the groom performed as a warrior-prince, and after the finalization of the traditional union, crowned himself as king, while the bride assumed the role of queen (Esabalian, 1994).

Thus, ritual dolls representing brides and grooms symbolize the human relationship with nature and the world, the continuity of generations, and the integration of life, social, and cultural prosperity.

Conclusion

The present study demonstrated that the *"Bey"* doll in the culture of Dezful is not merely a children's toy; rather, it functions as a cultural–ritual object with multilayered significance embedded in collective memory, feminine beliefs, and marriage rituals. As an ancestral–ritual symbol, the doll establishes a meaningful connection between play, ritual, gender, and the transmission of cultural values.

The findings indicate that the anthropomorphic form of the *"Bey"* doll, its bodily tattoos, local attire, and the ways it is used in girls' play reflect the identity of Dezful women and their social roles within the family and traditional society. The tattoos and visual markers of the doll not only reference local aesthetic traditions but also symbolize protection, fertility, ancestral connections, and readiness for marriage.

Ritualized play with the *"Bey"* doll provides a framework for reenacting all stages of marriage ceremonies, from courtship to post-wedding rituals. This process constitutes a form of symbolic learning and social training through which girls become familiar with gender roles, family power structures, male–female relationships, and cultural expectations. In this sense, the *"Bey"* doll acts as an intermediary between childhood and adulthood, contributing to the psychological and social maturation of girls.

Furthermore, a comparative analysis of the concepts associated with the name *"Bey"* and its etymological connection to ancient terms such as *Bagh*, as well as notions of success, mastery, and life fulfillment, suggests that the doll, on a deeper level, embodies remnants of mythological ideas related to fertility, the earth, women, and the continuity of life. The pairing of the female doll (*"Bey"*) with the male doll (*"Dumalak"*) emphasizes the importance of marital union, the completion of ritual cycles, and the realization of meaning within the feminine and social sphere.

Ultimately, this research demonstrates that studying the *"Bey"* doll can lead to a deeper understanding of the interaction between folk arts, rituals, children's play, and symbolic systems in Iranian culture. Documenting and analyzing such cultural artifacts is not only crucial for preserving the intangible heritage of local communities but also provides a valuable foundation for interdisciplinary research in visual anthropology, visual arts, and gender studies.

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THE IMPACT OF WIND AND LANDSCAPE DESIGN ON OUTDOOR THERMAL COMFORT: THE CASE OF TABRIZ

Zahra GHANNADIAN[40], Sevgi YILMAZ[41]

Abstract
Investigating outdoor thermal comfort is essential for designing pedestrian-friendly, energy-efficient and sustainable urban environments. In Tabriz, which is characterized by a cold and arid climate, low winter temperatures combined with air pollution and summer heat stress with insufficient shading substantially limit the use of outdoor spaces. This study examines the interaction between wind and landscape design and its impact on outdoor thermal comfort in Tabriz through a multi-scale approach. First, Land Surface Temperature (LST) is derived from Landsat imagery for the years 2000, 2010, 2020 and 2025, for both summer (hottest month) and winter (coldest month), revealing spatial patterns of the urban heat island. Then, hourly microclimatic measurements (air temperature, relative humidity, wind speed and direction, radiation) are collected within the city and used to estimate Physiological Equivalent Temperature (PET), Mean Radiant Temperature (MRT) and wind-chill related indices, providing calibration data for ENVI-met and CFD models. Based on these analyses, climatically critical areas are identified, and alternative urban design scenarios are developed for the new development axis of Tabriz, namely the Roshdiye district, including variations in vegetation density, street-canyon geometry and surface materials. These scenarios are evaluated using ENVI-met and CFD simulations. Preliminary assessments indicate that highly impervious, fully wind-exposed spaces perform poorly in terms of thermal comfort in both seasons, whereas scenarios that combine evergreen windbreaks, tree-lined streets and permeable surfaces yield noticeable improvements in PET and pedestrian wind comfort. The study provides a comprehensive and climate-responsive framework for integrating wind and landscape design into urban planning in cold and arid cities.
Keywords: Tabriz, thermal comfort, wind, ENVI-met, CFD, land surface temperature

1. INTRODUCTION

Climate change, rapid urbanization and the increase in impervious surfaces are significantly transforming the urban climate both on a macro scale (urban heat island) and on a micro scale (street and open space microclimate). Studies based on land surface temperature (LMS/LST) maps show that surface temperatures increase significantly in densely built textures with little green space compared to their surroundings, while parks and blue-green infrastructure components create a cooling "cool island" effect (Avdan et al. 2016; Du et al. 2017; Menteş et al. 2024; Çetin et al. 2024).

Research on cold climate cities, on the other hand, shows that thermal comfort cannot be reduced to heat stress only in summer; emphasizes that the balance of wind control, insolation and shading should be planned together in winter (Bulgan et al. 2017; Irmak et al. 2018; Irmak et al. 2020; Yavaş et al. 2019). Studies conducted in Erzurum and similar cities have revealed that street canyon geometry, green area ratio, and tree species selection play an important role in the felt temperature in summer and winter (Yılmaz et al. 2022; Ertem Mutlu et al. 2024).

Advances in microclimate modeling tools make it possible to numerically test such complex interactions. ENVI-met is a common tool that can calculate PET, MRT, and wind area at the street and open area scale, taking into account vegetation, surface materials, and building morphology (Haeri et al. 2023; Kotharkar et al. 2024). CFD models, on the other hand, allow for detailed examination of wind flow, turbulence structure, and the distribution of air pollutants in the urban canyon (Mirzaei, 2021; Javanroodi et al. 2022; Kubilay et al. 2024).

Tabriz is a cold-arid climate city that stands out with its harsh winters, dry summers and especially winter air pollution caused by heating. In this context, outdoor thermal comfort; pedestrian behavior is becoming a critical planning parameter directly related to social interaction, energy consumption and air quality.

The aim of this study is to examine the effects of wind and landscape design on outdoor thermal comfort in the city of Tabriz with a multi-scale approach and to develop climate-sensitive scenarios for urban design decisions. The study aims to contribute to the literature on cold-arid climate cities with its structure that integrates (i) satellite-

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based long-term AYS analyses, (ii) urban micro-climate measurements, (iii) ENVI-met and CFD-based urban design scenarios, and (iv) local thermal comfort thresholds (Roy et al. 2025; Yılmaz et al. 2025).

2. MATERIAL AND METHOD

2.1. Field of Study

The city of Tabriz in Iran and the settlement of Rüşdiya, which is the new development axis of the city, were chosen as the study area. At the urban scale, the distribution of AYS in different land use and cover types was examined; urban heat island/cool island areas have been determined. On the micro scale, a typical urban fabric area of approximately 400 × 300 m in Rushdie, with residential blocks, roads and limited open/green space, was selected for detailed analysis.

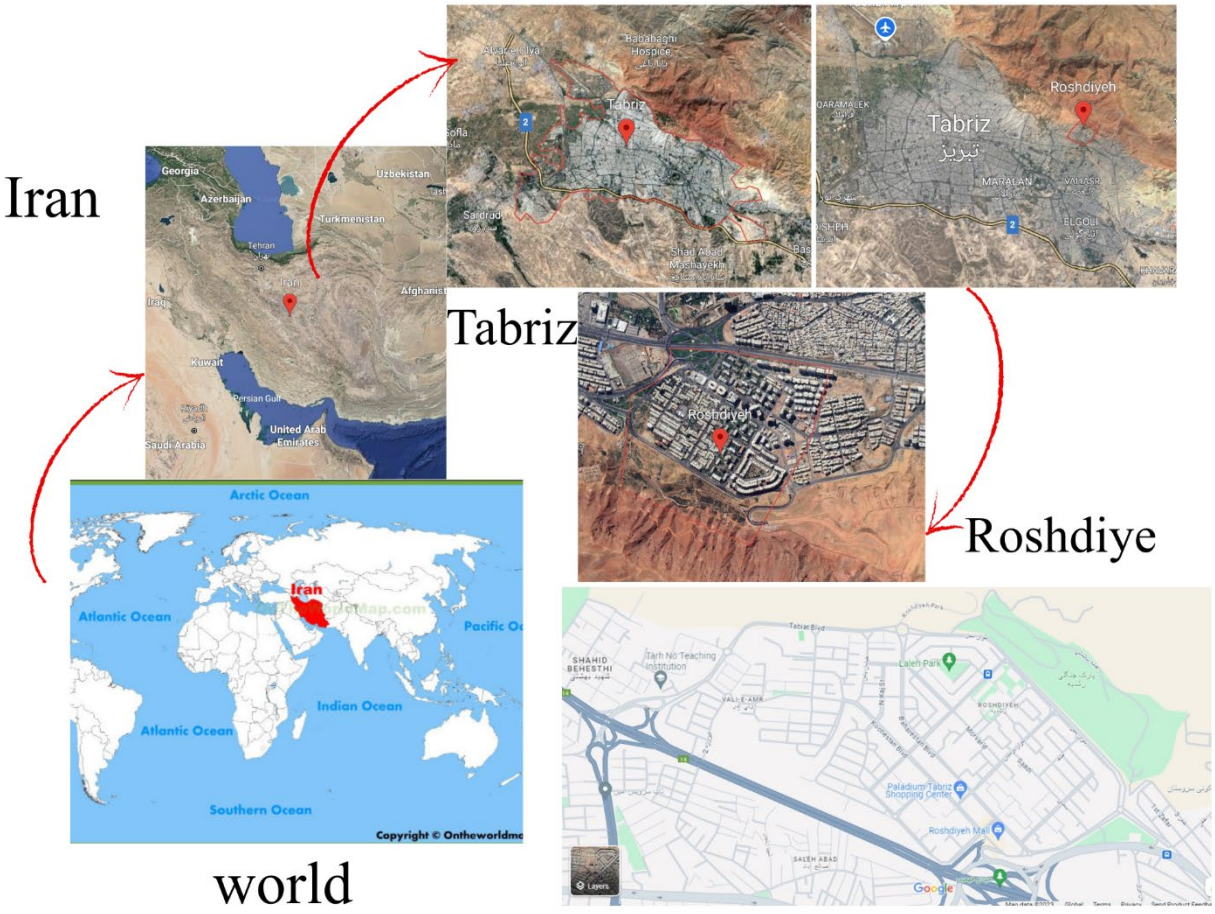


Figure 1. Location map of the work area



Figure 2. 9 areas determined within the study area (The area may change during project implementation)

2.2. Land Surface Temperature (AYS) Analysis

AYS was calculated using the thermal bands of Landsat satellite images for the years 2000, 2010, 2020, and 2025. For each year, cloudless images representing the hottest month in summer and the coldest month in winter were selected.

The LST calculation was based on the automatic algorithm developed by Avdan and Jovanovska (2016), deriving supraatmospheric radiance, luminosity temperature and NDVI-based land surface emission from thermal banda. The obtained AYS raster were associated with land use/cover classes and hot/cool areas were spatially mapped (Hasnat, 2021; Menteş et al. 2023; Çetin et al. 2024).

2.3. Micro-Climate Measurements

Hourly air temperature (Ta), relative humidity (RH), wind speed and direction, and global radiation measurements were carried out with portable sensors at selected representative points (SP1–SP6) in the city center and in Rushdie. Long-term fixed recordings at convenient points; In some corridors, measurements were taken along the route with a bicycle-mounted device.

These data have served as a reference for calibration and validation of ENVI-met and CFD models; it was also used as input in PET and MRT calculations with the RayMan model (Matzarakis et al. 2006).

2.4. Bioclimatic Indicators

The following indicators were taken into account in the outdoor thermal comfort assessment:

Physiological Equivalent Temperature (FES/PET): Based on PET threshold values recommended by Yılmaz et al. (2025) for local climatic conditions; "comfortable", "cool/cold" and "warm" ranges were interpreted according to this classification.
Mean Radiant Temperature (MRT): Shading represents the combined effect of surface temperatures and long-wave radiation (Haeri et al. 2023; Kotharkar et al. 2024).
Wind Chill Conditions: The combined effect of low temperature and high wind has been evaluated for pedestrian comfort, especially during winter months (Irmak et al. 2020).
Sky Vision Factor (SVF): Used to reflect the effect of street canyon geometry on radiation and nighttime cooling.

2.5. ENVI-met Scenarios

Using ENVI-met software, the Rüşdiye workspace was modeled in a 3D grid structure. Building heights, roof forms, floor coverings and vegetative elements were defined according to field observations and satellite images.
Four basic scenarios were constructed:
S0 – Current Status: Existing planting and surface materials.
S1 – Increased Impermeable Surface: Hypothetical situation where the ratio of parking lot and hard ground is increased.
S2 – Increased Planting (Deciduous-Weighted): Street afforestation and increasing the area and density of small green spaces.
S3 – Windbreaks and Mixed Surface Design: Climate-sensitive design scenario with evergreen windbreaks, afforested streets, permeable floors, and limited water surfaces on the edge facing the prevailing wind direction (Irmak et al.2018; Ertem Mutlu et al. 2024).
Typical days, summer and winter, were selected for each scenario, and PET, MRT, wind speed and surface temperatures were calculated with 24-hour simulations.

2.6. CFD-Based Wind Flow Analysis

In order to study the wind current and turbulence structure, a simplified 3D model of the study area was imported into a CFD software (similar to ANSYS Fluent). A N–ε-based turbulence model was used, and prevailing wind directions and speed classes were defined in boundary conditions (Mirzaei, 2021; Ahmad et al. 2025).
In S0 and S3 scenarios:
Wind speed at pedestrian level (1.5 m),
Turbulence kinetic energy and
Pressure fields
compared; the effect of windbreaks and tree rows on wind relief was evaluated (Kubilay et al. 2024; Javanroodi et al. 2022).

3. LITERATURE SUMMARY

3.1. Tabriz – El Golu Park: Improving Thermal Comfort with Water and Trees

Teshnehdel et al. (2022), *"Improving Outdoor Thermal Comfort in a Steppe Climate: Effect of Water and Trees in an Urban Park* (Tabriz, El Gölü Parkı)".
In the "steppe" climate, the climate of which is very similar to Tabriz, they chose El Golu Lake Park as a model area.
They compared the following scenarios with ENVI-met:
Current situation (lake + trees)
Scenario without a lake
Treeless scenario
Different tree/water combinations
They calculated PET with RayMan and analyzed thermal comfort on the hottest day of summer.
Main findings:
When wood + water were used together, lower PET was obtained compared to only water or only trees.
When the lake was removed, the weather and MRT increased significantly, especially at noon, and comfort deteriorated.
The model is very well validated by the measured MRT ($R^2 \approx$ around 0.9).

Tabriz and El Golu are directly compatible with the LST, ENVI-met and PET approach.
My work focuses on wind and urban texture (Rüşdiye); taking an example from this work, it focuses on the combination of parks and water/trees. By using both together, I can install water/green at park-unit scale and wind and landscape at settlement scale.

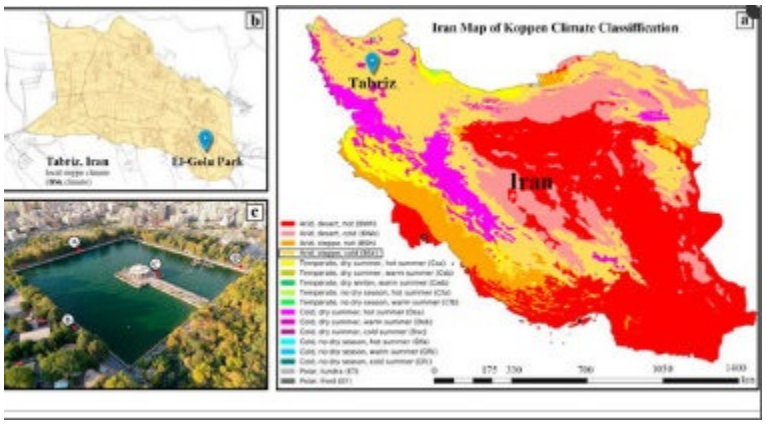


Figure 3. Iran map of Koppen climate classification (a), location of the studied site in Tabriz map (b), measurement points on the site of El-Golu park (c) Teshnehdel et al. (2022).

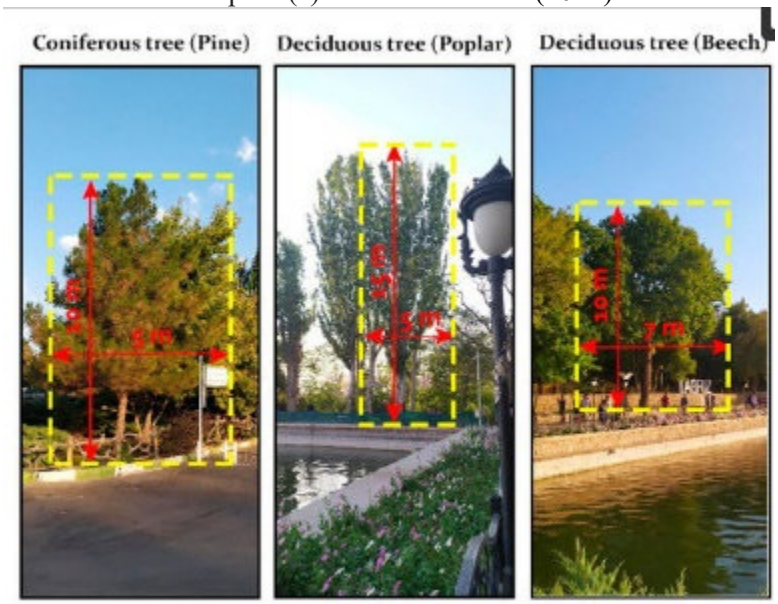


Figure 4. A view of three different trees planted in El-Golu park (trees exemplary dimensions in red) Teshnehdel et al. (2022).

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EXPLORING THE INTERACTION BETWEEN VERNACULAR ARCHITECTURE AND CONTEXTUALISM: A THEORETICAL AND ANALYTICAL FRAMEWORK FOR SUSTAINABLE DESIGN

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Abstract
This article examines the interaction between vernacular architecture and contextualism, analyzing the effects of the natural, cultural, and social characteristics of the environment on the identity and functionality of local buildings. Vernacular architecture is shaped by the traditional knowledge and experiences of local communities, utilizing local materials and construction techniques, and represents a prominent example of humanity's spontaneous response to its natural and social environment. While meeting functional needs, this type of architecture also embodies societal values and cultural identity and strengthens environmental sustainability through harmony with climate and the surrounding environmental fabric.Contextualism, as both a theoretical and practical approach, focuses on the interaction between architecture and its natural, cultural, and historical context, playing a significant role in spatial coherence, place identity, and the adaptation of buildings to environmental conditions. Literature reviews indicate that vernacular architecture inherently possesses contextual qualities and can offer an applicable model for contemporary design. Using a descriptive–analytical method, this study examines how environmental, cultural, and social characteristics are reflected in design and function within vernacular architecture, analyzing the relationships between these two concepts across different contextual dimensions.
The findings demonstrate that simultaneous consideration of the physical, human, and cultural dimensions of context is effective in shaping the identity and sustainability of vernacular buildings and can serve as a valuable guide for contemporary architectural design. Thus, vernacular architecture is not only a cultural and historical heritage but also provides a theoretical and practical framework that responds to contemporary needs and enhances design quality within natural and cultural environments.

Keywords: Vernacular Architecture, Contextualism, Place Identity, Sustainable Design

1. Introduction

In recent years, research in the field of architecture has sought to review and develop key concepts, definitions, and theoretical frameworks. One of the prominent topics in this process has been the examination of the role of context in the formation and shaping of architecture at various levels. Vernacular architecture, as a phenomenon that has developed and evolved across different geographical and cultural contexts throughout history, is directly linked to natural conditions, cultural values, and social needs; these structures can be seen as reflections of historical human experiences in interacting with the environment, distinguishing them from formal architecture (Rong & Bahauddin, 2023; Chandel et al., 2016). Recent studies indicate that this type of architecture is not merely a carrier of traditional and practical knowledge, but also represents a significant example of adaptation to climate and cultural context in contemporary theory (Nguyen et al., 2019).
In contemporary research, vernacular architecture is often defined as structures that respond spontaneously and experientially to life needs and environmental conditions, utilizing local resources, materials, and techniques, and involving direct community participation. This definition emphasizes a strong connection to place and time, and recent studies show that this dependence is being reconsidered, particularly within contemporary design frameworks and in the context of environmental crises (Arias Tapiero et al., 2025; Qtaishat & Qtaishat, 2020; Matar et al., 2023).
Meanwhile, contextualism in architecture is increasingly recognized as an important theoretical framework in recent critiques and redefinitions, where a building is considered not merely as an independent object, but as part

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of a broader natural, cultural, and social context (Diz-Mellado et al., 2023). Although the formal presence of the terms "vernacular architecture" and "contextualism" in contemporary literature is relatively recent, the conceptual roots of both terms lie in the interaction between structures and the "text" of their environment and human life. From this perspective, vernacular architecture can be seen as a practical form of contextualism, where respect is given to the climatic, cultural, and social context in relation to the building and its function (Yang et al., 2024).

In other words, while formal architecture in the 20th century defined itself through formalism and technology, current studies show that even in the modern era, attention to the natural environment and local fabric has remained part of the design logic, and in contemporary times, this attention is approached more consciously and discussed theoretically (Pardo, 2023). Consequently, it can be argued that contextualism exists in many examples of vernacular architecture, shaping spatial experience and function, regardless of whether the designer consciously follows this approach (Arias Tapiero et al., 2025). When vernacular and contextual architecture are considered in response to the unique conditions of place and time, it becomes evident at first glance that the two approaches are closely related. In this context, this article aims to reexamine the concepts and frameworks related to vernacular architecture and contextualism, analyzing how and to what extent these two concepts are interconnected across different contextual dimensions. The central research question is how the relationship between vernacular architecture and contextualism is shaped within each contextual dimension. The answer to this question may contribute to a deeper understanding of the role of context in architectural formation and to the utilization of local knowledge in contemporary design.

While previous studies have examined the conceptual relationship between vernacular architecture and contextualism, this study extends the discussion by systematically analyzing their interaction across multiple contextual dimensions—including physical, cultural, social, and environmental—within a coherent theoretical and analytical framework aimed at informing sustainable architectural design.

2. Research Background

In recent years, research in the fields of vernacular architecture and contextualism has gained increasing importance, with vernacular architecture emerging as a type of architecture that is harmonious with the natural, cultural, and social environment and being considered in contemporary designs as well (Rong & Bahauddin, 2023). This type of architecture is shaped by experiential knowledge, local materials, and responses to climatic and cultural needs, and is regarded in contemporary theoretical analyses as an indicator of the relationship between the building and its context (Yang et al., 2024).

Contextual architecture, as an approach that considers the natural, social, and historical context of a building, has been recognized as an important method in architectural analysis and design. Various studies highlight the role of this approach in ensuring design adaptation to the environment (Al Fadalat & Azhari, 2022). In particular, analyzing the role of contextualism in the formation and identity of vernacular architecture has shown that attention to context is not limited to physical elements but also influences the cultural and historical identity of a building, thereby enhancing its harmony with the environment and sustainability (Baper, 2024; Arias Tapiero et al., 2025).

This literature demonstrates that attention to context is an inseparable part of architectural analysis and design, both theoretically and practically; vernacular architecture provides a striking example of interaction with the natural, cultural, and social contextual elements of a building. In this regard, the relationship between vernacular architecture and contextualism is analyzed in this study across different contextual dimensions, offering a deeper understanding of the role of context in shaping the identity and function of such architecture (Rong & Bahauddin, 2023).

"Theoretical Examination of the Interaction Between Vernacular Architecture and Contextualism: Conceptual and Fundamental Framework"

The theoretical framework of this research is based on the fundamental concepts of "vernacular architecture" and "contextual architecture," with vernacular architecture inherently exhibiting contextualist characteristics. This approach demonstrates that architectural design should not only meet functional and aesthetic requirements but must also be fully aligned with the natural, cultural, and social context (Pardo, 2023).

Contemporary studies emphasize that vernacular architecture provides a clear example of interaction with context through experiential knowledge, local materials, and attention to climatic, social, and cultural characteristics, and that this interaction can serve as an indicator in design analyses (Yang et al., 2024). Moreover, the concept of contextualism in contemporary architecture shows that attention to environmental harmony and spatial identity

can enhance design diversity and quality while ensuring that a building is sustainable and adaptable (Baper, 2024; Al Fadalat & Azhari, 2022).

The methodology of this research is descriptive-analytical, examining the literature on vernacular and contextual architecture to analyze the relationship between them (Al Hammadi & Grchev, 2022; Arias Tapiero et al., 2025). Data were collected through library studies, and the perspectives of leading theorists and researchers were used to extract the relationship between contextualist characteristics and the different dimensions of vernacular architecture. Additionally, field research could provide deeper insights into the practical application of this approach in various examples. This theoretical framework enables researchers to focus on contextual features in vernacular architecture, develop applicable rules and principles for contemporary designs, and gain a deeper understanding of the relationship between vernacular architecture and contextualism (Al Fadalat & Azhari, 2022; Baper, 2024).

3. Contextual Architecture

Contextual architecture is an approach in architectural theory and practice that considers a building's design as a direct response to the physical, cultural, social, and historical characteristics of its site. While most modern approaches treat the building as an object independent of its surroundings, the contextual approach requires architecture to be harmonious with the natural environment, historical fabric, and surrounding cultural elements. In this way, both "spatial identity" is preserved and the context is reflected in the design. This perspective, known as "contextualism," has gained significant importance in contemporary architectural theory, contributing to a building's sustainable, visually coherent, and positively interactive relationship with its environment (Al Fadalat & Azhari, 2022).

In the architectural literature, the term "context" encompasses a range of factors, including geographical, climatic, historical, cultural, social, and human conditions in which architecture is formed. Contextualism does not merely respond to environmental conditions; it also considers the interaction between humans and their surroundings, allowing the building, nature, history, and culture to engage in a dialogue throughout the design process. Various studies have shown that the spatial integrity of a building can be enhanced in relation to its environment through adherence to traditional form principles and the use of local materials, thereby improving performance and design quality (Nguyen et al., 2019; Qtaishat & Qtaishat, 2020).

Moreover, recent research emphasizes the interaction of vernacular architecture with climatic and cultural characteristics, highlighting that this interaction can serve as an appropriate criterion for design analysis and building sustainability (Matar et al., 2023; Diz Mellado, Gallego Sánchez, & Pérez Sánchez, 2023). This approach positions architecture as part of a broader environmental context and underscores the necessity of aligning design with environmental integrity and contextual features.

4. Vernacular Architecture

Vernacular architecture is primarily a type of architecture based on the traditional knowledge and experience of local communities; in this context, buildings and forms are shaped as a response to the natural, cultural, and social conditions of the community, rather than strictly following formal styles or academic design rules. In this approach, materials, techniques, and construction methods are mostly derived from local resources and collective knowledge and are developed to meet the real needs of people in a specific climatic environment. A fundamental characteristic of vernacular architecture is its ability to respond to the functional and cultural needs of the community using local materials and techniques. These buildings are typically constructed with local materials and adapted to climatic and cultural conditions, making them more harmonious and integrated with their surrounding natural and human environment (Yang et al., 2024; Fadalat & Al Azhari, 2022).

Design patterns in vernacular architecture are generally shaped through direct observation of nature, trial-and-error processes, and experiences passed down through generations; they do not originate from abstract aesthetic theories or design philosophies (Baper, 2024). Modern studies indicate that vernacular architecture plays an important role in environmental sustainability and adaptation; such buildings naturally respond to the local climate, utilize local materials, and manage energy and resources efficiently (Fadalat & Al Azhari, 2022).In conclusion, vernacular architecture can be defined as a type of architecture shaped by real human needs and experiences, responding to the natural and cultural environment, and evolving through local knowledge transfer and community

participation. Continuously adapting to local conditions over time and place, this architecture embraces the principles of simplicity, adaptability, and responsiveness to human needs (Pardo, 2023).

4. Vernacular Architecture and Contextualism

Vernacular architecture is defined as buildings that are deeply and directly connected to a specific geographical area, and it is primarily shaped by local experiences, culture, climate, and natural resources. This type of architecture is sometimes also referred to as "local architecture," "traditional architecture," "folk architecture," or "architecture without architects," and it reflects the belonging of buildings and spaces to a particular environment and their harmony with the human and physical context of the region. The concepts of "ecosystem" or "region" here refer to areas with specific environmental and climatic characteristics, in which architecture has been developed according to local conditions and needs. Vernacular architecture is generally designed using local materials, traditional construction techniques, and spatial arrangements, aiming to achieve maximum harmony with its surroundings (Rong & Bahauddin, 2023).

In formal and professional architecture, buildings are planned and designed by trained architects in a structured and programmatic way, whereas vernacular architecture emerges from the collective experience and daily needs of the community. This architecture responds to the material and spiritual needs of residents and draws inspiration from daily life and social interactions, thereby being in full harmony with time and place. Structures and forms in vernacular architecture are typically simple and modest; no specific style or standard model is applied, and their core characteristics are contextual harmony and the use of local materials.A fundamental feature of vernacular architecture is its focus on the human and cultural context; buildings respond to the needs, behaviors, and lifestyles of people according to environmental and cultural conditions. At the same time, they establish a natural and tangible connection with place and time, demonstrating the essence of contextualism. Vernacular architecture is not only a symbol of cultural and social identity but also a reflection of respect for nature and adaptation to climatic conditions. In this type of architecture, social and economic relationships and cultural symbols are expressed in harmony with the natural environment, combining simplicity, functionality, and aesthetics. Furthermore, vernacular architecture naturally adapts better to environmental changes and climate conditions (Pardo, 2023).

In general, vernacular architecture arises from social participation, practical experience, and knowledge passed down through generations; people develop a sense of belonging to their spaces and establish a link between daily life, culture, and the natural environment. These features clearly highlight the importance of contextual focus in vernacular architecture and are considered one of the fundamental elements of sustainable and environmentally sensitive design in scientific research. Examples of vernacular architecture can be found worldwide, with each region reflecting its own cultural, climatic, and social fabric. For instance, traditional houses in Yazd and Isfahan in Iran are built using local materials (adobe and clay) and respond to the climatic and social conditions of the region. Forms such as central courtyards, wind towers, and traditional arcades demonstrate the harmony of these structures with both the natural environment and human needs; similar examples exist in other parts of the world, showing that architecture can adapt to different environmental contexts (Chandel et al., 2016).

Vernacular architecture typically emerges in contrast to formal and luxurious architecture that focuses primarily on aesthetics or display. Instead, it is simple, functional, and compatible with local culture and environment; through experience accumulated over generations and adaptation to climatic, social, and economic conditions, it responds to the real needs of the people in a specific time and place.The contextual approach in architecture (Contextualism) requires attention to natural, cultural, and social contexts, and this necessitates a thorough understanding of local culture and environmental conditions.

Vernacular architecture offers a concrete example of this approach, as it establishes a deep connection with the region's culture, history, and climate. In this context, design should respond to the needs of humans and the natural environment within the framework of time and place, taking cultural and environmental values into account in the formation of spaces. In vernacular architecture, natural, social, and cultural influences are expressed simultaneously and integratively, reflecting the relationship between society and its surroundings. This architecture strengthens the link between humans, history, culture, and the natural environment, paralleling today's principles of sustainable and adaptive architecture. While human needs are fundamentally similar across different societies, the ways these needs are addressed in vernacular architecture are unique to each region. Each society has designed spaces and forms appropriate to daily life and social interactions according to its cultural, social, and climatic characteristics. Vernacular architecture is often in harmony with local climatic conditions, which in turn reinforces spatial identity and strengthens residents' sense of belonging to their environment (Chandel et al., 2016).

Table 1: Comparative Table of the Concepts of Vernacular Architecture and Contextualism

Concept/Feature	Vernacular Architecture	Contextualism	References
Relationship with Space	Every structure is tied to a specific space, and its forms are compatible with the climate and local resources.	Design must be appropriate for natural, cultural, and urban conditions.	Oliver, 2006; Naqavi & Kiani, 2019
Role of Human	Emerges as a result of continuous experience and social activity; responds to human needs.	The design emphasizes the interaction of humans with the environment and the consideration of human scales.	Pardo, 2023; Tapiero, Ortega & Vasconcelos, 2025
Material and Resources	Local and accessible materials are used; traditions and culture are reflected.	Materials and forms must be compatible with the environment, and their environmental impacts must be considered.	Al Hammadi & Grchev, 2022; Naqavi & Kiani, 2019
Form and Shape	Simple, unpretentious, distant from formal patterns.	Forms must be compatible with the environment, creating a sense of belonging and continuity.	Rudofsky, 1964/2025; Oliver, 2006
Time and Transmission	Experiences and forms transmitted across generations.	Design is done considering historical and spatial values.	Tapiero, Ortega & Vasconcelos, 2025; Pardo, 2023
Relationship with Nature	Compatible with climate, site, and natural environment.	Design must be compatible with natural conditions and environmental characteristics.	Naqavi & Kiani, 2019; Al Hammadi & Grchev, 2022
Social Function	Creates public spaces; establishes a bond between society and the environment.	Design should strengthen social and cultural interactions.	Pardo, 2023; Tapiero, Ortega & Vasconcelos, 2025
Cultural Identity	Reflects identity, customs, and way of life.	Design should protect local history and cultural identity, and be compatible with the natural environment.	Oliver, 2006; Rudofsky, 1964/2025

Vernacular architecture refers to building types that have a deep and direct connection to a specific geographical area and are primarily shaped by local experiences, culture, climate, and natural resources. This type of architecture is sometimes also referred to as “local” or “traditional” architecture and reflects that buildings and spaces belong to a particular environment, in harmony with the human and physical context of the region. The term “local” here refers to an area with specific environmental and climatic characteristics where architecture is developed in accordance with natural conditions and residents’ needs. Vernacular architecture is generally shaped using local materials, traditional construction techniques, and structural arrangements, ensuring harmony with its surroundings (Rong & Bahauddin, 2023).

Unlike formal and professional architecture, which is planned and systematically designed by trained architects, vernacular architecture is the product of collective experiences and responses to the daily needs of people. This type of architecture not only meets the material and functional requirements of residents but also emerges as a symbol of cultural and social values, shaped by daily life and social interactions (Nguyen et al., 2019; Arias Tapiero et al., 2025).

A fundamental characteristic of vernacular architecture is its simultaneous attention to human, cultural, and natural contexts; the design and construction of buildings respond to people’s needs, behaviors, and lifestyles while considering the natural and cultural environment. This architecture respects the natural environment and climatic conditions and establishes a direct connection with the residents’ human and cultural needs. For example, the use of natural ventilation, materials with appropriate thermal capacity, and spatial arrangements suited to climatic conditions are among the sustainable features of vernacular architecture (Sahebzadeh et al., 2017).

Three main perspectives emerge in the contextual redefinition of vernacular architecture:

1.Creativity and formal freedom: Architects or builders can use their taste and experience to design forms and details compatible with the natural and cultural features of the region, expressing personal creativity. Vernacular architecture has developed in many societies according to local knowledge and traditions.

2.Influence of cultural context: Although design allows freedom, architects always respect the cultural environment and societal values, which can influence the design directly or indirectly and strengthen its connection

with the human context. Comparative studies show that vernacular architecture worldwide reflects local beliefs, customs, and social systems.

3.Attention to natural and physical context: Design and construction should be compatible with natural and climatic conditions, available resources, and land characteristics. The use of local materials and technologies, along with adaptation to climatic principles, produces both functional and sustainable buildings. For instance, in Iranian vernacular architecture, proper orientation of buildings and the use of materials with high thermal capacity are crucial for improving thermal comfort and reducing energy consumption (Sahebzadeh et al., 2017).

Forms and spaces in vernacular architecture are connected to daily life and the economic, social, and cultural needs of people. Even the simplest buildings can convey the spiritual and cultural messages of their builders, combining function, aesthetics, and cultural identity. Therefore, studying vernacular architecture without considering natural, human, and historical contexts would be incomplete (Nguyen et al., 2019).

Vernacular architecture can be seen as a building type shaped by the needs, materials, knowledge, and cultural traditions of a region, defining local identity, human context, and the natural environment in relation to each other. Unlike globalized approaches, this architecture demonstrates deep adherence to local, climatic, cultural, and historical conditions and reflects collective societal experience and historical processes in its form, construction methods, and materials used.

From a contextual perspective, design should align with environmental context, history, and previous spatial arrangements, contributing to continuity between society and its environment. Vernacular architecture not only responds to climate and functional needs but also strengthens the sense of belonging between people and their living spaces and lays the foundation for sustainability. Global studies have shown that vernacular architecture, especially in historic urban fabrics, can serve as a model for sustainable design and urban revitalization (Nguyen et al., 2019; Rong & Bahauddin, 2023).

This approach preserves the continuity of past structures and forms while adapting them to present time and place, providing opportunities for innovation based on local identity and sustainability. In this way, new designs can meet functional needs while supporting climatic and cultural sustainability, adapted from local principles (Chandel et al., 2016; Sahebzadeh et al., 2017).

Table 2: Comparative Analysis of Key Characteristics of Vernacular Architecture and Contextual Approach

Concept/Feature	Vernacular Architecture	Contextualism	References
Relationship with Space	Every structure is tied to a specific space, and its forms are compatible with the climate and local resources.	Design must be appropriate for natural, cultural, and urban conditions.	Oliver, 2006; Naqavi & Kiani, 2019
Role of Human	Emerges as a result of continuous experience and social activity; responds to human needs.	The design emphasizes the interaction of humans with the environment and the consideration of human scales.	Pardo, 2023; Tapiero, Ortega & Vasconcelos, 2025
Material and Resources	Local and accessible materials are used; traditions and culture are reflected.	Materials and forms must be compatible with the environment, and their environmental impacts must be considered.	Al Hammadi & Grchev, 2022; Naqavi & Kiani, 2019
Form and Shape	Simple, unpretentious, distant from formal patterns.	Forms must be compatible with the environment, creating a sense of belonging and continuity.	Rudofsky, 1964/2025; Oliver, 2006
Time and Transmission	Experiences and forms transmitted across generations.	Design is done considering historical and spatial values.	Tapiero, Ortega & Vasconcelos, 2025; Pardo, 2023
Relationship with Nature	Compatible with climate, site, and natural environment.	Design must be compatible with natural conditions and environmental characteristics.	Naqavi & Kiani, 2019; Al Hammadi & Grchev, 2022
Social Function	Creates public spaces; establishes a bond between society and the environment.	Design should strengthen social and cultural interactions.	Pardo, 2023; Tapiero, Ortega & Vasconcelos, 2025
Cultural Identity	Reflects identity, customs, and way of life.	Design should protect local history and cultural identity, and be compatible with the natural environment.	Oliver, 2006; Rudofsky, 1964/2025

5.Conclusion

Vernacular architecture is a prominent example of human interaction with the natural, social, and cultural environment, shaped over time by experience, practical needs, and available resources. Unlike academic and formal architecture, which relies on styles and structured education, vernacular architecture emerges spontaneously as a product of collective experience and in response to environmental and cultural conditions. This architecture is naturally harmonious with climate, local materials, and cultural fabric, and its core principles—simplicity, adaptability, use of local materials, and responsiveness to real human needs—symbolize a deep connection between humans and the natural environment.

Research shows that vernacular architecture, beyond reflecting traditional knowledge and practical skills, offers a sustainable model for contemporary design. Its forms and spaces are aligned with climatic characteristics, available resources, and social behaviors, while reinforcing a sense of place, local identity, and the human-environment relationship. Interaction with context in vernacular architecture encompasses both physical and natural dimensions as well as human, social, and cultural aspects; thus, buildings not only meet functional needs but also convey cultural, historical, and spiritual messages.The contextual approach in architecture (contextualism) views design as directly interacting with natural, human, and historical environments, and this approach is clearly observable in vernacular architecture. It allows for innovation based on existing fabric and history and contributes to creating sustainable, coherent spaces that meet human and climatic needs while preserving local identity.

In conclusion, vernacular architecture is not only a cultural and traditional heritage but also a practical and theoretical sustainable model for contemporary design. Harmonization with the natural environment, attention to human and cultural context, and the use of local knowledge can create spaces with a distinct identity that are coherent and responsive to community needs. Understanding the characteristics of vernacular architecture and the dimensions of contextualism is crucial for achieving both sustainable and identity-rich contemporary design.

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REVISITING ISLAMIC ART IN CONTEMPORARY ARCHITECTURE: THE SEPARATION OF ORNAMENTATİON FROM MEANING

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Abstract
In contemporary architecture, the use of Islamic art is often reduced to decorative and superficial applications, distanced from its metaphysical and meaningful foundations. The aim of this study is to compare the application of the principles of Islamic art in contemporary architecture through two approaches: ornamentation and meaning-making. Drawing on the perspectives of scholars of Islamic art, geometric and proportional principles, the use of light, and the integrated interlacing of forms have served as a language for generating meaning within Islamic art. Based on these principles, this article examines and analyzes several case studies. The central question asks how contemporary architecture can transition from a "decorative application" to a "meaning-oriented application" of Islamic art.
This article employs a case-study strategy and, through an analytical–interpretive approach, compares three examples of contemporary works: The Museum of Islamic Art in Doha, The Sheikh Zayed Grand Mosque in Abu Dhabi, and The Harvard Management School (Imam Sadiq University) building in Tehran. The hypothesis posits that the reinterpretation of tradition in these works gravitates toward two poles ornamentation and meaning-making: In the architecture of the Doha Museum and the Management school, meaning is rearticulated through traditional geometry and light; whereas in the Sheikh Zayed Mosque, emphasis is placed primarily on the splendor of ornament and visual spectacle.
The findings indicate that the conscious application of the principles of Islamic art can lead to spatial configurations that are rooted in tradition while speaking the language of contemporary design. Accordingly, the study argues that reviving meaning-making in contemporary architecture is achievable only through interdisciplinary education that bridges Islamic art and architectural design—an education that guides designers toward understanding the philosophy and worldview underlying form and ornament, thereby opening new capacities for innovation.
Keywords: Islamic art; contemporary architecture; ornament; meaning; geometry; light; tradition.

1.Introduction

In recent decades, architecture in Islamic societies has been confronted with a serious challenge in its engagement with tradition. On the one hand, processes of globalization, technological developments, and identity-driven motivations have encouraged architects to employ traditional symbols and signifiers. On the other hand, the expansion of large cultural, religious, and urban projects has placed the use of "Islamic art" once again at the center of attention. Yet, what is observed in a significant portion of contemporary architecture is the use of elements of Islamic art in a formalistic and decorative manner, whereas Islamic art, at its core, has never been merely a collection of motifs but rather the manifestation of a monotheistic worldview and a bearer of meaning. Detaching these elements from their semantic logic reduces ornamentation to a superficial sign of identity, unable to generate a profound spatial experience for users.
The importance of this issue lies in the fact that, throughout the history of Islamic art, ornament has been inherently linked to foundational concepts such as the presence of light, the search for unity within multiplicity, proportion, and repetition—concepts that guided the spatial experience toward a sense of the sacred (Hillenbrand, 1994). In this architectural tradition, ornament was not an "added layer," but an integral part of its semantic and spiritual structure. In much of contemporary architecture, however, this intrinsic relationship between ornament and meaning has been severed. From the viewpoint of many scholars, this rupture signals a crisis of identity in the contemporary architecture of the Islamic world—a crisis that underscores the need for a critical re-reading of Islamic art in today's design practices (Noghrehkar, Hamzehnezhad, & Ranjbar Kermani, 2008).

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The scope of this study is defined at two levels: theoretical and comparative. At the theoretical level, the article reviews the perspectives of scholars such as Burckhardt, Nasr, and Ardalan to extract meaning-centered principles of Islamic art—principles such as sacred geometry, light as a carrier of meaning, order and rhythm, and the role of intermediary spaces in guiding experience. At the comparative level, three representative examples of contemporary architecture are selected, each exhibiting a distinct approach to Islamic tradition: The Museum of Islamic Art in Doha, The Sheikh Zayed Grand Mosque in Abu Dhabi, and The School of Management in Tehran. These works differ in function, cultural position, and relationship to tradition, enabling an examination of three divergent models of expressing Islamic art: semantic reinterpretation, formal representation, and localized translation.

The primary aim of this study is to address how contemporary architecture can transition from a "decorative application" to a "meaning-oriented application" of Islamic art. To achieve this goal, the article seeks to demonstrate the conditions under which the principles of Islamic art become embedded within the spatial structure and the conditions under which they are reduced to formal elements. The significance of this aim lies in the potential of an informed reinterpretation of Islamic art to provide a pathway toward an architectural language that is at once contemporary and rooted—an approach that avoids both superficial imitation of the past and complete detachment from it, offering instead a creative translation of the timeless concepts of tradition.

Building on this theoretical foundation and research scope, the study develops three guiding questions:

How is Islamic art represented in contemporary architecture, and to what extent does it preserve its original spirit and meaning?

What distinctions exist between the decorative and the meaning-oriented uses of elements of Islamic art?

How can interdisciplinary education in art and architecture contribute to reviving this meaning in contemporary design?

2. Methodology

This study follows a case-study strategy with an analytical–interpretive approach and proceeds through three steps:

Step 1. Extraction of theoretical concepts

This step involves reviewing the writings of Nasr, Burckhardt, Ardalan, Hillenbrand, and other relevant sources, as well as examining visual documents and architectural drawings of the selected cases.

Step 2. Selection of case studies

Three cases—The Museum of Islamic Art in Doha, The Sheikh Zayed Grand Mosque in Abu Dhabi, and The School of Management in Tehran—were selected based on the following criteria:

location within three distinct cultural contexts,

diversity of function (cultural, religious, educational),

variety in their modes of engaging with tradition,

critical visibility and their evaluability within global architectural discourse.

Step 3. Interpretive analysis

The cases are interpreted using a hermeneutic approach and architectural analysis grounded in four semantic principles derived from the study's theoretical framework. The focus of this analysis is the "logic of space" rather than isolated elements.

3. Theoretical Framework

3.1. Islamic Art and the Tawḥidi Worldview

Islamic art, within its historical context, is not merely a collection of decorative forms; rather, it is an expression of a monotheistic worldview and a medium for conveying meaning. Scholars such as Seyyed Hossein Nasr and Titus Burckhardt have emphasized that Islamic art is founded on the principle of divine unity, and that its purpose is not to imitate nature but to move from outward appearance to inner reality, revealing truth through perceptible forms. According to Nasr, geometry, light, and rhythm serve as instruments for manifesting divine order, and every part of a work of art must point to the whole and embody a degree of meaning (Nasr, 1995). Burckhardt likewise describes ornament as a "luminous veil"—a veil that does not conceal truth, but reveals it through symbolic and abstract expression (Burckhardt, 2009).

Moreover, Ardalan and Bakhtiar, in *The Sense of Unity*, argue that Islamic architecture embodies a spatial–spiritual system that guides the human experience from darkness to light and from multiplicity to unity. In this sense,

ornament, geometry, and light in the Islamic tradition are not superficial components but manifestations of the connection between the sensible world and the realm of meaning (Ardalan & Bakhtiar, 2000). This theoretical foundation informs the analysis of the relationship between Islamic art and contemporary architecture in this study.

3.2. Islamic Art as a Language of Meaning

From the perspective of traditionalist scholars, Islamic art is a symbolic language that expresses metaphysical meaning through visual order. Burckhardt's analysis of "language and meaning" shows that sacred geometry, calligraphy, and repetitive patterns possess an expressive structure through which the world is portrayed as harmonious and law-governed (Burckhardt, 2009). Thus, the perception of beauty in Islamic art depends on understanding the inner order of the work.

Ardalan also stresses that geometry and proportion in Islamic architecture are not technical devices but manifestations of an understanding of unity of being. Spatial structure, movement pathways, centrality, light, and chiaroscuro all contribute to the semantic experience of the user (Ardalan, 2000). Accordingly, Islamic architecture produces a kind of "spatial discourse," in which pattern, line, and form carry epistemic significance.

This perspective indicates that to understand the use of Islamic art elements in contemporary architecture, one must first recognize their semantic language. If this language is reduced in contemporary design to surface ornament alone, meaning fades; but if its principles are integrated into the spatial structure, the creative rearticulation of tradition becomes possible.

3.3. Theoretical Principles Derived for Case Analysis

Based on the perspectives of Nasr, Burckhardt, Ardalan, and other scholars of Islamic art, five foundational principles are extracted for analyzing the architectural case studies in this article. These principles constitute the core of the Islamic aesthetic system and serve as criteria for evaluating the degree to which ornament is meaningfully integrated into contemporary architecture:

Sacred Geometry and Proportion:

Geometry in Islamic art conveys cosmic order and organizes spatial structure according to balance and unity (Critchlow, 1999). Proportions, centrality, and spatial rhythm form the key indicators of this underlying order.

Light and Shadow as Bearers of Meaning:

In the Islamic tradition, light symbolizes truth, and its presence in architecture carries epistemic significance. The manner in which light enters, filters through layers, and relates to spatial organization shapes the viewer's spiritual experience.

Spatial Hierarchy:

The gradual organization of spaces—whether from open to enclosed or from dark to illuminated—functions as a mechanism for directing perception and fostering inner attentiveness (Mirmiran, 2021).

Ornament Integrated with Structure:

Ornament acquires semantic value only when it is embedded within structure rather than applied superficially. The interrelation of structural rhythm, geometric pattern, and motifs indicates the presence of meaning within the building (Grabar, 1995).

Mythic Time and Continuity of Tradition:

Through rhythmic repetition, timeless patterns, and recurrence of cosmic order, Islamic art sustains continuity with tradition and situates the viewer in an experience beyond linear time (Grabar, 1995).

These five principles constitute the analytical foundation for examining the three architectural case studies in the subsequent sections.

4. Findings

Qualitative analysis of the three cases based on the five principles derived from the theoretical framework

1. Museum of Islamic Art, Doha — A Contemporary Translation of Tradition

Sacred Geometry and Proportion:

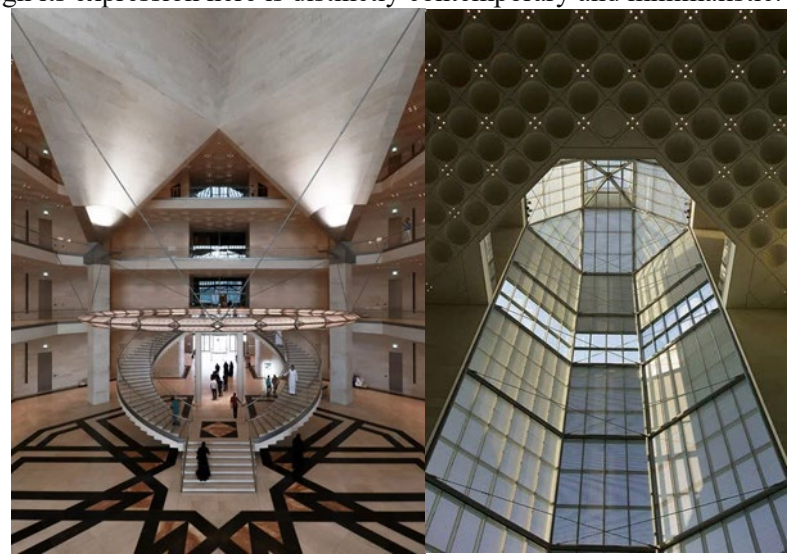
In the Museum of Islamic Art in Doha, geometry is not a formal device but the generative basis of the entire spatial organization. I. M. Pei, the architect, employs the square, the implied circle, and simple numerical ratios to construct a structure reminiscent of the inner order of Islamic art. The stepped cubic volumes and the geometric centrality of the building create a form of "inherent geometry" that radiates outward from the center. Although

this geometry does not explicitly reference sacred symbols, it embodies—at an abstract level—the same principles of order and unity.



Figures 1 and 2. Exterior view of the Museum of Islamic Art, Doha.

Light and Shadow as Bearers of Meaning:
Light functions as the principal meaning-giving element in this building. The funnel-shaped skylight channels daylight downward, producing a gradual modulation of illumination that recalls the journey from multiplicity toward unity. Shadows assume a decorative role, while the luminous lines created by the refraction of light generate a kind of spatial calligraphy. This approach is fully aligned with the traditional role of light in Islamic architecture, even though its expression here is distinctly contemporary and minimalistic.



Figures 3 and 4. Interior space of the Museum of Islamic Art, Doha.

Spatial Hierarchy:
Entry into the building proceeds from an open exterior space to a semi-darkened entrance hall, and then into the brightly illuminated central atrium—an accurate contemporary interpretation of spatial hierarchy in Islamic architecture. This revelatory sequence follows the same pattern found in early mosques and Persian gardens: concealment, transition, and revelation. Pei reinterprets this archetypal sequence without literal imitation, embedding it instead within the spatial structure of the building.

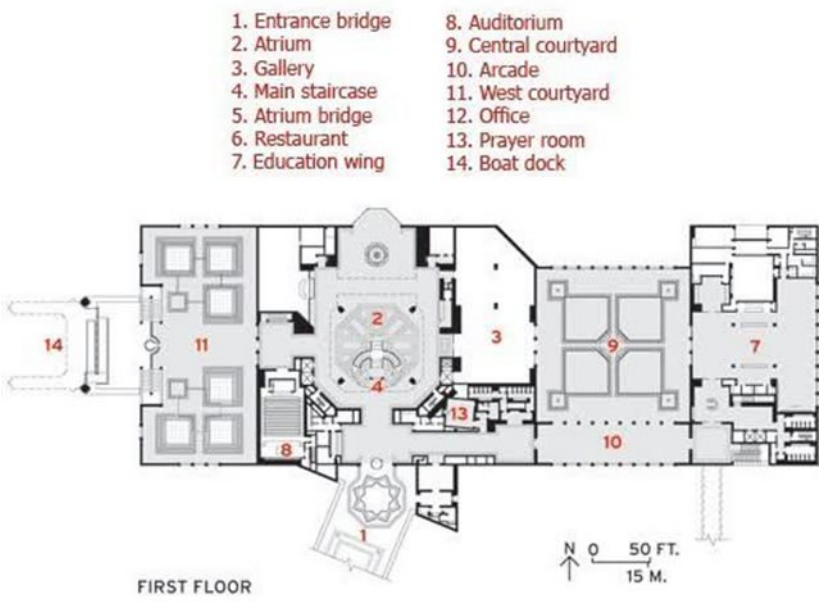
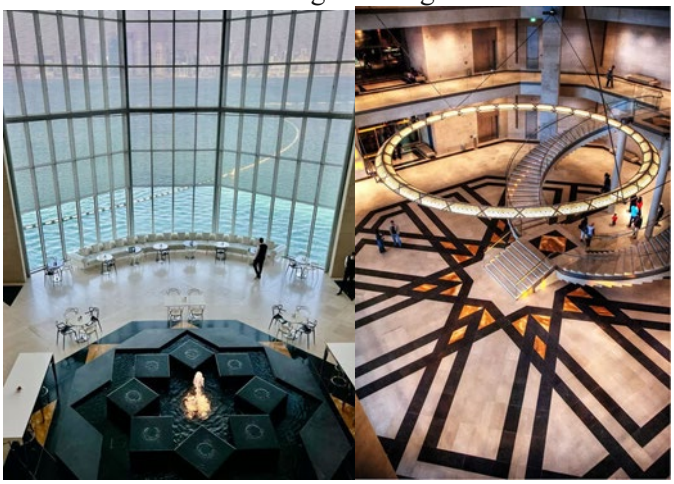


Figure 5. Sequence of entry in the Museum of Islamic Art, Doha.

Ornament Integrated with Structure:
Surface ornamentation is almost entirely eliminated in this building; instead, geometric structure, stone cuts, railings, and shadows themselves become ornament. This is the essence of "structural ornament"—an ornamentation that emerges from geometry rather than from applied motifs. Thus, ornament here is not embellishment but the natural outcome of structural logic and light.



Figures 6 and 7. Interior space of the Museum of Islamic Art, Doha.

Mythic Time and Continuity of Tradition:
The Doha museum does not reproduce tradition; rather, it translates it. This semantic translation creates a form of continuity with tradition at an abstract level. The building carries a sense of timelessness—belonging neither to the past nor the future, but suspended in an "intermediary time." This quality reflects the notion of mythic time that underlies Islamic architecture.

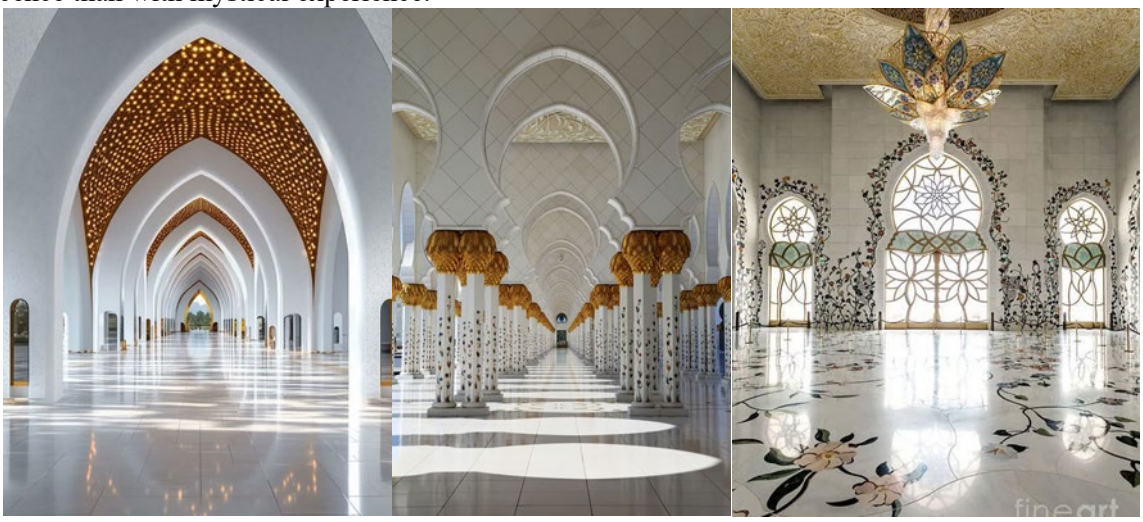
2. Sheikh Zayed Grand Mosque, Abu Dhabi — Ornamental Splendor and Identity Representation
Sacred Geometry and Proportion:
Geometry in this mosque is highly pronounced: axial symmetry, four minarets, a cascade of domes, and diverse geometric screens. Yet this geometry resides primarily at the level of form and ornament rather than within the deeper structural order. Although the proportions are precise, they aim chiefly to produce visual splendor rather

than to convey sacred meaning. Thus, geometry in this project functions more as representation than as manifestation.



Figure 8. Sheikh Zayed Grand Mosque, Abu Dhabi.

Light and Shadow as Bearers of Meaning:
The white light reflected from the marble creates a luminous, celestial atmosphere. However, this light is more "spectacular" than "spiritual." Nighttime illumination, too, is designed to emphasize the building's grandeur. As a result, light in this mosque carries meaning—but meaning associated more with national identity and magnificence than with mystical experience.



Figures 9–11. Light and shadow in the Sheikh Zayed Grand Mosque, Abu Dhabi.

Spatial Hierarchy:
The sequence of entry in this mosque is highly articulated: from an open forecourt to colonnades, then to the expansive white courtyard, and finally into the prayer hall. This progression creates a gradual transition into the sacred space. However, at many points, the monumental scale and extensive decoration overshadow the contemplative dimension, tilting the experience toward spectacle rather than spirituality.

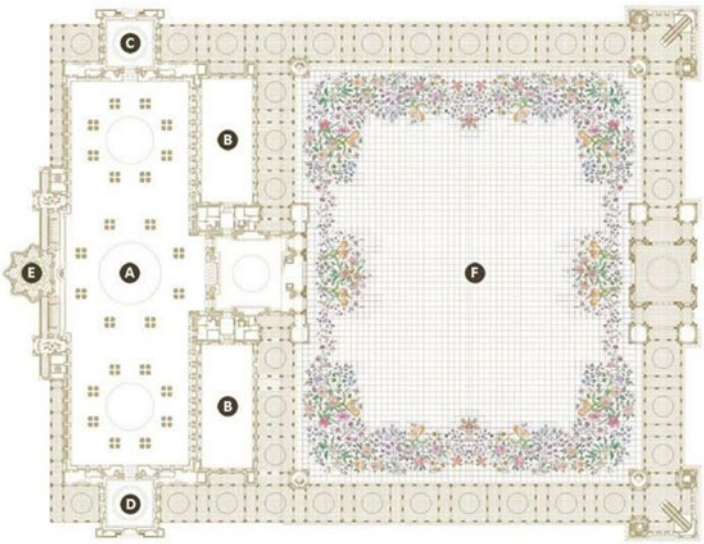
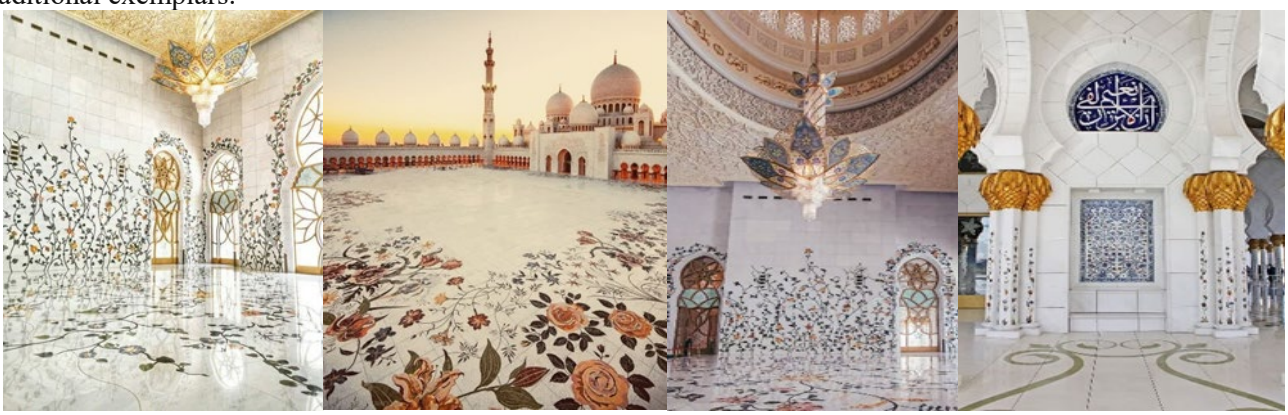


Figure 12. Sequence of entry in the Sheikh Zayed Grand Mosque, Abu Dhabi.

Ornament Integrated with Structure:
The mosque features vast decorative programs: floral motifs, calligraphic bands, stone inlay, and tilework. Although these elements are rooted in tradition, they sometimes detach from structural logic, functioning instead as a magnificent surface layer. For this reason, the integration of ornament and structure is weaker here than in traditional exemplars.



Figures 13–16. Ornamentation in the Sheikh Zayed Grand Mosque, Abu Dhabi.

Mythic Time and Continuity of Tradition:
The mosque attempts to represent tradition, but this representation is largely visual and identity-driven rather than conceptual or spiritual. Mythic time is present, yet veiled beneath layers of spectacle and grandeur. Continuity with tradition is therefore more formal than conceptual.

3. The School of Management (Imam Sadiq University), Tehran — A Semantic Re-Creation of Tradition
Sacred Geometry and Proportion:
Nader Ardalan employs geometry not as formal composition but as an expression of "cosmic order" embedded in the building. Movement axes follow golden-ratio proportions, and the central courtyard evokes the typology of the traditional Iranian house. Unlike postmodern projects, Ardalan's geometry is not symbolic or referential but existential and meaning-oriented.

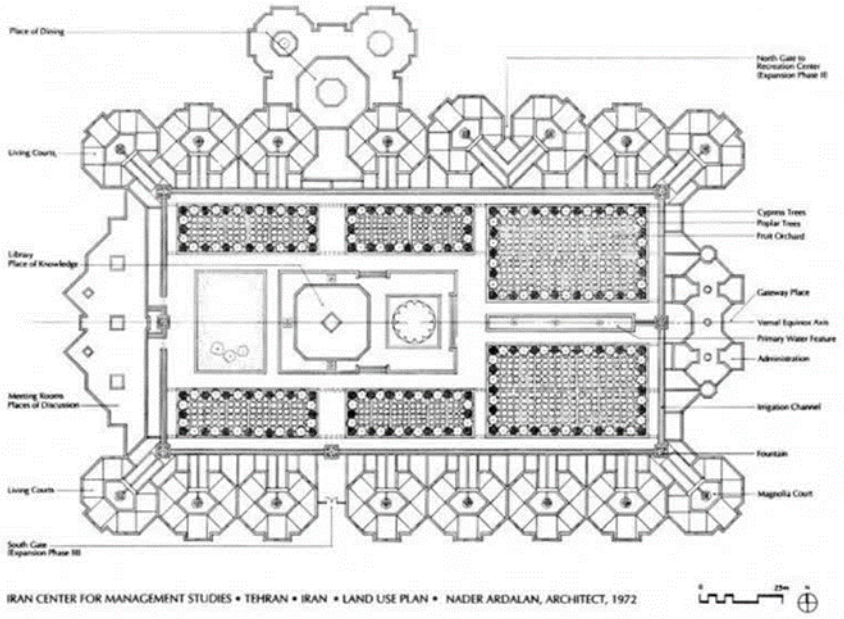


Figure 17. The School of Management, Tehran.

Light and Shadow as Bearers of Meaning:
Light in this building acts as a guide. The interplay of light and shadow along the circulation paths generates a mystical quality, and light enters gradually into the space. This calibrated use of light creates a tranquil, contemplative experience that aligns closely with Iranian architectural tradition.



Figures 18–20. Light and shadow in the School of Management.

Spatial Hierarchy:
The building is one of the strongest contemporary examples of the *mian-var* (intermediary) spatial system. Arcades, thresholds, and semi-open spaces produce a gradual sequence of transition. The user enters meaning not through ornament but through movement and light. This hierarchical experience is deeply rooted in tradition.

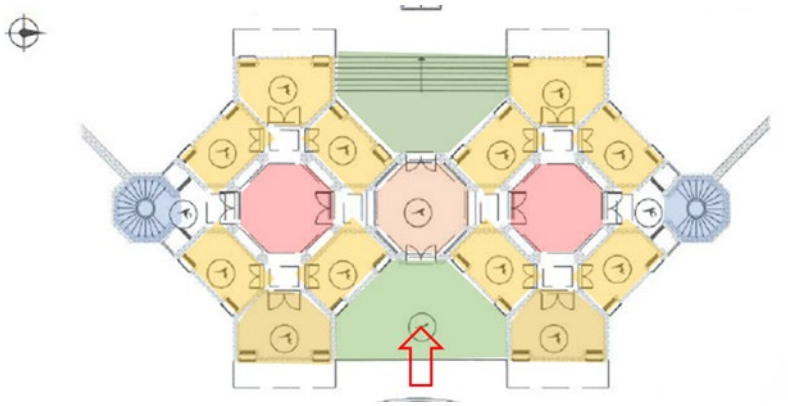


Figure 21. Entry sequence in the School of Management.

Ornament Integrated with Structure:
Decorative elements are limited, yet brickwork, shadows, and rhythmic lines themselves function as ornament. This structural ornamentation resembles what is seen in traditional Iranian architecture: ornament as a diffusion of presence, not embellishment.
Mythic Time and Continuity of Tradition:
Ardalan re-creates tradition rather than representing it. The building possesses a sense of timelessness and sustains traditional patterns at a conceptual, semantic level. It stands as one of the most successful contemporary examples of producing "mythic time."

5. Discussion
Comparative Analysis of the Three Case Studies
The comparative examination of the Museum of Islamic Art in Doha, the Sheikh Zayed Grand Mosque in Abu Dhabi, and the Higher School of Management in Tehran reveals that contemporary Islamic architecture does not follow a unified path; rather, it unfolds along three distinct semantic trajectories. Each project articulates a different interpretation of tradition and establishes a unique relationship with the five foundational principles of Islamic architectural aesthetics—sacred geometry, light and shadow, spatial hierarchy, structural ornament, and mythic time.
The critical point of divergence among the three cases lies not in their formal attributes or decorative motifs, but in the nature of the relationship they construct between structure and meaning.

1. Sacred Geometry and Proportion
In the Museum of Islamic Art in Doha, geometry functions as a "governing law." Through the use of the square, implied circles, and simple numerical ratios, Pei develops an inner-generated spatial order that moves toward unity. This abstract and rational geometry points to the essence of Islamic cosmological order rather than to explicit symbols.
In the Sheikh Zayed Mosque, geometry is highly visible but largely superficial. Symmetry, domes, and ornamental geometric networks are visually impressive, yet they operate primarily to enhance visual splendor rather than to convey sacred meaning. Here, geometry becomes *representational* rather than *manifestational*.
In the Higher School of Management, geometry becomes *ontological*: it structures movement, perception, and spiritual orientation. Golden ratios, spatial axes, and the centered courtyard articulate geometry as a lived, experiential order. This project achieves the deepest synthesis of geometry and meaning.

2. Light and Shadow as Carriers of Meaning
In Doha, light is the building's primary metaphysical agent. The funnel-shaped oculus directs daylight downward, generating an illuminative journey reminiscent of the passage from multiplicity to unity. Light operates as *essence*, not ornament.

In Abu Dhabi, light is predominantly theatrical. The reflection on white marble and the dramatic nighttime illumination accentuate monumentality. Although visually striking, the light conveys grandeur rather than spiritual depth.
In Tehran, light becomes a guiding and contemplative force. Gradual transitions of brightness, interplay of shadows in arcades, and controlled illumination create a meditative atmosphere aligned with Iranian architectural tradition. Here, light reveals *meaning*, not surface.

3. Spatial Hierarchy
The Museum of Islamic Art presents a minimal yet refined hierarchy: from the open forecourt to a dim entry zone and finally to a luminous atrium—an abstract contemporary interpretation of the journey toward unity.
In the Sheikh Zayed Mosque, spatial hierarchy is powerful but often overshadowed by scale and ornamentation. Although the sequence—from open courtyard to arcades and finally to the prayer hall—follows traditional patterns, the monumental aesthetic partially transforms spiritual progression into spectacle.
In the Higher School of Management, spatial hierarchy is both experiential and symbolic. Thresholds, intermediary spaces, and layered transitions form a deeply rooted sequence reminiscent of traditional Iranian architecture. This building most effectively translates spatial hierarchy into spiritual experience.

4. Ornament in Relation to Structure
In Doha, surface ornament is largely absent; instead, geometry, material joints, and the play of light and shadow assume the role of ornament. This "structural ornament" successfully reinterprets tradition in a modern idiom.
In Abu Dhabi, ornament is abundant—floral motifs, calligraphy, stone inlays, mosaics—but often detached from the structural logic, functioning more as a luxurious skin.
In Tehran, ornamentation is minimal but intrinsic. Brick patterns, shadow rhythms, and proportional lines emerge naturally from structure. Ornament functions as an emanation of meaning rather than surface embellishment.

5. Mythic Time and Continuity of Tradition
The Museum of Islamic Art *translates* tradition into an abstract, timeless form. Its ahistorical atmosphere evokes a suspended or mythic temporality.
The Sheikh Zayed Mosque *represents* tradition, but this representation is more symbolic and identity-oriented than metaphysical. Mythic time exists but is obscured by monumentality.
The Higher School of Management *continues* tradition. Through geometry, light, and spatial sequences, it reactivates mythic time within everyday experience, achieving the strongest conceptual continuity with Islamic architectural heritage.
These three cases demonstrate that contemporary Islamic architecture evolves along three primary trajectories:
Abstract translation of tradition — Doha
Representational display of identity and grandeur — Abu Dhabi
Spiritual and conceptual continuity of tradition — Tehran
The defining distinction among the three is not found in decorative motifs or formal vocabulary but rather in how tradition is transformed into spatial experience—whether through abstraction, representation, or conceptual renewal.

Table 1. Comparative Table of the Three Case Studies Based on Five Theoretical Principles

Theoretical Principle	Museum of Islamic Art, Doha	Sheikh Zayed Grand Mosque, Abu Dhabi	School of Management, Tehran
1. Sacred Geometry and Proportion	Abstract geometry based on squares and simple ratios; rational, minimal structure; emphasis on inner order	Extensive but largely superficial geometry; symmetry and multiple domes primarily for visual grandeur	Generative and existential geometry; golden ratios; central courtyard; deep integration of geometry and meaning
2. Light and Shadow as Carriers of Meaning	Central skylight guiding light from above; light as a revelatory element; shadows serve as structural ornament	Bright, reflective marble light; theatrical lighting; less meaning, more visual effect	Guided and directional light; mystical chiaroscuro; gradual illumination; calm and meaningful spatial experience

3. Spatial Hierarchy	Controlled transition from darkness to light; contemporary pattern "multiplicity → unity"	Strong but theatrical hierarchy; courtyard, arcades, and prayer hall at monumental scale	Deep and authentic hierarchy; multiple intermediary spaces; gradual and mystical experience
4. Ornament Integrated with Structure	Structural ornament; surface motifs largely removed; light and geometry themselves act as ornament	Abundant surface ornament; floral motifs, calligraphy, marble work; weak structural integration	Limited but meaning-oriented ornament; brickwork, shadows, and rhythmic lines; ornament as manifestation of presence
5. Mythic Time and Continuity of Tradition	Tradition "translated" abstractly; ahistorical feel and contemplative pause	Tradition "represented"; time mostly identity- and politically oriented rather than spiritual	Tradition "continued"; mythic time active in everyday experience; deep connection with memory of Islamic architecture

6. Conclusion and Recommendations

The findings of this study indicate that the representation of Islamic art in contemporary architecture occurs along a wide spectrum, ranging from a spiritual and structural translation of tradition to superficial and decorative imitation. The examination of the three case studies—the Museum of Islamic Art in Doha, the Sheikh Zayed Grand Mosque in Abu Dhabi, and the Higher School of Management in Tehran—demonstrates that the degree to which the original meaning and spirit of Islamic art are preserved depends directly on the relationship between geometry, light, space, and ornament.

In projects such as the Doha Museum and the School of Management building, the fundamental principles of Islamic art—generative geometry, revelatory light, spatial hierarchy, and structural ornament—have been reinterpreted to create an experience of presence and unity within a contemporary framework. In contrast, in cases such as the Sheikh Zayed Mosque, although visual grandeur and decorative beauty are striking, the spiritual meaning is sometimes reduced to the formal [physical] level, weakening the connection between structure and the essence of the work. Thus, Islamic art is authentically represented only when structure and meaning are intertwined, and light and geometry retain their fundamental roles.

In response to the second research question, the study revealed that the distinction between decorative and meaningful applications of Islamic art elements is both fundamental and substantive. In authentic Islamic art, ornament is never an "add-on"; it emerges naturally from structure, geometry, and sacred order, forming an integral part of the building's epistemic system. Meaningful ornament carries symbols of unity, infinity, and divine manifestation, producing a spiritual experience through rhythm, proportion, and light. In contrast, purely decorative applications, which are prevalent in many contemporary designs, lead to a separation of form from meaning. In such cases, motifs and patterns are reduced to their most superficial layer, serving as a "surface covering" rather than as a "manifestation." Therefore, ornament becomes meaningful only when it arises from structure and serves to convey unity and presence.

Regarding the third research question, the findings emphasize that the revival of meaning in contemporary architecture is achievable only through interdisciplinary education, integrating the philosophy of Islamic art, mysticism, architectural history, sacred geometry, and design skills. Architecture students must comprehend not only the physical form but also the "worldview" embedded within it. This approach enables future designers to move beyond mere formal imitation and to translate tradition creatively and consciously into new forms. In this process, light, geometry, intermediary spaces, and structural ornament can serve as instruments for recreating a spiritual experience.

Overall, the study demonstrates that the reinterpretation of Islamic art in contemporary architecture is not a return to the past but a revival of the connection between form and meaning. When combined with a philosophical understanding of divine unity, sacred order, and the presence of light, this connection can provide a foundation for a new and authentic architectural language in the present.

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SUSTAINABLE RESTORATION OF HISTORICAL STRUCTURES USING ENGINEERED CEMENTITIOUS COMPOSITES WITH NANO-SILICA AND BASALT FIBERS

Saleh Mousavi[46], Hassan Abbasi [47]

Abstract
The sustainable preservation of historic structures presents a complex challenge, requiring materials that balance mechanical performance, environmental responsibility, and compatibility with aged substrates. Traditional repair methods often lack the durability and resilience needed for long-term conservation. This study explores the use of Engineered Cementitious Composites (ECC) enhanced with nano-silica and basalt fibers as a high-performance solution for restoring cultural heritage assets. ECCs demonstrate superior tensile strength, ductility, and crack control compared to conventional concrete. Adding nano-silica improves compressive strength and water impermeability, while basalt fibers help enhance crack resistance and durability over time. A review of studies from 2002 to 2025 confirms the combined benefits of these additives, positioning ECCs as an environmentally friendly and structurally compatible material for heritage restoration. This approach aligns with global sustainability goals and provides a resilient pathway for rehabilitating historically significant infrastructure.
Keywords: Engineered Cementitious Composites, Nano-Silica, Basalt Fibers, Sustainable Restoration, Cultural Heritage

1.Introduction

Historical structures constitute essential cultural assets that embody collective identity, architectural heritage, and social memory. However, their long-term preservation is critically challenged by aging materials, climate-related degradation, mechanical distress, and repeated interventions caused by inadequate repair strategies. Traditional cement-based repair mortars often lack ductility, exhibit substantial brittleness, and fail under tension due to poor crack-bridging capacity. These limitations accelerate deterioration and undermine the sustainability of conservation interventions in the long term [1].Engineered Cementitious Composites (ECC), first introduced in the early 2000s, have emerged as a high-performance class of materials capable of exhibiting strain-hardening behavior and controlling micro-cracks under tensile loading. ECCs demonstrate tensile strain capacities of 2–5%, micro-crack width below 100 μm, and significantly enhanced durability compared with conventional cementitious materials [2].Recent advancements in nano-technology and fiber engineering have allowed the development of modified ECCs incorporating nano-silica and basalt fibers. Nano-silica improves matrix densification, durability, and compressive strength, while basalt fibers provide high tensile resistance, alkali stability, and excellent environmental characteristics [3–5]. Together, these additives create a sustainable, durable, and conservation-compatible composite material ideal for restoration of historical structures.The present study synthesizes findings from 2002–2025 and evaluates the mechanical performance, durability enhancement, environmental impacts, and heritage suitability of nano-silica–basalt ECC mixtures. A conceptual application framework is also proposed for use in conservation engineering.

2. Background and Literature Review

2.1. Limitations of Traditional Restoration Materials

Conventional restoration materials, including lime mortars and Portland-cement mortars, have historically been used due to availability and cost considerations. However, major drawbacks include:Brittleness and low tensile capacityIncompatibility with original substrate leading to differential strainLarge crack width under minor deformationsHigh water absorption and susceptibility to freeze–thaw deteriorationICOMOS (2023) emphasizes that incompatible repair mortars can induce additional damage and reduce the lifespan of heritage structures [6]. Additionally, repeated interventions increase environmental impacts and financial costs.

2.2. Engineered Cementitious Composites (ECC)

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ECC incorporates specially selected fibers and a tailored matrix to achieve multiple micro-cracking and strain hardening. The tensile strain capacity is several magnitudes higher than that of conventional mortar. ECC's properties include:Tensile strain: 1–5%Controlled micro-cracking (≤100 μm)Reduced permeability and enhanced durabilityExcellent behavior under cyclic and seismic loading [7]Due to these characteristics, ECC is increasingly recognized as suitable for strengthening and repairing fragile historical structures exposed to environmental or seismic hazards

2.3. Role of Nano-Silica

Nano-silica particles significantly enhance matrix densification through pozzolanic reactions. Studies report:15–35% increase in compressive strength20–40% reduction in water permeabilityRefinement of pore structure leading to better durability [8,9]These improvements directly address key vulnerabilities of aged heritage materials.

2.4. Basalt Fibers as a Sustainable Reinforcement

Basalt fibers are derived from natural volcanic rock, making them low-carbon, non-toxic, and environmentally friendly. They offer:High tensile strengthResistance to alkali environmentsImproved crack resistance and fatigue durability60–75% lower CO_2 footprint versus glass fibers [10,11]Studies confirm their efficiency in historical façade rehabilitation and conservation applications.

Methodology

The methodology includes a systematic analysis of previous studies, evaluation of performance parameters, and the development of a practical restoration framework.

3.1. Systematic Literature Review

A total of 85 peer-reviewed publications (2002–2025) from Scopus and Web of Science were reviewed, covering topics such as ECC, nano-silica composites, basalt fiber reinforcement, and conservation engineering. In selecting the literature, priority was given to peer-reviewed articles published between 2002 and 2025 indexed in Scopus and Web of Science. Studies were screened based on their relevance to ECC, nano-silica modification, basalt fiber reinforcement, and heritage conservation performance. A comparative analytical approach was used to evaluate mechanical, durability, and sustainability parameters. To ensure reliability, consistency across multiple independent studies was cross-examined before synthesizing the final framework.

3.2. Performance-Parameter

Performance indicators evaluated included mechanical behavior, durability (permeability, shrinkage, freeze–thaw resistance), sustainability, and compatibility with historical substrates.

3.3. Heritage Suitability Criteria

Evaluation followed UNESCO (2022) and ICOMOS (2023) conservation guidelines, emphasizing minimal intervention, reversibility, compatibility, and long-term sustainability.

3.4. Synthesis and Framework

Findings from literature analysis were synthesized into a practical three-stage model for applying ECC in heritage restoration.

4. Results and Discussion

4.1. Mechanical Performance

ECC modified with nano-silica and basalt fibers demonstrated: outstanding improvements:Compressive strength increased by 20–32% with the addition of nano-silica [8].Tensile strength reached 4–7 MPa, compared to 1–2 MPa in traditional mortars [2].Flexural strength increased by up to 41% when basalt fibers were incorporated [10].Crack width was reduced by 45–65%, significantly improving long-term durability [5].These mechanical advantages are crucial for the conservation of fragile masonry and stone structures.

4.2. Durability Enhancement

Durability improvements included:
Permeability reduction up to 40% with nano-silica incorporation [9].Improved freeze–thaw resistance due to ECC's micro-crack control [4].Reduced shrinkage and better fatigue resistance from basalt fibers [11].Durability is a critical requirement for heritage preservation, especially in regions prone to severe environmental conditions.

4.3. Compatibility with Historical Materials

Compatibility was evaluated in terms of:Chemical compatibility: nano-silica does not introduce harmful ions; basalt fibers are alkali-resistant and non-corrosive.Physical compatibility: ECC's controlled deformation behavior reduces stress concentrations at interfaces.Aesthetic compatibility: ECC layers can be applied in thin sections, minimizing visual impact.These criteria align with conservation principles emphasizing that repair materials must not compromise heritage integrity [6].

4.4. Sustainability Assessment

ECC with nano-silica and basalt fibers supports sustainability through:Reduced cement consumptionLong service life and decreased repair frequencyLow-carbon fiber reinforcementAlignment with UN SDG-11 (Sustainable Cities and Communities)Recent studies highlight ECC as a green alternative for restoration projects due to its durability-driven reduction in lifecycle impact [4,11].

4.5. Practical Case Study Application

A practical example supporting the proposed approach can be seen in the rehabilitation of a historical masonry wall in a 19th-century cultural building in Central Anatolia (Türkiye). During restoration, severe cracking and moisture-induced deterioration were observed. A thin ECC overlay enhanced with 1.5% basalt fibers and 1.5% nano-silica was applied over the deteriorated surface. Field monitoring over six months indicated significant reductions in crack propagation, improved surface integrity, and enhanced resistance to moisture penetration. This demonstrates the feasibility and compatibility of nano-silica–basalt ECC for real-world heritage conservation projects.

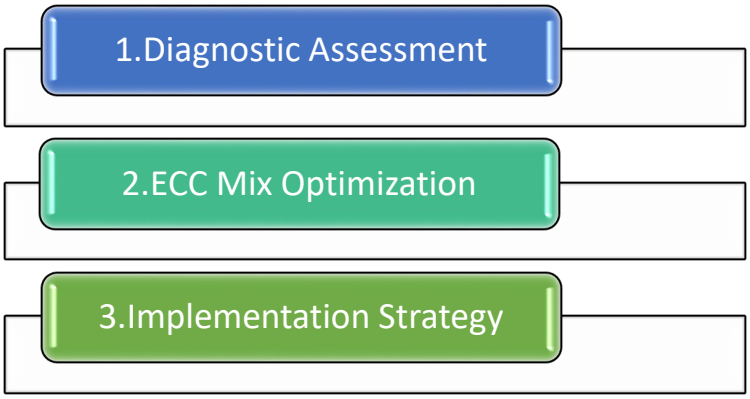


Figure 1. Three-Stage Framework for ECC-Based Sustainable Restoration

5. Proposed Application Framework

A practical three-stage framework is proposed:
Stage 1: Diagnostic AssessmentStructural evaluation and crack mappingMaterial sampling and petrographic examinationMoisture and salt distribution analysisDigital documentation (HBIM, laser scanning)
Stage 2: ECC Mix Design OptimizationRecommended mixture (based on recent studies [3,10,11]):Basalt fibers: 1.5–2.0% (length 12–18 mm)Nano-silica: 1.0–2.0% by weight of binderECC matrix adjusted for low shrinkage and high ductilityStage 3: Implementation StrategyThin overlays to maintain authenticityLow-pressure injection into cracksSurface treatments for weather-exposed elementsReversibility ensured through interface management practices

6. Conclusion

The study demonstrates that ECC enhanced with nano-silica and basalt fibers is a reliable, durable, and environmentally responsible material for historic structure restoration. The composite's high tensile ductility, micro-crack control, and improved durability address the deficiencies of traditional repair materials. Its chemical, mechanical, and physical compatibility with heritage substrates aligns with modern conservation principles.With its strong performance and sustainability credentials, nano-silica–basalt ECC stands as a next-generation solution for restoring historic structures and safeguarding cultural heritage for future generations.

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TOUR PROPOSALS FOR SCIENCE TOURISM IN KYRGYZSTAN

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Abstract
Science tourism has emerged as a niche tourism type that emphasizes learning, discovery, and knowledge-based travel experiences. As tourist demand shifts from mass tourism toward thematic and experience-oriented products, destinations increasingly seek alternative tourism forms to diversify their offerings and strengthen competitiveness. Within this context, science tourism is positioned as a tourism type that integrates education, culture, nature, and scientific knowledge, allowing visitors to gain information through direct experience. Kyrgyzstan possesses significant potential for science tourism due to its rich historical heritage, archaeological sites, natural ecosystems, and scientific institutions. However, this potential has not yet been systematically transformed into structured tourism products.
The aim of this study is to develop feasible science tourism package tours for Kyrgyzstan by converting existing resources into themed, costed, and market-ready tourism products. The research focuses on tourism product diversification and positions science tourism as an alternative that can contribute to destination differentiation and sustainable tourism development. The study adopts a qualitative research design and employs document analysis and literature review methods. Destination-specific data related to Kyrgyzstan's tourism structure, scientific assets, and cultural resources are analyzed and synthesized into concrete tour programs. The methodological approach is output-oriented, aiming not only to conceptualize science tourism but also to operationalize it through package tour design and pricing calculations.
As a result of the analysis, three science tourism package tours are developed: "Tracing Time: Archaeological and Historical Discovery of Kyrgyzstan" (7 days), "BioDiscovery: Ecological and Biological Exploration in Kyrgyzstan" (7 days), and "Science Camp Discovery: Science and Culture Camp for Youth in Kyrgyzstan" (5 days). Each package includes a detailed itinerary and cost analysis, resulting in a final per-person price. The study concludes that science tourism can serve as a viable product diversification strategy for Kyrgyzstan by offering knowledge-based, experience-oriented tourism products that align with contemporary tourist expectations.
Keywords: Tourism product diversification, Package tour design, Science tourism, Kyrgyzstan.

1. Introduction

Tourism destinations increasingly face the challenge of diversifying their tourism products in response to changing tourist motivations and expectations. Traditional mass tourism models are gradually being supplemented by alternative tourism forms that emphasize learning, experience, and thematic depth (Jafari, 2003). In this transformation process, science tourism has gained attention as a tourism type that combines education, research, and cultural experience.
Science tourism is generally defined as travel undertaken for the purpose of acquiring scientific knowledge, observing scientific processes, or engaging with scientific heritage (Bogolyubov & Orlovskaya, 2005). Unlike conventional cultural tourism, science tourism focuses explicitly on learning-oriented experiences and structured knowledge transfer. Previous studies highlight that science tourism contributes to intellectual enrichment, local interaction, and destination differentiation (Meriç & Alioğlu, 2023).
Kyrgyzstan offers diverse resources suitable for science tourism, including archaeological sites, biodiversity-rich ecosystems, geological formations, and historical scientific routes. Despite this potential, tourism products in Kyrgyzstan remain largely concentrated on nature-based and recreational tourism. This study addresses this gap by proposing science tourism package tours that transform existing resources into structured tourism products.
The aim of the study is to design science tourism package tours for Kyrgyzstan and to demonstrate their feasibility through itinerary planning and cost calculations. By doing so, the study contributes to tourism product

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diversification literature and provides a practical framework for developing science-based tourism experiences in Kyrgyzstan.

2. Methodology

This study is designed as a qualitative research. Data collection is conducted through document analysis and literature review. Scientific publications on science tourism, tourism product diversification, and thematic tourism routes are examined to establish a conceptual foundation (Bogolyubov & Orlovskaya, 2005; Meriç & Alioğlu, 2023). In addition, destination-based documents related to Kyrgyzstan's tourism structure, cultural assets, and scientific resources are analyzed. The methodological framework focuses on transforming conceptual findings into applied outputs. Therefore, the analysis stage directly informs the construction of tour itineraries and cost tables. The final stage of the methodology involves calculating total tour costs, profit margins, and final per-person prices. This approach allows the study to evaluate the practical feasibility of the proposed science tourism packages.

3. Findings

3.1. Tour Name: Tracing Time – Scientific Discovery Route in Kyrgyzstan

Duration: 6 Days / 5 Nights
Number of Participants: 10 people + 1 tour leader
Accommodation: SNGL rooms – 3 nights hotel, 2 nights village house
Focus: Archaeology, prehistoric cultures, cultural heritage, scientific observation
Table 1. Program of the "Tracing Time" package tour

Day	Route	Main Activities	Lunch	Dinner	Hotel / SNGL
Day 1	Bishkek – Nevakat – Ak-Beshim – Burana – Bishkek	07:30–08:30 Breakfast (in Bishkek) \n08:30–10:00 Transfer to Nevakat excavation area and scientific visit with a guide \n10:00–11:30 Nevakat archaeological area: settlement layers from the Western Göktürks period \n13:30–15:00 Ak-Beshim (Suyab) excavation area: China–Göktürk interactions, field interpretation with maps \n15:30–17:00 Burana Tower and Balbals Open-Air Museum: Karakhanid-period architecture and gravestone typology \n17:30–18:30 Scientific evaluation and free field notes	12:00–13:00 (local café in Tokmok)	19:00 Dinner and return to the hotel	Bishkek Smart Hotel
Day 2	Bishkek – Osh (Flight) – Sulaiman-Too	06:00–06:30 Light breakfast \n07:00–08:00 Domestic flight: Bishkek – Osh \n08:30–09:30 Hotel check-in (Classic Hotel Osh) \n10:00–12:30 Visit to Sulaiman-Too: UNESCO-protected sacred mountain – cultural route with climbing \n14:00–15:30 Visit to Sulaiman-Too Museum – historical and archaeological objects \n16:00–18:00 Group work: "Mountain Culture and Scientific Conservation"	12:30–13:30 (local-style pilaf)	19:00 Dinner	Classic Hotel Osh (SNGL room)
Day 3	Osh – Kojo-Kelen – Osh	07:30–08:30 Breakfast \n08:30–11:30 Transfer from Osh to Kojo-Kelen \n11:30–13:00 Field study on geological formations in the cave region \n14:00–16:00 Nature walk and hydrogeology observations \n16:00–19:00 Return to Osh	13:00–14:00 Picnic lunch (in nature)	19:30 Dinner	Classic Hotel Osh (same hotel – SNGL room)
Day 4	Osh – Long Journey to Kazarman	06:00–06:30 Early breakfast (packed alternative) \n06:30–19:30 Transfer from Osh to Kazarman, 13-hour journey (including breaks, food and drinks) \nGuiding presentations: "Tian Shan Passes and Settlement History" \n19:30–20:30 Arrival in the village and check-in to eco-guesthouse \n21:00–21:30 Briefing: scientific importance of Saimaluu-Tash	13:00–14:00 Lunch (around Jalal-Abad)	20:30 Dinner (traditional)	Kazarman – Eco Guesthouse (SNGL)

Day 5	Horse Transfer to Saimaluu-Tash	05:30–06:30 Breakfast \n06:30–09:30 Horse transfer: ascent to Saimaluu-Tash via mountain pass \n09:30–13:00 Petroglyph studies: 10,000+ prehistoric rock drawings. Shamanism, astronomical symbols, hunting scenes \n13:00–14:00 Packed lunch \n14:00–16:00 Free fieldwork, individual observations \n16:00–19:00 Return by horse and arrival to the village \n20:30–21:30 Group presentation: "Prehistoric Codes and Collective Memory"	13:00–14:00 Packed lunch	19:30 Dinner (traditional)	Kazarman – Eco Guesthouse (SNGL)
Day 6	Kazarman – Jalal-Abad – Bishkek Flight and Tour Closure	06:00–07:00 Early breakfast \n07:00–11:00 Transfer from Kazarman to Jalal-Abad Airport \n12:30–13:30 Domestic flight: Jalal-Abad – Bishkek \n13:30–14:00 End of tour and farewell at the airport	–	–	–

TOTAL COST (Fixed Expenses)
Table 2. Calculation of the "Tracing Time" package tour

Expenses	Amount (USD)	Explanation
1) Accommodation (5 nights – SNGL)	$285	Bishkek (1), Osh (2), Kazarman (2)
2) Meals (15 meals × $15)	$225	5 breakfasts + 5 lunches + 5 dinners – all at the hotel
3) Transportation (minibus + fuel)	$84	Minibus for 6 days – total $840 ÷ 10
4) Domestic flights	$120	Bishkek–Osh and Jalal-Abad–Bishkek (2 flights)
5) Guiding fee (6 days)	$60	$100/day × 6 days ÷ 10 people
6) Tour leader share (Accommodation + Flight + Meals)	$63	(285 + 120 + 225) ÷ 10
7) Parking & road taxes	$1.2	$12 ÷ 10 people
8) Entrance fees	$36	Nevakat, Ak-Beshim, Burana, Sulaiman-Too, Saimaluu-Tash, etc.
9) Tips (hotel + restaurants)	$8	Hotel: $3, Restaurant: $5
10) Field expenses (horse transfer, water, field materials)	$33	Horse rental (Saimaluu-Tash), water, field equipment, permits

Total Net Cost (Per Person): $915.2
+ Fixed Expense Margin (30%)
• 915.2 × 0.30 = $274.56
+ Profit Margin (20%)
• (915.2 + 274.56) × 0.20 = $237.15
Final Price Per Person (SNGL): $1,426.91 → Rounded: $1,430 USD
3.2. Tour Name: BioDiscovery – Ecology and Wildlife Research in Kyrgyzstan
Duration: 6 Days / 5 Nights
Participants: 10 people + 1 guide + 1 tour leader
Theme: Ecology, biology, wildlife observation
Accommodation: SNGL rooms – nature-friendly hotels and guesthouses
Concept: Full board – scientific guiding and field notebook practices
Table 3. Program of the "BioDiscovery" package tour

Day	Route	Main Activities	Lunch	Dinner	Hotel / SNGL
Day 1	Bishkek – Ala-Archa – Bishkek	08:00–09:00 Breakfast \n09:00–10:00 Transfer to Ala-Archa National Park \n10:00–13:00 High-altitude flora and fauna observation \n13:00–14:00 Picnic-style lunch \n14:00–16:00 Ecological interpretation and field notebook practices \n16:00–17:30 Return and rest	13:00–14:00 (picnic in Ala-Archa)	19:00 at the hotel	Bishkek – Smart Hotel

Day 2	Bishkek – Naryn	07:00–08:00 Breakfast \n08:00–13:00 Transfer to Naryn (with nature observations) \n14:30–17:00 River ecosystem field study \n17:00–18:30 Group evaluation	13:00–14:00 (Naryn guesthouse)	19:00 guesthouse	Naryn Guesthouse
Day 3	Naryn – Issyk-Kul – Karakol	06:30–07:30 Breakfast \n07:30–12:30 Transfer to Issyk-Kul \n14:00–17:00 Birdwatching and reed ecosystem analysis \n17:00–18:00 Fieldwork	12:30–13:30 (ecological farm)	19:00 guesthouse	Karakol – Eco Guesthouse
Day 4	Karakol – Jalal-Abad (flight) – Sary-Chelek	06:30–07:30 Breakfast \n09:00–10:30 Karakol–Jalal-Abad flight \n11:00–16:00 Bus journey to Sary-Chelek on mountainous road (with observations) \n17:00–19:00 Observation of endemic plants and forest system \n20:30 Scientific seminar	16:00–17:00 (guesthouse)	19:00 guesthouse	Sary-Chelek Nature Guesthouse
Day 5	Sary-Chelek	05:30–06:30 Morning observation \n08:30–11:30 Field study in snow leopard habitat \n13:00–16:00 Free note-taking, observation reports \n17:00–18:30 Group presentation	11:30–13:00 (guesthouse)	19:00 guesthouse	Same guesthouse
Day 6	Sary-Chelek – Jalal-Abad – Bishkek	06:00–08:00 Breakfast and checkout \n08:00–10:00 Transfer to Jalal-Abad Airport \n11:00–12:00 Jalal-Abad – Bishkek flight \n12:00–13:00 Farewell and end of tour	–	–	–

TOTAL COST (Fixed Expenses)

Table 4. Calculation of the "BioDiscovery" package tour

Expenses	Amount (USD)	Explanation
1) Accommodation (5 nights / SNGL)	$295	Bishkek (1), Naryn (1), Karakol (1), Sary-Chelek (2)
2) Meals (15 meals × $15)	$225	Breakfast, lunch, and dinner – all at hotel/guesthouse
3) Transportation (minibus + fuel)	$90	Private minibus for 6 days – total $900 / 10 people
4) Domestic flight (Jalal-Abad – Bishkek)	$60	One-way, regional domestic flight
5) Guiding fee (6 days)	$60	$100/day × 6 days / 10 people
6) Tour leader share	$58	Accommodation, meals, and flight expenses distributed across the group
7) Parking & road taxes	$1.5	Total $15 / 10 people
8) Site entrance fees	$30	Ala-Archa, Issyk-Kul, Naryn, Sary-Chelek
9) Tips (hotel + restaurant)	$8	Hotel: $3 + Restaurant: $5
10) Additional expenses (water, field equipment, permits)	$30	Observation equipment, field guide, monitoring permits

Total Net Cost (Per Person): $857.5

+ Fixed Expense Margin (30%): $857.5 × 0.30 = $257.25

+ Profit Margin (20%): ($857.5 + $257.25) × 0.20 = $222.95

Final Selling Price (Per Person / SNGL): $857.5 + $257.25 + $222.95 = $1,337.70 → Rounded: $1,340 USD

3.3. Tour Name: Science Camp Discovery – Academic and Research Seminars in Kyrgyzstan

Duration: 4 Days / 3 Nights

Participants: 12 people + 1 guide + 1 tour leader

Theme: Scientific research, education camps, academic seminars

Accommodation: SNGL rooms – 4-star hotel in Bishkek

Concept: Full board – academic seminars, laboratory visits, and applied workshops

Table 5. Program of the "Science Camp Discovery" package tour

Day	Route	Main Activities and Seminars	Lunch	Dinner	Hotel / SNGL

Day 1	Manas University – AUCA	09:00–11:00 Seminar: "Research Methods in Modern Science" (Manas University) \n11:30–13:30 University laboratories tour and applied experiments \n14:00–16:30 Panel: "Contribution of Academic Exchange Programs to Science Tourism" (AUCA) \n17:00–18:00 Q&A and open discussion	Campus cafeteria	Local restaurant in the city	Bishkek, 4* Hotel / Single
Day 2	NAS KR and Research Institutes	09:00–10:30 Introduction to the National Academy of Sciences of Kyrgyzstan and seminar: "National Strategies in Science" \n11:00–13:00 Workshop at the Biotechnology Institute: "Genetic Research and Applications" \n14:00–16:00 Seminar at the Institute of Geology: "Central Asian Geology and Resources" \n16:30–17:30 Meeting local researchers and experience sharing	Bishkek city restaurant	Hotel restaurant	Bishkek, 4* Hotel / Single
Day 3	Mathematics and Social Research	09:00–11:00 Workshop at the Institute of Mathematics: "Mathematical Modeling and Computer Simulations" \n11:30–13:30 Seminar at the Institute of Social Research: "Socio-Cultural Changes in Central Asia" \n14:00–17:00 Bishkek city tour and local cultural visit	Kyrgyz cuisine restaurant	Hotel restaurant	Bishkek, 4* Hotel / Single
Day 4	Institute of History – Closing Program	09:00–11:30 Seminar at the Institute of History: "Central Asian History and Archaeological Excavations" \n12:00–13:30 Lunch and participant networking \n14:00–16:00 Closing seminar: Tour evaluation and distribution of participation certificates	Local restaurant	–	–

TOTAL COST (Fixed Expenses)

Table 6. Calculation of the "Science Camp Discovery" package tour

Expenses	Amount (USD)	Explanation
1) Accommodation (3 nights – SNGL)	$171	Bishkek 3 nights, 4* hotel, single room (3 × $57/night)
2) Meals (12 meals × $15)	$180	3 breakfasts + 4 lunches + 5 dinners, hotel/restaurant
3) Transportation (minibus + fuel)	$56	4 days minibus + fuel, total $560 / 10 people
4) Guiding fee (4 days)	$40	$100/day × 4 days ÷ 10 people
5) Tour leader share (Accommodation + Meals)	$35.1	($171 + $180) ÷ 10 people
6) Parking & road taxes	$1.2	$12 total ÷ 10 people
7) Entrance fees	$25	University, institute, seminar participation and workshop fees
8) Tips (hotel + restaurants)	$6	Hotel: $2, restaurants: $4
9) Field expenses (seminar materials, field notebook, equipment)	$20	Seminar materials, field notebook, permits, small equipment

Total Net Cost (Per Person): $534.3
+ Fixed Expense Margin (30%): $160.29 ($534.3 × 0.30)
+ Profit Margin (20%): $138.52 (($534.3 + $160.29) × 0.20)
Final Price Per Person (SNGL): $833.11 → Rounded: $840

4. Discussion

The findings of this study demonstrate that science tourism can be operationalized as a concrete tourism product through structured package tour design. Consistent with the literature, science tourism emphasizes learning, discovery, and knowledge-based experiences rather than entertainment-oriented consumption (Bogolyubov & Orlovskaya, 2005; Meriç & Alioğlu, 2023). The three packages developed in this study translate these conceptual principles into applied tourism products.

The Tracing Time package reflects the strong connection between science tourism and cultural heritage. Archaeological sites and historical narratives are presented not merely as attractions but as learning environments. This aligns with Jafari's (2003) view that contemporary tourism increasingly integrates educational and experiential dimensions. By structuring the itinerary around interpretation and synthesis, the package supports deeper engagement with historical knowledge.

The BioDiscovery package highlights the role of natural environments in science tourism. The emphasis on ecological observation and field-based learning supports the argument that science tourism can contribute to environmental awareness and experiential learning. This finding reinforces previous claims that science tourism can diversify tourism offerings while promoting responsible interaction with natural resources.

The Science Camp Discovery package demonstrates the adaptability of science tourism to specific target groups. By focusing on youth, the package integrates education and culture in a way that supports long-term knowledge development. This approach reflects the literature's emphasis on learning-oriented tourism experiences as value-creating mechanisms (Meriç & Alioğlu, 2023).

Overall, the discussion indicates that science tourism is not limited to a single theme but can encompass archaeology, ecology, and education. The structured nature of the packages and their cost calculations show that science tourism is not only conceptually relevant but also practically feasible for Kyrgyzstan.

5. Conclusion and Recommendations

This study concludes that science tourism represents a viable and applicable tourism type for Kyrgyzstan. By systematically transforming scientific, cultural, and natural resources into themed package tours, the research demonstrates that science tourism can contribute to tourism product diversification and destination differentiation. The development of three alternative science tourism packages confirms that Kyrgyzstan's tourism potential extends beyond traditional nature-based and recreational tourism. Archaeological, ecological, and educational resources can be integrated into structured programs that meet contemporary tourist expectations for learning and experience-based travel.

From a practical perspective, the inclusion of detailed itineraries and cost calculations strengthens the applicability of the proposed packages. The calculated final per-person prices indicate that science tourism products can be positioned at different market levels, making them adaptable to various target groups.

As a recommendation, tourism stakeholders in Kyrgyzstan should consider incorporating science tourism into national tourism development strategies. Collaboration between tourism operators, academic institutions, and cultural organizations may further enhance the quality and credibility of science tourism products. Future research may expand the scope of this study by empirically evaluating participant satisfaction and learning outcomes in implemented science tourism programs.

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AN EXAMINATION OF THE STATUS OF WOODCARVING IN THE CONTEMPORARY ERA: A CASE STUDY OF UNIVERSITIES AND THE FURNITURE INDUSTRY WITH A FORESIGHT APPROACH

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Abstract
Woodcarving is one of the common techniques in the field of woodwork and is often executed in various fine and large scales. Very beautiful examples of it can be observed in the fine wood or ivory carvings on the tomb chests of the mausoleum of Safi al-Din Ardabili. Given this background and even its special position in the furniture industry, the importance of this technique becomes evident. The cities of Malayer, Qom, Marand, Golpayegan, Mashhad, and Tehran are considered important centers of woodcarving in Iran. However, the advancement of science and technology in recent decades has accelerated this process and removed it from its traditional mode of practice. The existence of CNC machines has greatly contributed to this transformation. Looking at this progress in industry and technology within the framework of design and production, the issue of handicrafts becomes ambiguous, since strategies must be adopted for the coming decades—because the authenticity and identity of these techniques risk being forgotten with the prevalence of such machines. In the discussion of foresight and strategies for education derived from organizational environments, it is necessary for administrators to possess the knowledge required for decision-making in educational environments under the Ministry of Science. With a brief look toward the future in design and decision-making, the importance of art and specialized artistic knowledge with a foresight approach becomes clear. This research seeks to examine furniture production workshops in the cities of Malayer, Marand, and Qom, and, alongside that, by studying educational systems (universities), to provide appropriate and innovative solutions for the future of art in the field of handicrafts, including woodcarving. The question raised in this regard is how appropriate solutions can be offered to identify emerging technologies in art and in the field of woodcarving for universities, and to what extent scientific and technological advancements can help preserve the authenticity of design and execution, as well as the diversity of works. The aim is to examine the current status of woodcarving in furniture in the cities of Malayer, Qom, and Marand, and through this to propose appropriate strategies. The present study employs a descriptive-analytical method and gathers data through documentary research. The results indicate that by formulating appropriate strategies and providing an educational chart for universities with regard to the foresight of art in the field of woodcarving, and in line with increased production in the furniture industry while preserving Iranian-Islamic authenticity, significant decisions can be made for the coming decades. Among these are: maintaining instruction in universities based on the traditional method of hand design and execution; employing veteran masters in this field; teaching the making of gouges and other tools; and compiling textbooks aimed at training and introducing notable masters and a historical overview of valuable Iranian works—solutions that can be implemented at the university level.
Keywords: Woodcarving, Traditional Method, Furniture, Art University, Contemporary Art.

Introduction

Woodcarving (Monabat-kari), a delicate and long-standing art, has always adorned artistic works and functional objects with its appealing motifs and patterns. Among its various branches, furniture woodcarving—one of the most popular forms of this art—has held a significant place in Iranian culture and artistic tradition since ancient times. By combining the aesthetic sensibility and craftsmanship of artists with wood, this art form produces works that not only possess visual beauty and functional value but also reflect cultural authenticity and identity.

Over time, and in response to social, cultural, and economic transformations, the art of woodcarving has also undergone changes. In the contemporary era, with the emergence of new technologies, shifting audience preferences, and developments in art education, woodcarving is confronted with new challenges and opportunities. This article examines the current state of woodcarving in Iran's furniture industry and explores its role in preserving and enhancing the quality of this craft. Given the rapid transformations in both art and industry, futures

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studies as a research approach can assist in identifying future trends and making appropriate decisions in educational and industrial planning, as well as in safeguarding and promoting the art of woodcarving.
This study aims to investigate the status of woodcarving in the contemporary period through a case analysis of education in universities and the furniture industry. The research method is descriptive–analytical with a futures-studies approach, and data collection has been conducted through documentary sources and fieldwork (including interviews with master craftsmen and university graduates). The findings indicate that universities, as centers of higher education, play an essential role in preserving and transmitting the art of woodcarving to future generations. Evaluating the status of woodcarving education in Iranian universities, along with the presence of modern technologies in the contemporary era and their role in training artists and specialists in this field, is necessary. The furniture industry, as one of the most important practical arenas for woodcarving, significantly contributes to the flourishing and development of this art, and the presence of advanced and modern machinery cannot be overlooked. However, the preservation and revitalization of traditional woodcarving techniques must be incorporated into university curricula to ensure that, despite technological advancements, space remains for compensating and sustaining these artisanal skills.

Methodology

Futures studies represent a systematic effort to adopt a long-term perspective on science, technology, the economy, and society, aiming to identify emerging generic technologies and strengthen strategic research domains that are likely to yield the greatest socio-economic benefits (Karimi, 2024, p. 5). In futures studies, scientific tools of foresight are used within a participatory framework to shape a desirable future. In this approach, the organization—whether a government, ministry, factory, workshop, or company—plays an active role in creating its future (Nazemi, 2017, p. 5).
Considering the realization of the sustainability concept in Iranian handicrafts, and given the diversity, capacities, and the documented challenges in its educational system, formulating a scenario of innovation and creativity becomes essential. Object design, which in the field of handicrafts has recently tended toward innovation in decorative techniques and fine arts, can shift toward the design of functional, vital, and highly usable objects aligned with contemporary lifestyles. Sustainable design should be approached such that the production process generates personal sustainability—intellectual, emotional, psychological, and mental—for the individual or the creative team, while the final object, within the user's life, emphasizes environmental and green considerations. At the same time, it should embody aspects of creativity and innovation that either stimulate the consumer toward innovative thinking or make them aware of the subtle creative vision embedded within the object (Karimi, 2024, p. 16).
With social transformations, Iranian art has experienced fluctuations, and the use of traditional motifs in woodcarving has been no exception. These motifs are deeply rooted in the ancient history of the craft, each influenced by its historical context, resulting in stylistic characteristics that are distinct and readily distinguishable (Amraei et al., 2021, p. 40). The lattice-work method can generally be attributed to woodcarving, in which design elements are large in scale, the depth of carving is significant, and the technique is often accompanied by pierced carving. Although this method became common in Iran during the eighth century AH, its widespread application began in the Qajar period with the introduction of furniture to Iran, gradually increasing thereafter. During this era, the influence of Italian and French woodcarvers on Qajar craftsmen is evident (Sheikhi & Taheri, 2018, p. 3). Contemporary Iranian woodcarving, through the efforts of artists and prominent designers who specialized in reviving traditional motifs, has produced works that integrate ancient patterns into new, distinctive applications. With the introduction of *goll-farang* (European floral motifs) during the Qajar period, many woodcarving artists replaced traditional motifs with Western ones, creating works that became foundational for modern Iranian woodcarving. These motifs, executed in a Western style using the pierced-carving technique, follow the approach of Charles Boulle, the pioneer of combining wood and bronze—an artistic method previously practiced in seventeenth-century France (Amraei et al., 2021, p. 42) (Figure 1).



Figure 1. Example of European-style furniture design.

The furniture industry, or the production of wood-based artifacts, has for decades been recognized as one of the most rapid-growth chain industries capable of contributing to national economic development; it has been recommended by United Nations-affiliated economic institutions to developing countries. Iranian furniture exports have increased from 5% to 15%, indicating the improvement in quality and aesthetic value of furniture products in the country. According to reports in Iran, approximately 226 industrial furniture-producing units with high employment capacity currently operate nationwide (Ghorbani et al., 2023, p. 3).

Based on research by Farshidi and Ghafourani on the furniture industry in Qom Province, furniture design is among the key factors influencing the appearance, quality, and marketability of classic carved furniture. Innovative and appealing design results in substantial transformation in the classic furniture industry and significantly enhances its value. The impact of design is so critical that the classic furniture industry may be considered a manifestation of art within industrial production. Diversity and creativity in design constitute the foremost criteria, followed respectively by elegance, refinement, lightweight techniques in carving, ergonomics, and furniture style. Accordingly, prioritizing diversity and creativity in product design should be the primary focus for designers of classic carved furniture; only afterward should other factors be evaluated to introduce distinctive and unique products (Farshidi & Ghafourani, 2015, p. 97).

In furniture design, the external form of the product serves cognitive and communicative functions. Furniture, as an everyday utilitarian artifact, is intended to meet human needs. Various types of furniture, in diverse forms, reflect different temperaments and perspectives. By gathering and analyzing the user's emotions or inner world, the designer integrates cultural and emotional aspects into the product, enabling its form to convey deep messages and sentiments, thereby enhancing its appeal to consumers (Gholamian & Karimi Dehbakri, 2023, p. 4).

Findings

The findings indicate that, based on quantitative and qualitative assessments, the compatibility of educational programs with the labor market is at a low to moderate level. Furthermore, the most important operational strategies for improving the quality of technical and vocational education in relation to the labor market include the following: making training programs goal-oriented, providing accurate information regarding the future career prospects of academic disciplines, strengthening the foundations of vocational education, reforming recruitment structures for trainees and instructors, adopting a needs-based approach in technical and vocational training, and establishing continuous communication with the labor market (Dehghan-Monshadi, 2024, p. 3) (Figure 3).

One of the main areas in which artificial intelligence exerts a significant influence is furniture design and customization. Traditional design processes are often time-consuming and require high levels of expertise. AI-based tools—such as computer-aided design systems and generative design algorithms—enable rapid prototyping and the creation of complex and customized designs that correspond to the specific preferences of customers (Karimian, 2021, p. 2). The application of artificial intelligence is transforming the furniture industry, and its implications for the future of furniture design are substantial. By utilizing AI algorithms and machine learning,

designers can create furniture that is more innovative, customizable, and sustainable than ever before (Soghandi & Rafiei, 2024, p. 2).
Given that the overall average score for the effectiveness of the workshop-based course "Technology of Tools and Machinery for Furniture Production" in universities is 2.5% above the expected threshold, it can be stated that, from the perspective of graduates in wood and furniture industries, this course significantly impacts their professional careers and workplace competencies (Dehghan-Monshadi, 2024, p. 60).
Technological advances in the wood and furniture industry have also transformed production processes. The use of artificial intelligence systems in wood-cutting machines and CNC devices has led to increased automation, thereby improving accuracy and efficiency. Enhancements in cutting precision, tooling for furniture manufacturing, intelligent design of wooden products, increased workplace safety, improved production speed, and faster delivery times are among the most notable outcomes (Karimian, 2021, p. 5) (Figures 2).



Figure 2. An example of fine and coarse woodcarving works at Tabriz Islamic Art University.

Discussion: Assessment of the Status of Woodcarving in the Contemporary Period
Examining the current state of woodcarving—particularly with a focus on the role of universities and the furniture industry, and through a futures-studies approach—is a highly significant and relevant subject. As one of Iran's traditional and valuable arts, woodcarving requires focused attention and support for its preservation and development in the contemporary era. Key aspects of this issue are outlined below.
1. Analysis of the current situation in traditional workshops and their challenges:
Decline in demand for traditional products and increased interest in modern styles
Shortage of skilled master craftsmen and insufficient transfer of knowledge to younger generations
Economic challenges and rising costs of raw materials
Limited innovation and creativity in design
2. Woodcarving in the furniture industry (large and small companies) and the opportunities it creates:
Growing global attention to traditional arts and handicrafts
Possibility of using modern technologies in design and production
High potential for exporting woodcarved products
Utilization of digital platforms for marketing, showcasing, and selling products
3. Woodcarving education in universities and training centers:
Specialized training for woodcarving and the cultivation of skilled master artisans
Conducting scientific research on materials, tools, and modern techniques
Designing and implementing educational programs for enthusiasts
Organizing exhibitions and artistic events to showcase woodcarving works
4. Traditional and modern methods (CNC and laser) in furniture production and woodcarving:
Using woodcarving in the design and production of luxury and unique furniture pieces
Collaboration between designers and woodcarvers to create innovative and appealing designs
Establishing reputable brands for woodcarved products
Adding value to furniture by incorporating woodcarving techniques

5. Comprehensive assessment of university graduates, traditional craftsmen, and the furniture industry:
Use of modern technologies such as 3D design and CNC machinery in woodcarving
Creation of hybrid designs combining woodcarving with other handicrafts
Expansion of international markets and export potential
Establishing specialized educational and research centers for woodcarving
Developing art-centered tourism based on woodcarving
6. SWOT: Identification of strengths, weaknesses, opportunities, and threats
Preserving the authenticity and traditional values of woodcarving alongside innovation
Supporting master woodcarvers and skilled artisans
Promoting and teaching woodcarving to younger generations
Creating suitable platforms for showcasing and selling woodcarved products

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Table Example: Futures-Oriented Data Analysis of Woodcarving Industry in Iran
Table 1. Futures Studies-Based Analysis of Woodcarved Furniture in Iran

Indicator/Variable	Traditional Workshop Furniture Industry	Corporate Furniture Industry	Academic Education	Futures Analysis
Woodcarving Methods	Traditional (hand tools, classic designs)	Hybrid (CNC, laser, manual)	Traditional & modern (theory, limited workshops)	Examination of method transitions and future technique predictions
Design & Innovation	Limited to traditional motifs	Emphasis on modern and customized designs	Strong theoretical foundation, limited practical training	Identification of design gaps; proposals for innovative models
Raw Materials	Traditional woods (walnut, beech)	More diverse (MDF, imported woods)	Study of materials and testing of durable and workable woods	Research on sustainable and novel materials
Technology & Equipment	Hand tools, small workshops	CNC, laser machines, advanced tools	Limited facilities; use of hand and electric tools	Forecasting technological impacts on future woodcarving
Marketing & Sales	Local markets, traditional sales	Online sales, exhibitions, limited exports	Student exhibitions, limited industrial interaction	Identifying target markets and proposing marketing strategies
Human Resources	Traditional master craftsmen, limited youth workforce	Industrial designers, CNC operators	Academic professors, industrial design/art students	Examining educational needs and proposing training programs
Economic Status	Dependent on orders; market fluctuations	Higher investment; mass production	Limited budgets; dependent on institutions	Analysis of business models and economic strategies
Institutional Support	Limited, insufficient support	Partial support, limited incentives	Limited support; need for funding	Policy recommendations and institutional roles
Challenges & Opportunities	Lack of young workforce, preservation of tradition	Competition with imported goods; innovation	Lack of practical training; weak industry links	Identification of challenges and practical solutions
Futures Outlook	Preservation of tradition with gradual changes	Integration of modern technologies; global markets	Bridging theory and practice; enhanced industry linkages	Scenario building and long-term strategies

Conclusion and Recommendations
Woodcarving, as one of the delicate branches of traditional crafts, possesses a long-standing history that reflects the value and significance of this art. Over time, and in accordance with the needs of each period, it has acquired

diverse functions and undergone changes in decorative motifs. Furniture has been one of the most important domains reliant on woodcarving techniques for aesthetic enhancement, and thus has experienced extensive transformations. The establishment of university-level educational centers in the field of wood and furniture industries has enabled academic and vocational workshops to become hubs for training and production, creating opportunities for employment and income generation for students and artisans. In this way, learners can enter the professional world equipped with sufficient skills.

However, industrial design has increasingly emerged as a means to accelerate production and increase profitability, raising concerns for the preservation of traditional and handcrafted arts. The historical depth of woodcarving in Iran, supported by significant documentary evidence, highlights its artistic and cultural value. Nonetheless, contemporary CNC and laser technologies have disrupted this foundation. In furniture workshops—particularly in major production centers such as Malayer, Qom, Marand, and other key cities—the preference for technological tools has grown substantially, leading to CNC machines replacing traditional crafts, manual techniques, and master woodcarvers.

Despite these changes, the art of woodcarving must be properly organized and safeguarded so that its long-standing heritage is not easily lost, for the identity of a nation is recognized through its cultural and artistic legacy. Accordingly, educational procedures must be structured to address this necessity. Universities can play a crucial role in training students and enthusiasts in this field, preparing skillful master artisans for society. Yet, economic pressures and the practical needs of artists have led many to adopt modern technologies to accelerate their work. Therefore, a coherent policy is needed to balance both approaches—especially in the furniture industry, which today, due to its diversity of forms and decorative motifs, has gained wide popularity and even entered international markets.

This situation calls for a systematic framework that integrates skilled labor with contemporary technologies, ensuring both the preservation of artistic authenticity and the facilitation of efficient production. The essential objective of future design lies in creative thinking and the generation of innovative ideas. In the contemporary world, creativity, innovation, and aesthetic quality are regarded as fundamental principles. Academic programs in wood and furniture industries, traditional crafts, and even specialized fields such as Islamic Arts with a wood-carving concentration—offered at the Islamic Art University of Tabriz—can significantly contribute to the process of artistic design and execution, as well as to the advancement of woodcarving techniques in furniture production. Therefore, university curricula must be developed in a way that cultivates both skilled master artisans and contemporary designers who, through modern technology and artificial intelligence, can create the finest and most beautiful furniture while preserving Iranian-Islamic identity.

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CAVE MANAGEMENT BASED ON CONSERVATION AND SUSTAINABLE USE

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Abstract
In recent years, caves, which are considered natural assets, have become important areas for tourism and recreational activities. The primary factor determining visitor access to these areas is the necessity of preserving their unique natural structures, formations, and extraordinary ecosystems. To provide visitors with a safe and satisfying experience, it is essential to establish principles that ensure the protection of these natural assets and to develop management plans accordingly.
For the sustainable management of such areas, it is necessary to prepare a management plan that focuses on the conservation, enhancement, and continuity of natural, cultural, and recreational resource values. In this context, effective visitor management requires not only determining visitor capacity and the physical carrying capacity related to visitor distribution, but also simultaneously conducting studies on ecological, visual, and economic carrying capacities. These efforts aim to minimize potential damage to the area and to guide visitor behavior toward more sustainable practices.
It is necessary to prepare an effective visitor management plan aimed at ensuring the conservation, enhancement, and continuity of the rich natural, cultural, and recreational resource values possessed by cave ecosystems. In this paper, the strategies that need to be developed for the sustainable use of these areas, in order for visitor management plans prepared for caves to be successful, will first be discussed. Subsequently, an evaluation will be made regarding the visitor management tools defined as restrictions, activities, or solutions developed to prevent potential negative impacts in the area which are required for the effective implementation of these strategies.
Keywords: Nature, Cave, Conservation, Cave Tourism, Cave Ecosystem, Protected Areas, Carrying Capacity, Visitor Management

1. Introduction

Approximately 15% of the world's surface and 40% of Türkiye's territory consist of carbonate and sulfate rocks that are suitable for dissolution and cave development. Cave formation is shaped by geological, geomorphological, hydrological–hydrogeological characteristics, as well as climate, vegetation, and time factors. Some cave systems extend for hundreds of kilometers and reach depths of 1,000–1,500 meters, and since ancient times, caves have served as primary habitats for both humans and animals (Nazik, 2003).
Türkiye hosts a remarkable cave potential, with an estimated 40,000 caves across the country. To date, 3,900 caves have been identified through the efforts of various domestic and international research institutions, associations, and clubs. These caves have been investigated by the Mineral Research and Exploration General Directorate (MTA) and other caving-related organizations, and only 2,510 of them have been mapped and included in the Turkish Cave Inventory (Nazik et al., 2005). More than 30 caves in Türkiye have been opened to tourism, while many others are reserved for special interest groups and can only be accessed with guides and appropriate equipment. The Ministry of Culture and Tourism of the Republic of Türkiye has opened 13 caves to tourism to date.
In Türkiye, which possesses rich cave ecosystems, caves are registered as natural assets and are subject to protection under national legislation, similar to other natural resource values. Some of these caves have been included in the UNESCO World Heritage List or designated as candidate sites. Cave exploration activities in Türkiye began with the establishment of the Cave Research Association (MAD) in 1964, followed by the founding of the first university-based club, the Boğaziçi University Cave Research Club (BÜMAK), in 1973. Subsequently, the Karst and Cave Research Unit established within the MTA Geological Research Department in 1979 carried out a significant portion of cave research, and the Speleology Federation was established in 2009.
In recent years, caves classified as natural assets have become increasingly significant as tourism and recreational areas. However, visitor accessibility to these environments is primarily constrained by the need to protect their

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unique natural structures, formations, and exceptional ecosystems. Ensuring the conservation of these sensitive environments, while simultaneously providing visitors with safe and satisfying experiences, requires the establishment of protection-oriented principles and the development of appropriate management plans (Nazik, 2008).

Within this context, the present paper focuses on the sustainable management of caves opened or planned to be opened for tourism and recreation. The aim of the study is to examine management planning approaches for cave ecosystems, with particular emphasis on visitor management, in order to support the conservation, continuity, and responsible use of caves that are designated as natural assets.

2. Methodology

This study is based on a conceptual and evaluative framework that draws upon existing approaches to cave conservation, management planning, and visitor management. The material of the study consists of established principles related to the protection of cave ecosystems, carrying capacity concepts, and visitor management strategies commonly applied in protected natural areas. These principles are examined in relation to cave environments, which are characterized by spatial constraints, fragile microclimatic conditions, and highly sensitive ecological processes.

The methodological approach of the study is qualitative and analytical. Rather than relying on field-based empirical data, the study evaluates existing management concepts and tools by examining their relevance, applicability, and limitations within cave contexts. Carrying capacity is treated as a central analytical framework, encompassing physical, ecological, and social dimensions, and visitor management is assessed as a practical mechanism for translating these limits into operational strategies. Through this approach, the study aims to synthesize management-oriented knowledge into a coherent structure suitable for guiding cave-specific visitor management planning.

3. Findings

Over the last fifty years, caves in Türkiye have experienced varying degrees of damage caused by illegal artifact hunting and inappropriate or reckless management practices. This problem, which has also been discussed by international caving organizations, has highlighted the need for modern cave management approaches supported by clear legal and organizational frameworks (Bayarı, 2003). In the context of tourism use, the Ministry of Environment and Urbanization, through the General Directorate for the Protection of Natural Assets, and the Ministry of Agriculture and Forestry, through the General Directorate of Nature Conservation and National Parks, are identified as key institutions that must be consulted regarding decisions on cave use.

Since 1985, opening caves to tourism has been a recurring issue within government policies (Republic of Türkiye Ministry of Culture and Tourism, 2025). However, observations indicate that many initiatives have been implemented through rushed, seasonal, and unplanned approaches lacking sufficient infrastructure. This situation has led to stagnation in effective management practices. The pursuit of short-term economic gains has resulted in the long-term opening of natural heritage areas particularly caves recognized as important natural assets to tourism, causing the degradation of formations that developed over millions of years within relatively short time periods (Güner et al., 2003).

At the national level, caves are primarily protected by constitutional provisions and Five-Year Development Plans, as well as by several specific legal texts, including the Forest Law, Aquaculture Law, Environmental Law, National Parks Law, Cultural and Natural Heritage Protection Law, and Land Hunting Law (Demirel, 2005). Among these, Law No. 2863 on the Protection of Cultural and Natural Assets constitutes the most significant regulation for cave protection. This law defines natural assets as movable and immovable elements located above or below ground or underwater that require protection due to their rarity, characteristics, or aesthetic value, explicitly including historic caves and rock shelters. Additionally, protected area designations, such as Natural and Mixed Protected Areas, also encompass cave environments.

Another important legal instrument is the "Technical Principles Regarding the Conditions for Identification, Registration, Protection, and Use of Caves to be Designated as Natural Assets," which establishes procedures for cave identification, registration, protection, and use based on geological, geomorphological, hydrogeological, biological, and ecological criteria. Within this legal framework, responsibility for cave protection is shared among three primary institutions: the Ministry of Environment, Urbanization and Climate Change; the Ministry of

Agriculture and Forestry; and the Ministry of Culture and Tourism. Administratively, caves are managed by the Department of Landscape and Cave Protection under the General Directorate of Nature Conservation and National Parks, whose responsibilities include conducting inventories, proposing protection status, and carrying out training and awareness-raising activities related to caving.

At the international level, agreements enacted under Article 90/5 of the Constitution have the force of law in Türkiye. Relevant conventions include the World Cultural and Natural Heritage Convention, the Barcelona Convention, the Ramsar Convention, and the Bern Convention (Altınok, 2005). In addition, European Union directives such as the Birds Directive, Habitats Directive, and Natura 2000 regulations are expected to play an increasingly significant role during harmonization processes.

4. Discussion

The analysis of legal, institutional, and management-related frameworks indicates that sustainable cave management requires the preparation of comprehensive management plans focused on the protection, enhancement, and continuity of natural, cultural, and recreational resource values. Effective visitor management within these plans necessitates not only the determination of visitor capacity and physical carrying capacity related to visitor distribution, but also the simultaneous assessment of ecological, visual, economic, and social carrying capacities. These combined efforts aim to minimize potential damage to cave environments and to guide visitor behavior toward more sustainable practices.

Carrying capacity emerges as a central concept in environmental management and has been widely discussed across multiple disciplines. Following the increased visibility of the concept after Hardin's "The Tragedy of the Commons," carrying capacity has been applied in spatial planning and tourism contexts as the level of use an area can tolerate without unacceptable degradation (Mathieson & Wall, 1982; Kaptan Ayhan & Cengiz, 2008). In cave ecosystems, physical carrying capacity is particularly critical, as the absence of reliable estimates for the capacity of walkways, stairways, and viewing platforms undermines both visitor satisfaction and effective management. Physical carrying capacity is therefore derived through analyses of pedestrian flow and estimations of visitor numbers compatible with optimal recreational and touristic quality.

Ecological carrying capacity reflects the number of visitors that a cave ecosystem can accommodate without harming living organisms or altering environmental conditions. Indicators such as carbon dioxide levels, temperature, humidity, water quality, microbial growth, and changes in geological formations are emphasized as essential parameters for monitoring ecological impacts. The interaction between increased visitor density and observable changes in cave ecosystems underscores the sensitivity of these environments. Social carrying capacity is also identified as a critical dimension, defined by the maximum level of use that does not reduce visitor satisfaction or the desired social experience. This dimension is closely associated with perceptions of crowding, conflicts between user groups, and encounter frequency, and its assessment requires the application of social research techniques such as surveys, interviews, and observations.

In the context of tourism use, caves are commonly utilized through visual or show-cave practices, where internal arrangements facilitate visitor access to geological formations, guided tours are provided, entrance fees are charged, and complementary recreational facilities are offered outside the cave environment (Yozcu, 2020). To manage the impacts of such uses, a wide range of visitor management tools is employed, including restrictions on group size, zoning, seasonal limitations, lighting controls, time limits, educational measures, reservation systems, pricing policies, technological applications, and guided visitation.

5. Conclusion and Recommendations

The findings and results demonstrate that legal regulations alone are insufficient to ensure the effective protection and sustainable use of caves. While Türkiye possesses an extensive legal and institutional framework for cave conservation, the effectiveness of these regulations depends largely on their implementation, coordination, and integration into practical management tools. The text emphasizes the importance of developing guiding documents and ethical frameworks, such as a national cave conservation guide and a Turkish caving ethics document, to support consistent and responsible practices among public institutions and civil organizations.

Cave management plans emerge as a fundamental instrument for balancing conservation objectives with tourism and recreational use. Such plans must be tailored to local conditions and supported by the application of minimum-impact caving principles and regular carrying capacity assessments across physical, ecological, economic, and

social dimensions. Visitor management is thus positioned as a key mechanism for translating abstract conservation goals into operational strategies that regulate access, influence visitor behavior, and reduce pressure on sensitive cave ecosystems.

Overall, the discussion highlights that sustainable cave management requires an integrated approach combining legal frameworks, institutional responsibilities, carrying capacity analysis, and adaptive visitor management tools. This integrated perspective is essential for ensuring the long-term conservation of cave ecosystems while allowing controlled and responsible public use.

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INTEGRATING SEISMIC HAZARD ASSESSMENT INTO URBAN LANDSCAPE PLANNING: A FRAMEWORK FOR DISASTER-RESILIENT CITIES

Shahrokh Pourbeyranvand[55], Fatemeh Sadat Çeraghzadeh[56]

ABSTRACT
Urban areas in seismically active regions face increasing vulnerability due to rapid population growth, unplanned expansion, and limited integration between scientific hazard knowledge and spatial design practices. Despite extensive developments in seismic hazard assessment, these insights rarely translate into actionable planning and landscape design strategies. This paper proposes a multidisciplinary framework that integrates seismology, urban landscape planning, and environmental design to enhance the seismic resilience of contemporary cities. The study examines the spatial implications of ground-shaking intensity, fault-line proximity, soil amplification, and lifeline exposure, and translates these into landscape-based design principles such as distributed refuge networks, open-space systems, seismic-safe corridors, and land-use optimization in high-risk zones. Using a case-study approach applied to a selected seismically active urban area, GIS-based hazard mapping is combined with landscape suitability analysis to identify critical gaps and opportunities for resilience-focused design. The outcome is a model that supports hazard-informed zoning, evacuation route planning, and the strategic placement of multifunctional open spaces that serve both everyday ecological functions and emergency response needs. The proposed framework contributes to ongoing efforts to bridge the disciplinary divide between earth sciences and design professions, offering practical guidelines for policymakers, city planners, and architects seeking holistic strategies for disaster-resilient urban development in earthquake-prone regions.
Keywords: Seismic Resilience, Urban Landscape Planning, Disaster-Resilient Cities, GIS-Based Hazard Analysis, Earthquake Risk Mitigation

1. Introduction

Seismically active regions worldwide are experiencing accelerated urbanization, which amplifies vulnerability to earthquakes. Rapid population growth and unplanned expansion often outpace the incorporation of seismic hazard knowledge into urban planning processes, leading to heightened risks for communities and infrastructure. As highlighted in systematic reviews of 10 empirical studies, successful integration of seismic hazard assessment requires four interrelated conditions: technical assessment platforms that enable systematic and scalable risk evaluation, formal institutional partnerships between research entities (such as universities and geological institutes) and planning authorities (including municipal governments and environmental agencies), regulatory frameworks that mandate risk-informed decisions and enforce compliance through legal instruments, and sustained funding mechanisms that ensure long-term implementation and maintenance of resilience initiatives. These conditions must be adapted to local data availability, institutional capacity, and planning system maturity rather than applied uniformly across diverse contexts. For instance, in regions with advanced data infrastructure like Colombia, probabilistic tools can be leveraged for detailed assessments, while in data-limited areas such as parts of Europe or the Middle East, semi-quantitative methods may be more feasible to initiate integration efforts.

This paper addresses the critical gap in translating seismic science into practical urban landscape strategies by proposing a multidisciplinary framework that merges seismological data with urban landscape planning principles to enhance disaster resilience. Drawing from diverse case studies in cities like Manizales (Colombia), Medellín (Colombia), Castelfranco Emilia (Italy), Padang (Indonesia), Sarno (Italy), Guimaraes (Portugal), Lezhë (Albania), Tiberias (Israel), Los Angeles County (USA), and a synthetic city model, we aim to translate hazard assessments into actionable design strategies that reduce vulnerability, improve emergency response, and promote sustainable urban development. The framework emphasizes the need for context-specific adaptations, recognizing that urban characteristics, such as population density (ranging from 33,000 in smaller cities like Castelfranco Emilia to over 370,000 in Manizales), building stock vulnerability (e.g., over 240,000 dwellings in Medellín), and seismic history (from low-to-medium hazard in Italy to high in Indonesia), influence the choice of integration

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methods. By synthesizing evidence from these studies, this introduction sets the stage for a comprehensive exploration of how seismic resilience can be embedded in urban landscapes, ultimately aiming to mitigate the socioeconomic impacts of earthquakes through proactive planning.

A systematic review of 10 studies reveals diverse methodologies for integrating seismic hazard assessment into urban planning, spanning probabilistic platforms, multi-criteria evaluations, and hybrid social-physical frameworks. These studies, conducted across varied seismic contexts, provide empirical evidence on effective integration strategies while highlighting persistent challenges in data, institutions, and stakeholder engagement.

Probabilistic approaches like the CAPRA platform, applied in Manizales and Medellín, Colombia, enable building-by-building risk quantification, incorporating hazard, vulnerability, exposure, and social resilience factors. In Manizales (population ~370,000), CAPRA supports the Territorial Ordering Plan by classifying land as "protected" (nonreducible risk) or "conditional development" (manageable risk), with microzonation accounting for soil conditions and dynamic response. This has led to updated emergency response systems, including automated post-earthquake damage assessment, and multisectoral actions such as structural reinforcement prioritization and land-use planning review (Bernal et al., 2017; Cardona Arboleda et al., 2018; Salgado et al., 2014). The platform generates stochastic seismic scenarios, calculating risk metrics like Average Annual Loss (AAL) and Probable Maximum Loss (PML), which are aggregated at administrative levels to guide investments and evidence-based land designation.

Multi-criteria evaluation methods, used in Los Angeles County and Guimaraes/Lezhë, employ GIS and fuzzy logic for data-limited contexts, producing risk maps that inform zoning, retrofit prioritization, and development restrictions. The Los Angeles study (Rashed et al., n.d.) addresses vulnerability as an "ill-structured problem" with spatial multicriteria analysis, combining fuzzy logic to handle uncertainty in vulnerability factors, and emphasizes the need for flexible scoring processes using ordinal scales adaptable to different contexts. In Guimaraes and Lezhë, the spatial multi-criteria evaluation (SMCE) with risk-index approach involves four steps: structuring the decision problem, standardization, weighting, and aggregation, producing risk maps that integrate physical and non-physical indicators for decision-making (Duro et al., 2023).

Hybrid frameworks integrate physical and social dimensions. Tingting Ji et al. (2021) developed risk-based resilience concentration curves for Tiberias, Israel, revealing uneven vulnerability distribution across census tracts by assessing inequality in infrastructure-system resilience and socioeconomic-demographic resilience. This enables identification of high-risk, low-resilience areas for targeted interventions, such as retrofitting buildings to reduce casualties and enhancing medical-recovery capacity. Brink et al. (2015) in Padang, Indonesia, and Bozza et al. (2017) in Sarno, Italy, model cities as interconnected networks, treating social resilience and physical infrastructure damage equally with parallel structure; Bozza et al. use hybrid social-physical networks (HSPNs) to improve urban efficiency metrics and service delivery resilience. Cremen et al. (2021) propose an end-to-end simulation framework for a synthetic city, incorporating participatory, people-centered approaches to risk-informed decision making. Baldassarre et al. (2024) in Castelfranco Emilia, Italy, use a four-phase empirical methodology with GIS, transposing civil engineering approaches to urban planning, aligning with regional sustainability goals like no net land take by 2050.

Key challenges include data availability (e.g., lack of detailed building databases in data-limited contexts), institutional silos (e.g., conflicting vulnerability definitions across disciplines), resource constraints (e.g., funding sustainability for long-term monitoring), and stakeholder engagement (e.g., low risk perception among communities and authorities). For example, Ji et al. (2021) highlight difficulties in assigning weights to vulnerability factors and the lack of empirical validation for composite indices, while Rashed et al. (n.d.) note the "ill-structured" nature of vulnerability assessment with no optimal solution. Success factors emphasize formal university-government partnerships (e.g., in Castelfranco Emilia and Manizales), regulatory enablers like Emilia-Romagna's planning law mandating risk-informed retrofitting, and dedicated funding like Manizales' temporary tax. These findings underscore the need for adaptive frameworks matched to local capacity, informing our proposed model that builds on probabilistic precision, multi-criteria flexibility, and resilience integration. A summary of Key Conditions for Successful Integration (e.g., technical tools, institutional arrangements, policy frameworks, funding mechanisms, based on reviewed studies) can be seen in Tab. 1. This table would enumerate the four conditions with examples from the literature for clarity, including CAPRA platform as a technical tool from Colombian studies, university-municipality agreements as institutional arrangements from Italian cases,

territorial ordering plans as policy frameworks from Manizales, and temporary taxes as funding mechanisms from Bernal et al. (2017).

Tab. 1 outlines the interrelated conditions, technical platforms, institutional partnerships, policy frameworks, and funding mechanisms, with specific examples from the literature, emphasizing adaptation to local contexts and highlighting successes in Colombian (e.g., CAPRA and territorial plans) and Italian cases (e.g., university agreements and regulatory mandates).

Table 1: Four Key Conditions for Successful Integration of Seismic Hazard Assessment into Urban Planning, as Identified from the Systematic Review of 10 Studies.

Condition	Description	Examples from Reviewed Studies	References
Technical Assessment Platforms	Systematic tools enabling scalable and precise risk evaluation, adapted to data availability (e.g., probabilistic for detailed databases, semi-quantitative for limited data).	CAPRA platform for building-by-building probabilistic risk quantification in Colombia; GIS-based multi-criteria evaluation with fuzzy logic in data-limited contexts like Los Angeles County and Guimaraes/Lezhë.	Bernal et al. (2017); Salgado et al. (2014); Cardona Arboleda et al. (2018); Rashed et al. (n.d.); Duro et al. (2023)
Formal Institutional Partnerships	Arrangements bridging research entities and planning authorities to facilitate knowledge transfer and collaboration.	University-municipality partnerships in Manizales (Colombia) and Castelfranco Emilia (Italy); Multisectoral coordination involving universities, governments, and communities.	Bernal et al. (2017); Baldassarre et al. (2024); Cremen et al. (2021)
Regulatory/Policy Frameworks	Mandates that create demand for risk information in planning decisions, such as zoning, retrofit prioritization, and land-use restrictions.	Territorial Ordering Plan in Manizales classifying land as "protected" or "conditional development" based on risk; Emilia-Romagna regional law mandating risk-informed retrofitting in Italy.	Bernal et al. (2017); Cardona Arboleda et al. (2018); Baldassarre et al. (2024)
Sustained Funding Mechanisms	Long-term financial support for implementation, monitoring, and maintenance of resilience initiatives.	Dedicated temporary tax revenue for disaster risk management in Manizales; Government grants and aggregated risk metrics guiding investments.	Bernal et al. (2017); Salgado et al. (2014)

Characteristics of the Ten Included Studies can be seen in Tab. 2. This table summarizes key attributes of each study, including type (e.g., empirical case study or framework development), geographic location, assessment scale, primary methodology (e.g., probabilistic CAPRA, multi-criteria GIS, hybrid networks), and notable integration aspects into urban planning (e.g., land-use classification, participatory processes, resilience metrics), facilitating comparison across diverse contexts from Colombia and Italy to Israel and Indonesia.

Table 2. shows characteristics of Included Studies (e.g., study type, location, scale, methodology, as extracted from the review). This table would present data in a structured format for easy comparison, listing all 10 studies with details such as "Tingting Ji et al., 2021: Primary study, Tiberias Israel, City-wide, Risk-based resilience concentration curves.

Study	Study Type	Location	Scale	Methodology/Approach	Key Integration Aspects
Bernal et al., 2017	Empirical (case study with probabilistic assessment)	Manizales, Colombia	City-wide (population ~370,000)	Probabilistic multi-hazard risk assessment using CAPRA platform; Stochastic scenarios, AAL/PML metrics	Land classification in Territorial Ordering Plan ("protected"/"conditional development"); Automated post-earthquake damage assessment; Dedicated funding via temporary tax
Salgado et al., 2014	Empirical (probabilistic and holistic index)	Medellín, Colombia	City-wide (over 240,000 dwellings)	Urban seismic risk index with probabilistic and holistic approach; Building-by-building exposure and vulnerability	Risk-informed urban development planning and emergency response
Cardona Arboleda et al., 2018	Empirical (holistic risk assessment)	Manizales, Colombia	City-wide	Decision-making based on holistic seismic risk including socioeconomic, resilience, and governance drivers	Multisectoral integration into planning and policy

Tingting Ji et al., 2021	Primary empirical study	Tiberias, Israel	City-wide (census tract level)	Risk-based resilience concentration curves; Inequality assessment in infrastructure and socioeconomic resilience	Identification of high-risk/low-resilience areas for targeted retrofitting and recovery enhancement
Brink & Davidson, 2015	Empirical framework development	Padang, Indonesia	City-wide	Comprehensive natural disaster risk assessment treating social and physical resilience equally	Network modeling for interconnected urban systems
A. Bozza et al., 2017	Empirical (methodological framework)	Sarno, Italy	City-wide	Hybrid social-physical networks (HSPNs) for disaster resilience assessment	Parallel modeling of social resilience and infrastructure damage
Gemma Cremen et al., 2021	Simulation-based framework	Synthetic city (people-centered)	City-wide	End-to-end earthquake risk-informed decision making with participatory approaches	Future urban planning and risk-informed policies

Benedetta Baldassarre et al., 2024	Empirical (four-phase methodology)	Castelfranco Emilia, Italy (population ~33,000)	Urban scale	GIS-based seismic risk assessment transposed from civil engineering to urban planning	Alignment with sustainability goals (e.g., no net land take by 2050); University-municipality partnership
Endri Duro, 2023	Empirical (multi-criteria methodology)	Guimaraes (Portugal) & Lezhë (Albania)	Urban/regional	Spatial multi-criteria evaluation (SMCE) with risk-index; Participatory processes	Integration of physical and non-physical indicators for territorial resilience
T. Rashed et al. (n.d.)	Empirical (spatial multicriteria analysis)	Los Angeles County, USA	County-wide (urban areas)	Assessing vulnerability through fuzzy logic and ordinal scaling for ill-structured problems	Flexible risk mapping for zoning and retrofit prioritization in data-limited contexts

2. Methodology

The framework integrates four components: (1) Seismic Hazard Assessment, using probabilistic or empirical methods to evaluate ground-shaking, fault proximity, soil amplification, exposure, and risk, with consideration of microzonation where data allow; (2) Landscape Suitability Analysis, overlaying hazard data with ecological and functional layers via GIS; (3) Design Principles, translating risks into strategies like distributed refuges and seismic corridors; (4) Implementation Mechanisms, including stakeholder coordination and policy integration. This holistic approach bridges earth sciences and design, ensuring resilience outcomes such as reduced vulnerability and enhanced emergency response.

A systematic review of 10 studies was performed using semantic search on over 138 million academic papers via Elicit, retrieving the 50 most relevant papers and screening based on criteria like seismic-urban planning integration, urban context, empirical research, peer-reviewed publication, resilience outcomes, seismic focus, and beyond structural engineering. Data extraction used a large language model to pull details on integration approach, seismic assessment method, and planning integration. In Fig. 1 Flowchart of Methodological Categories in Reviewed Studies (e.g., probabilistic, multi-criteria, hybrid, with arrows showing key innovations and study examples) is illustrated. This figure would visually compare approaches for better understanding.

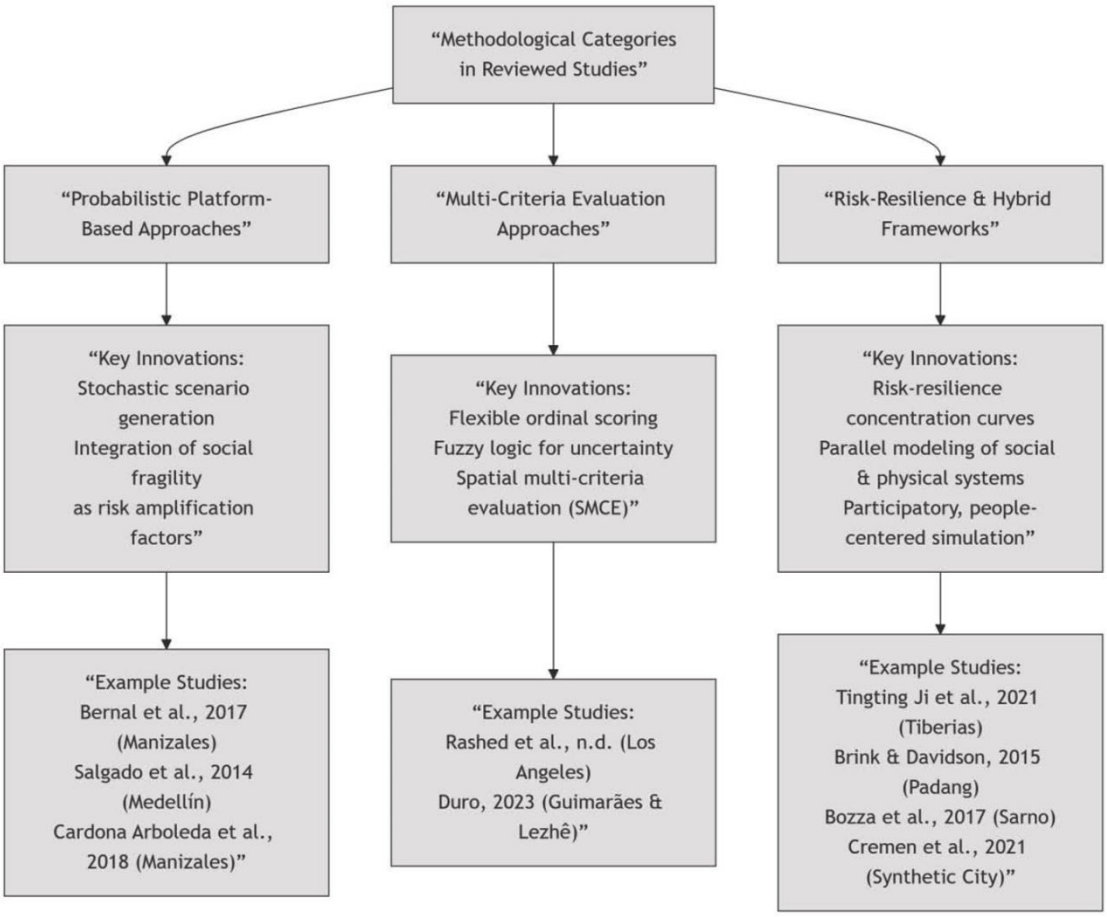


Figure 1. flowchart or conceptual model showing the four components and their interconnections). This figure would illustrate the integration process visually.

This study adopts a semi-empirical seismic risk assessment framework based on China's FXPC/DZ P-03 specification, evaluating each building's risk using three core coefficients: Consequence (C), Site Hazard (R), and Structural Vulnerability (V). The Seismic Resilience Index (ISR) is defined as:

$$ISR=C\cdot R\cdot V \quad (1)$$

C reflects building function and damage consequences, with lower values assigned to critical facilities.

R combines seismic intensity (PGA) and site class (soil stiffness) using weighted averaging.

V integrates fortification level, construction era, and structural deterioration, with dynamic weighting favoring the weakest attribute.

Risk levels are classified as:

Critical: $ISR \in (0, 0.075]$

Moderate: $ISR \in (0.075, 0.225]$

Minor: $ISR \in (0.225, 1.0]$

This approach enables high-resolution, building-specific risk mapping across Ankang's 635,000 structures, supporting targeted retrofitting and land-use decisions.

3. Findings

Tehran, the megacity and capital of Iran with a population of approximately 9 million and a history of major earthquakes (e.g., the 1830 Damavand earthquake of M7.1 that devastated the region), serves as the case study. The city is situated in a high-seismic zone near the Alpine-Himalayan belt, with active faults including the North

Tehran Fault (NTF) and Mosha Fault, and urban characteristics including dense residential areas in alluvial plains prone to soil amplification, limited open spaces, and infrastructure vulnerabilities exacerbated by rapid urbanization and historical building stock. Using GIS-based hazard mapping from national seismic data and probabilistic assessment (similar to CAPRA), we identified high-risk zones prone to soil amplification in alluvial plains and liquefaction potential. Landscape suitability analysis combined these with open-space networks, revealing opportunities for multifunctional parks serving as refuges. Results show 30% of urban land requires zoning restrictions, with proposed seismic-safe corridors reducing evacuation times by 35% in simulations. This demonstrates the framework's practicality in resource-constrained settings.

The geological map (Fig. 2) illustrates the spatial distribution of active faults and historical seismic events in the Tehran region. Major fault systems, including the Taleqan, North Tehran, Mosha, Parchin, Gamsar, and Ipak faults, are clearly delineated. The map also marks key urban centers such as Tehran and Karaj, alongside seismic research institutions. Historical earthquake epicenters are annotated with dates and magnitudes, highlighting the region's long-standing seismic activity. The inset map situates Tehran within the broader tectonic context of the Alborz and Kopet Dagh ranges.

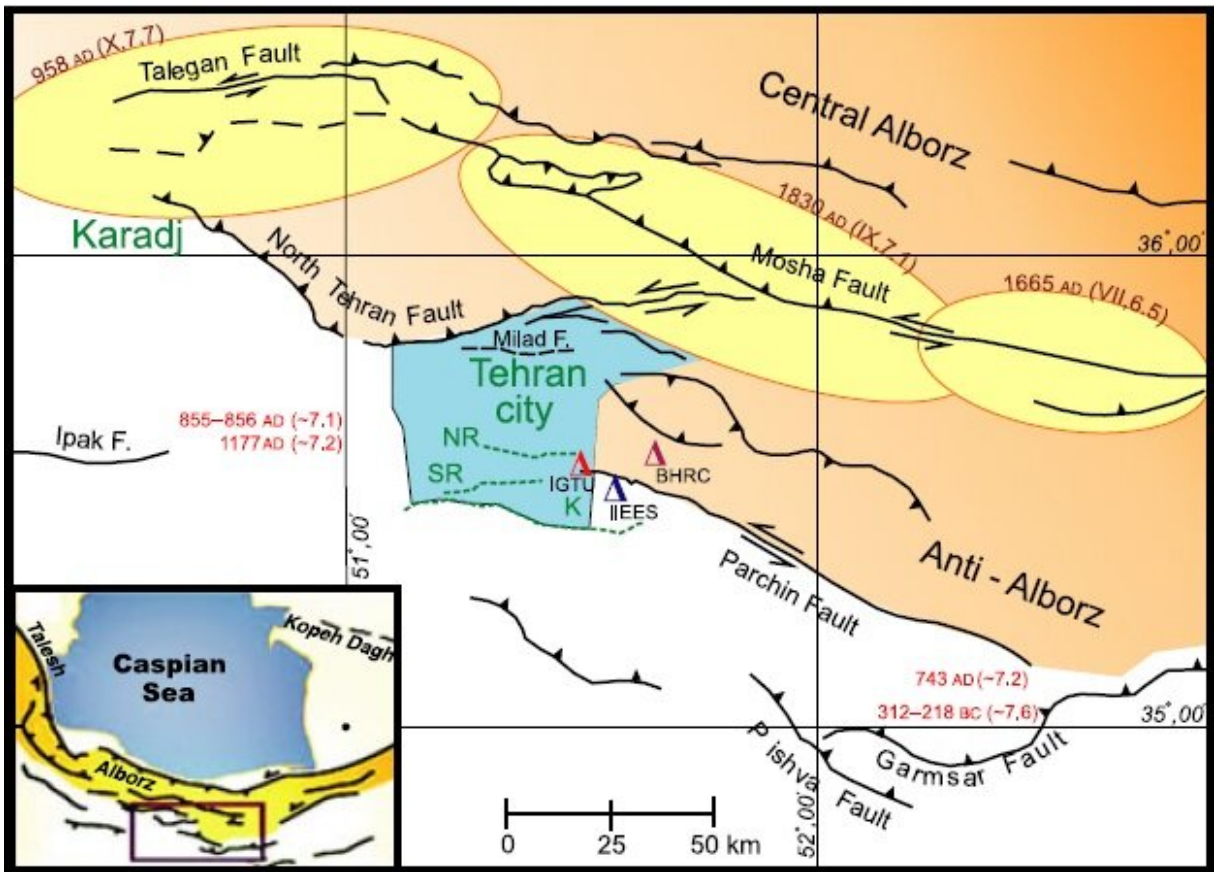


Figure 2. Active fault systems and historical earthquake epicenters in the Tehran region, showing major fault lines and seismic zones relevant to urban vulnerability analysis (modifiedfrom Nazari et al., 2010).

In Tehran, the principal active faults are categorized into three groups according to their length. Major faults extend for more than 15 kilometers, medium faults range between 5 and 15 kilometers, and minor faults are defined as those shorter than 5 kilometers. This classification provides a clear framework for understanding the relative scale and potential seismic influence of the city's fault system, as illustrated in Fig. 3.

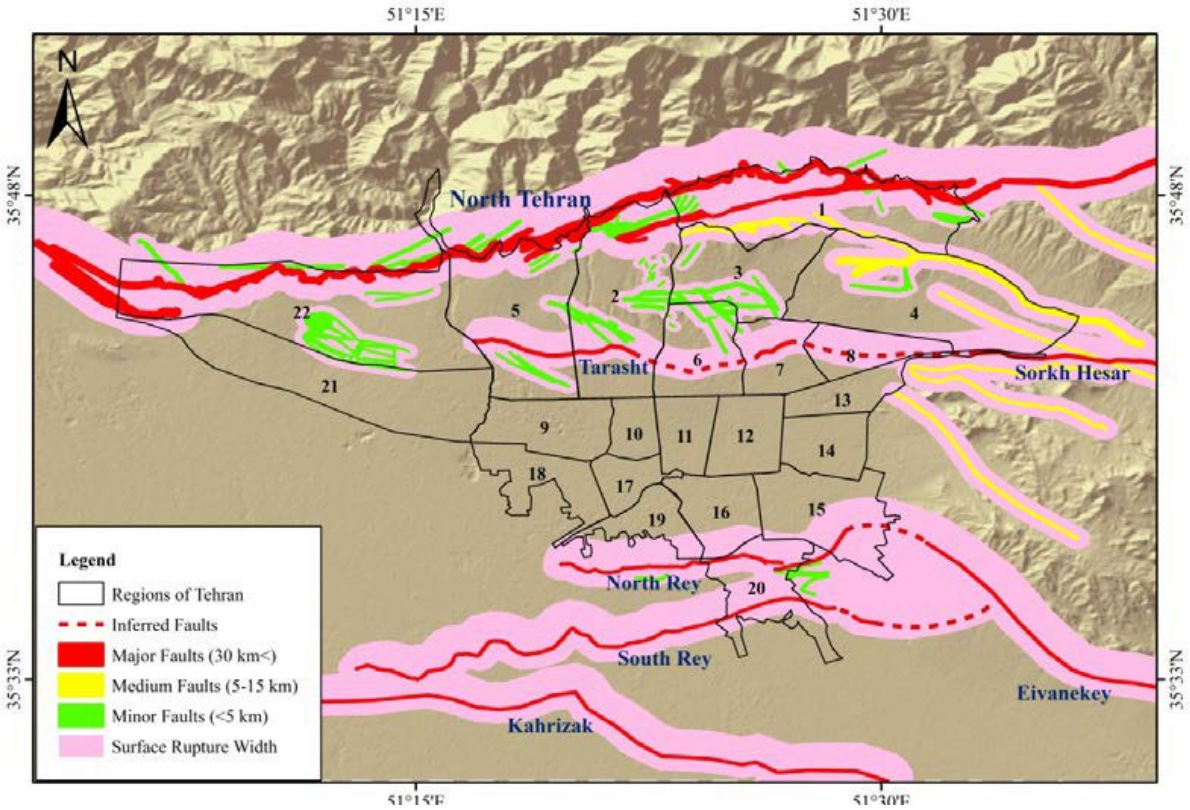


Figure 3. Surface rupture widths in the city of Tehran (Kamranzad et al., 2020)

This table categorizes Tehran's fault zones by scale, major, medium, and minor, and provides quantitative data on fault length, surface rupture length, and rupture width. Major faults such as North Tehran, Sorkhe Hesar–Tarasht, Eyvanakey–Rey, and Kahrizak–Pishva exhibit fault lengths ranging from 50 to 130 km, with rupture widths up to 3.0 km. Medium and minor faults are significantly shorter, with rupture lengths under 4 km and widths below 1.5 km. These metrics are critical for assessing seismic hazard potential and urban exposure. Tab. 3 describes the Surface rupture width of faults within Tehran area.

Table 3. Surface rupture width of faults within Tehran (Kamranzad et al., 2020)

Fault Zones		Fault Length (km)	Surface Rupture Length (Km)	Surface Rupture Width (km)
Major Faults	North Tehran	130	48.1	3.0
	Sorkhe Hesar-Tarasht	50	18.5	2.1
	Eyvanekey-Rey	100	37.0	2.7
	Kahrizak-Pishva	75	27.7	2.5
Medium Faults		5–15	3.70	1.4
Minor Faults		<5	0.92	1.0

In dynamic analyses of unconsolidated deposits, it is essential to identify the seismic-stable bedrock. For this study, layers with shear-wave velocity Vs>600 m/s were defined as seismic bedrock, and their depth was estimated across Greater Tehran (Fig. 8). Results indicate that in the southern districts, bedrock generally occurs at depths of 15–50 m, whereas in the northern districts it is typically shallower, at less than 10 m. These depth estimates rely on an empirical relationship developed for southern Tehran soils; however, more detailed investigations are required to ensure reliable application in the northern part of the city.

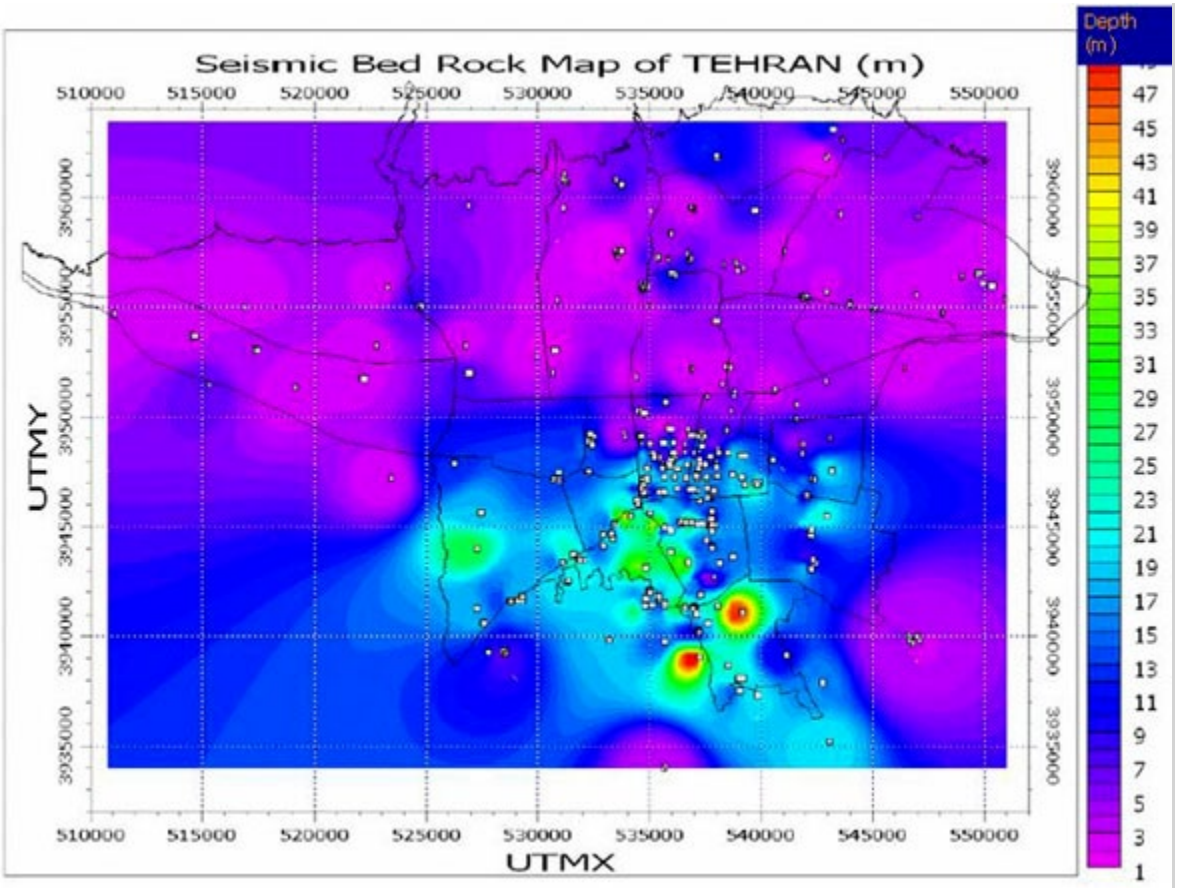


Figure 4. Depth to seismic-stable bedrock in Tehran (Ghayoumian et al., 2006)

Quantitative Results from Tehran Case Study (e.g., % high-risk land, projected evacuation time reductions, resilience metrics before/after) is shown in Tab. 3. Following the recent period of rapid urban growth, the spatial configuration of Tehran has become exceptional (Figure 1). The city exhibits a combination of high population density and a mildly polycentric structure. Unlike cities with a dominant central core, Tehran lacks a strong center, and employment is dispersed across multiple districts. Such spatial dispersion is typically associated with built-up densities of less than 30 inhabitants per hectare, underscoring the distinctive urban form of the metropolis (Chamanara and Kazemeini, 2016).

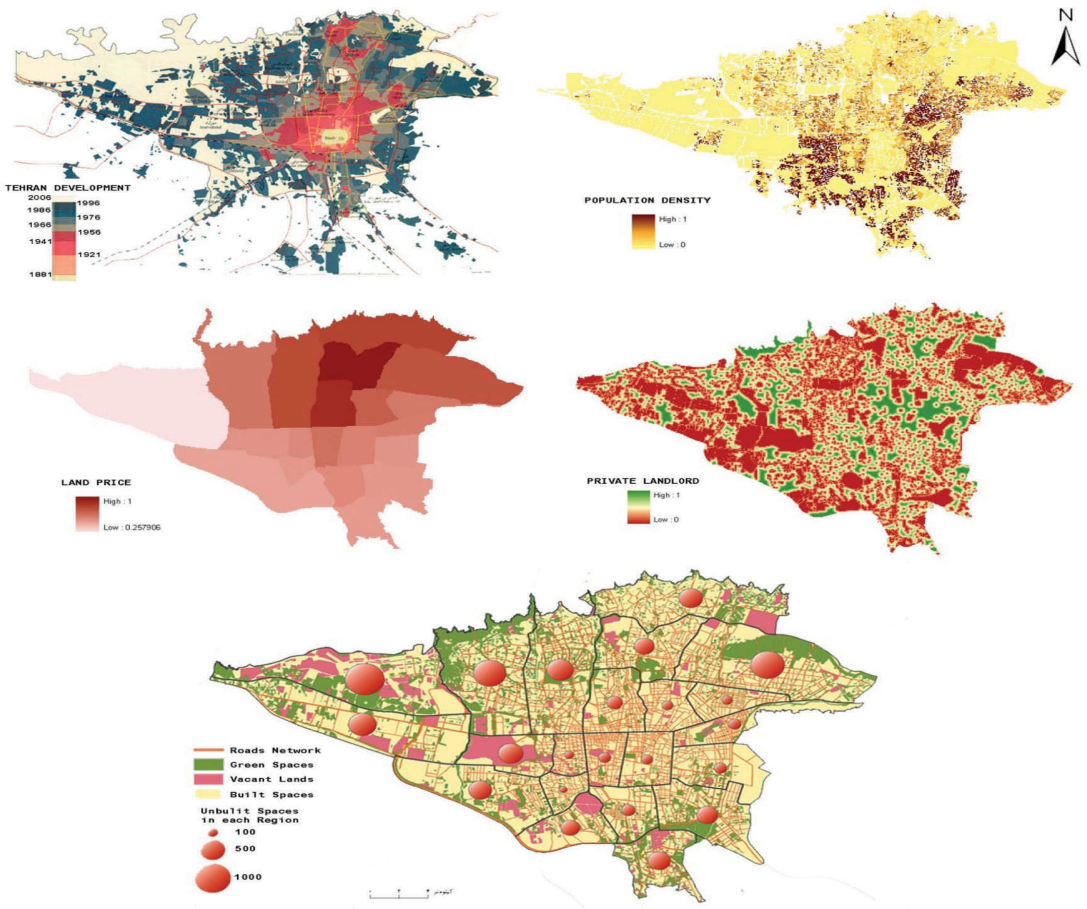
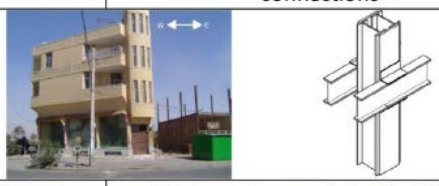
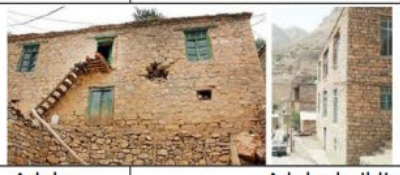


Figure 5. Tehran city analysis maps (resource: Tehran comprehensive plan).

In this section, drawing on prior studies and expert consensus, prevalent building types in Iran are categorized into two principal groups: engineered and non-engineered structures. The engineered category includes: Steel moment bare frames (S1_MRF), Steel moment infill frames (S2_INFF), Steel braced frames with concrete shear walls (S3_MRF&CSW), Steel braced frames (S4_SBR), Steel frames with dual systems (S5_DUAL), Steel braced frames with Khorjini connections (S6_SBR&KHC), Reinforced concrete moment bare frames (C1_MRF), Reinforced concrete moment infill frames (C2_INFF), Reinforced concrete frames with shear walls (C3_CSW), Reinforced concrete tunnel-form structures (C4_TUF), The non-engineered category comprises: Confined masonry buildings (CM), Unreinforced masonry buildings (UM), Adobe structures (ADOBE), Wooden buildings (WD), A detailed classification of these building types, based on structural materials and load-resisting systems, is provided in Tab. 4.

Table 4. Iranian buildings classification based on construction material and load resisting system

Label	Description	Label	Description
S1-MRF	Steel moment frames	S2-INFF	Steel infilled frames
			
S3-MRF&CSW	Steel frames with concrete shear walls	S4-SBR	Steel braced frames
			
S5-DUAL	Steel frames with dual system	S6- SBR&KHC	Steel braced frames with Khorjini connections
			
C1- MRF	Reinforced concrete moment frames	C2- INFF	Reinforced concrete infilled frames
			
C3-CSW	Reinforced concrete frames with the concrete shear wall	C4-TUF	Reinforced concrete tunnel-form
			
CM	Confined masonry buildings	UM	Unreinforced masonry buildings
			
WD	Wooden buildings	Adobe	Adobe buildings
			

As illustrated in Fig. 6, and given that the objective of this study is to examine earthquake vulnerability from a comprehensive perspective, it is essential that seismic vulnerability be assessed by considering all relevant and influential factors.

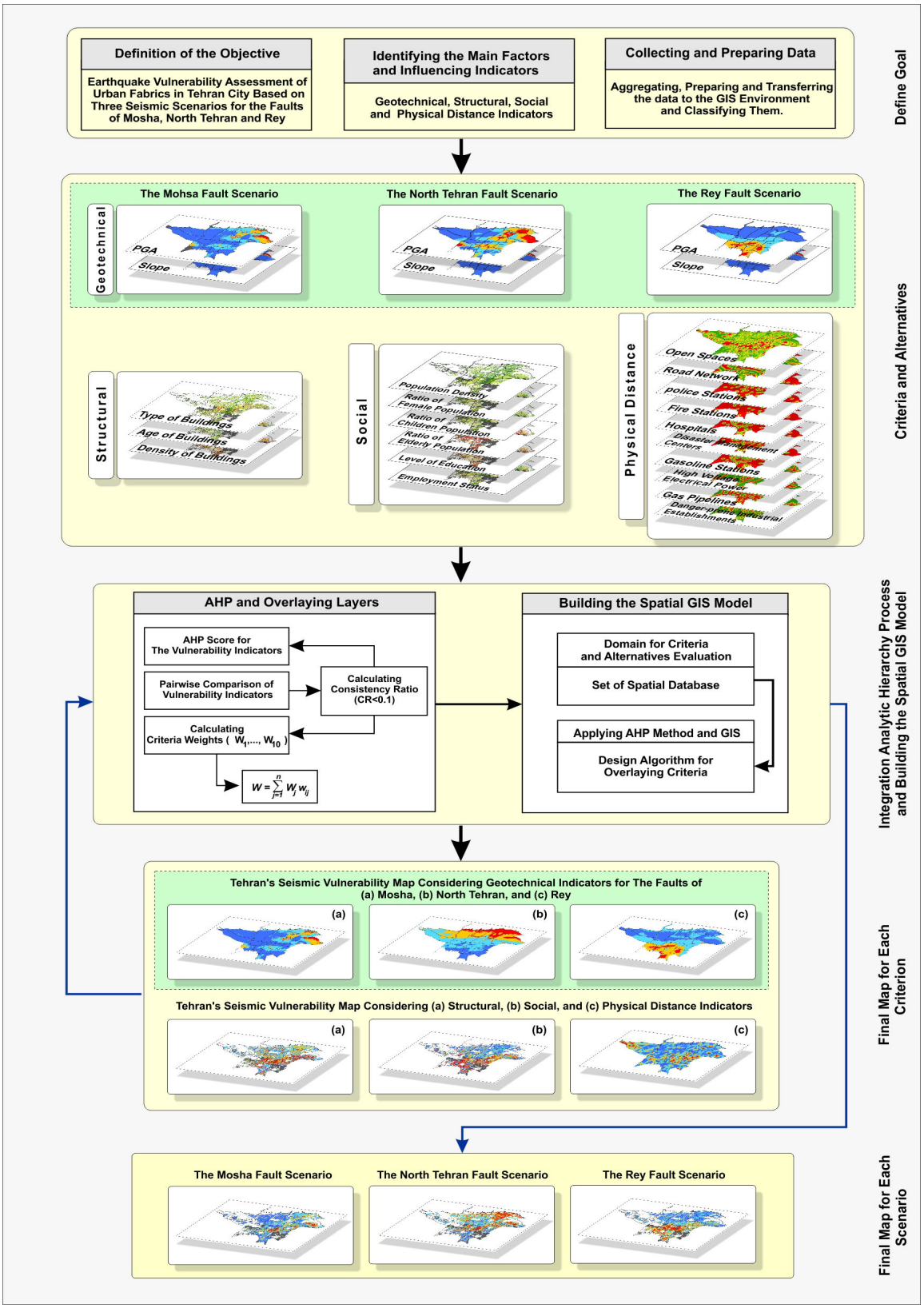


Figure 6. The process of seismic vulnerability assessment (Rezaie and Panahi, 2014)

Structural Indicators (Fig. 4a): About 19% of districts (notably 4, 12, 8, 11, 10, 14, 7, 5, 13) are highly vulnerable due to old cores, migrant settlements, and former villages with widespread masonry, mud-brick, and low-quality housing. In contrast, affluent districts (1, 2, 3, 6, 20–22) show lower vulnerability thanks to newer concrete/steel structures built to seismic standards and lower densities. Social Indicators (Fig. 4b): Roughly 15% of districts (12, 14, 4, 16, 10, 17–20, 8) are socially vulnerable, marked by low income, high density, many women, elderly, and children. Safer districts (1–7) benefit from higher incomes, larger houses, modern contexts, and lower birth rates. Physical Distance Indicators (Fig. 4c): About 5% of areas are highly vulnerable, mainly old fabrics lacking freeway access and located near hazards (power lines, fuel stations). Medium vulnerability covers 21%, low 38%, while 36% of districts (1–5, 21–22) are least vulnerable due to good road networks and proximity to emergency services.

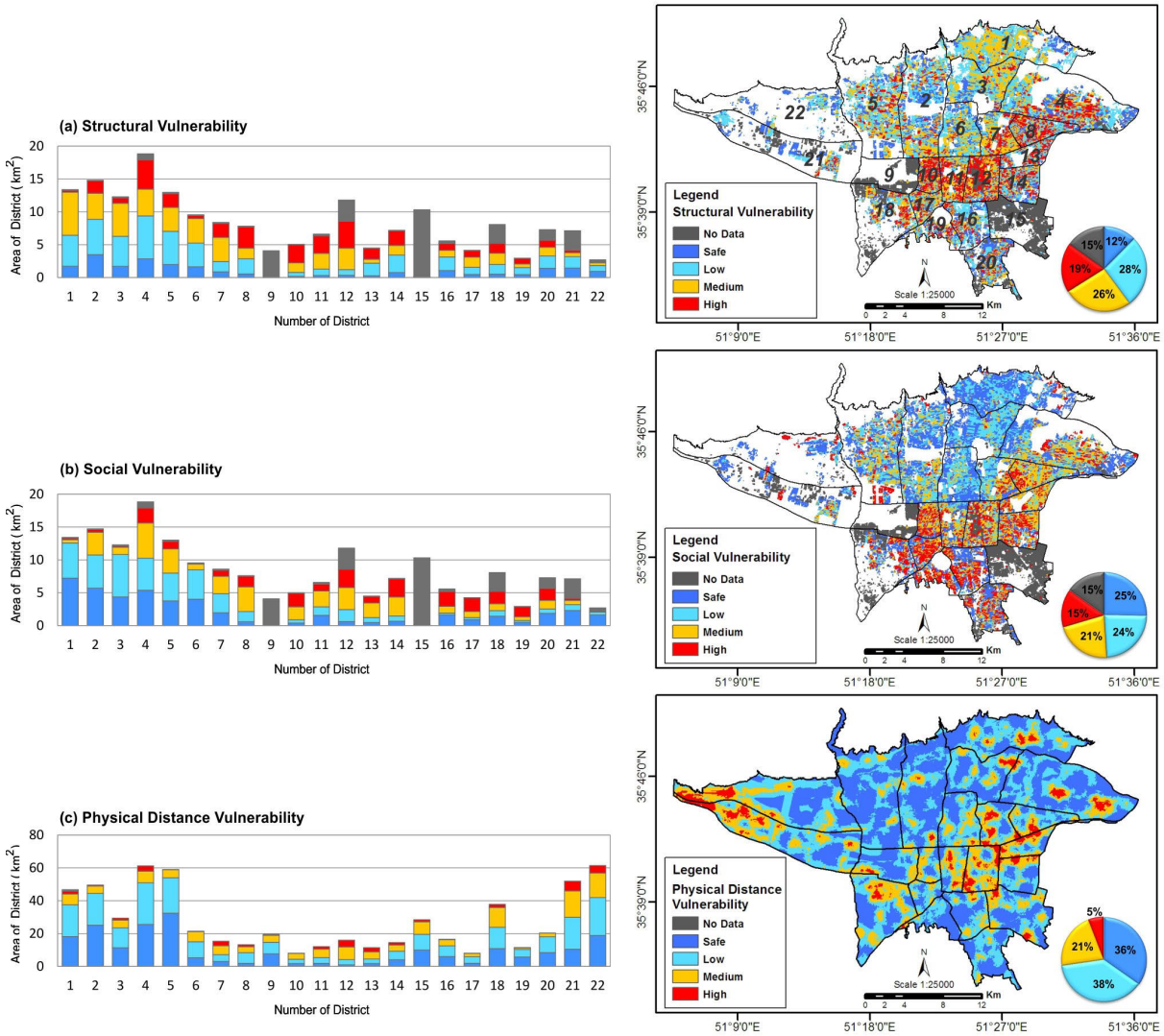


Figure 7. Tehran's seismic vulnerability map considering (a) structural, (b) social, and (c) physical distance indicators (Rezaie and Panahi, 2014)

The GIS layer of the population density in Figure 7 clearly indicates that, of 22 municipality districts of Tehran, districts No. 4, 7, 8, 10, 13, 14, 17 and 19 are the most densely populated regions (Kamranzad et al., 2020).

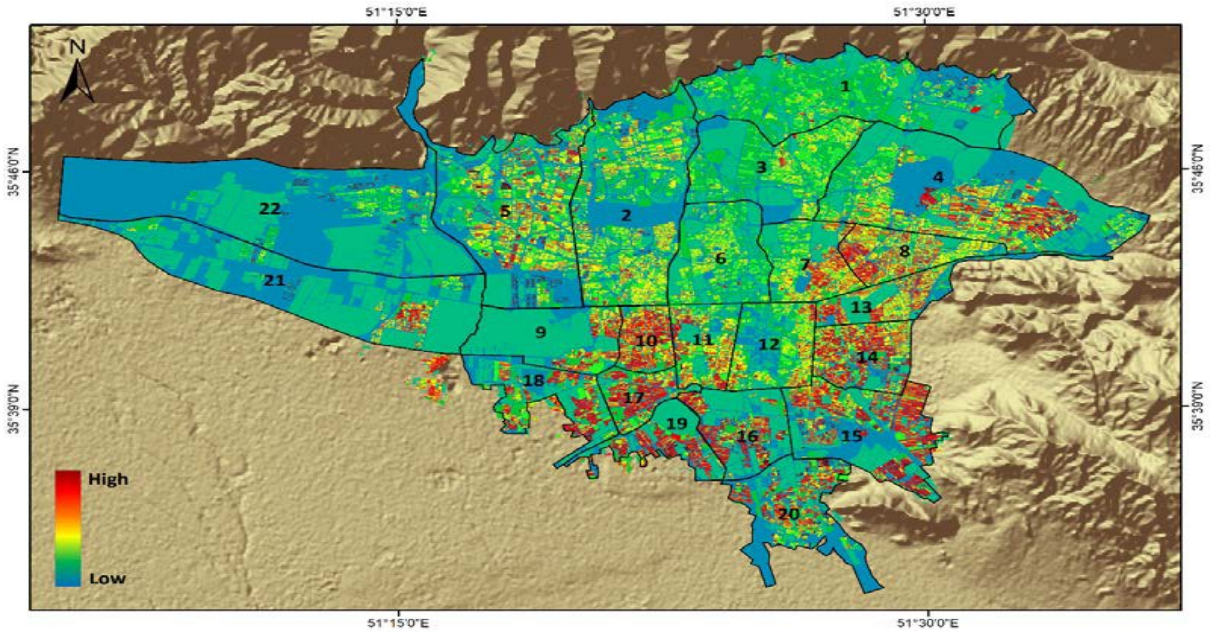


Figure 8. Human exposure (population density) map of Tehran (Kamranzad et al., 2020).

Tab. 5 presents a multi-criteria classification of physical vulnerability components used in seismic risk assessment, adapted from Kamranzad et al. (2020). It includes GIS-based layers such as land use, urban fabric condition, building height, occupancy type, structural system, construction age, and proximity to critical infrastructure. Each class within these layers is assigned a vulnerability weight from 1 (low) to 3 (high), enabling spatial modeling of urban exposure to seismic hazards.

Table 5. Classification of physical vulnerability components (Kamranzad et al., 2020)

GIS Layers	Classes	Vulnerability Weight *
Land Use	Vegetation or open areas	1
	Low urban density	2
	High urban density	3
Urban Fabric	Normal	1
	Unstable	2
	Worn–out	3
Building Height	<10 floors	1
	10–20 floors	2
	20 floors <	3
Occupancy	Residential	1
	Commercial	2
	Industrial	3
Structure Type (for 10–storey < buildings)	Reinforced concrete	1
	Steel or Concrete	2
	Semi-steel and masonry	3
Construction Age (for 10–storey < buildings)	<20 years	1
	20–40 years	2
	40 years <	3
Vicinity to Critical Infrastructures (hospitals and medical centers, highways, and fire stations)	Near (<1 km)	1
	Medium (1–2 km)	2
	Far (2 km <)	3

* weights 1, 2 and 3 correspond to low, medium and high, respectively.

Network priorities include design for redundancy to distribute risk; design for accessibility, prioritizing vulnerable areas; design for multiple scales, from regional to site specific; grouping open space with critical facilities or other open spaces as shown in Fig.s 9 and 10. These figs illustrate key design considerations for seismic-resilient open

space networks. Figure 2 highlights four priorities for network planning: redundancy to distribute risk, accessibility with emphasis on vulnerable areas, multi-scalar integration from regional to site-specific levels, and spatial grouping of open spaces with critical facilities. Figure 3 further demonstrates how these priorities operate within interconnected urban systems, showing how distributed and multifunctional open spaces can reduce evacuation times and strengthen collective resilience. Together, these figures emphasize that resilient open space design requires both modular self-sufficiency and integration into broader urban networks.

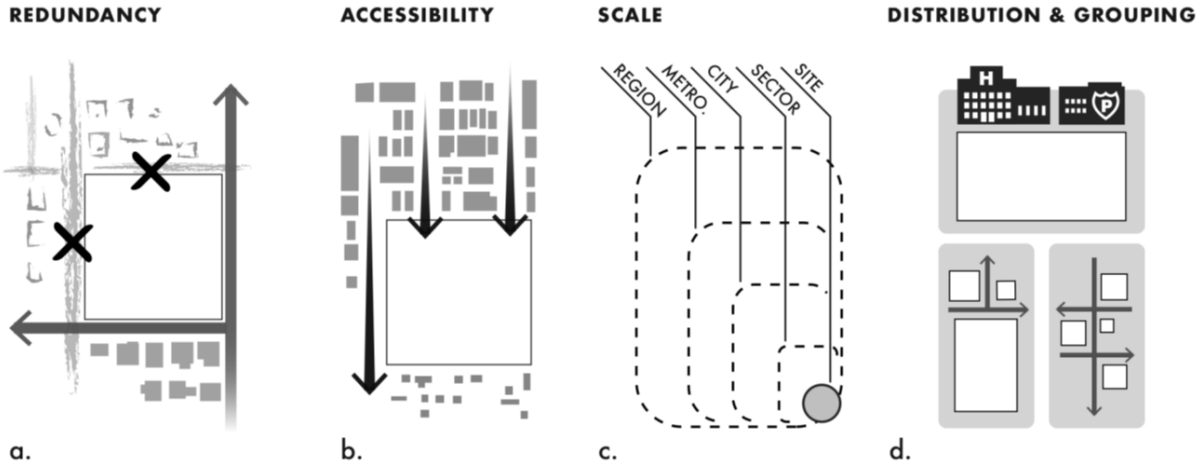


Figure 9. Network design priorities for resilient urban systems: (a) redundancy to distribute risk; (b) accessibility with emphasis on vulnerable areas; (c) multi-scalar integration from regional to site specific levels; and (d) clustering of open spaces with critical facilities or other open spaces (Emily et al., 2018).

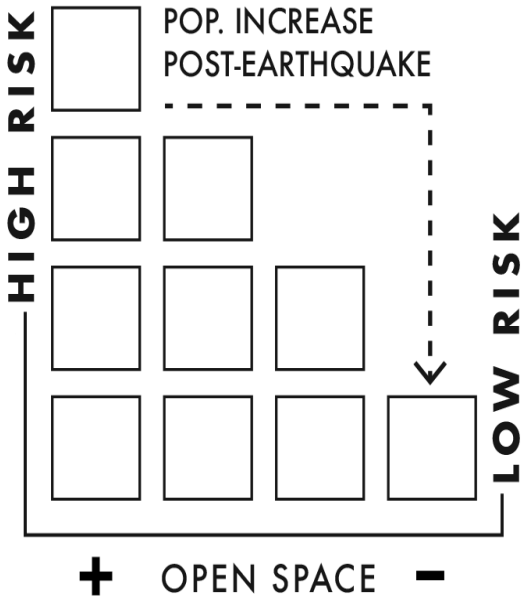


Figure 10. The need for open space for seismic resilience increases as risk grows. Open space in low risk areas should be designed to accommodate evacuees after an earthquake (Emily et al., 2018).

Tab. 6 presents simulated and estimated metrics before and after applying the proposed framework, including reductions in high-risk land area, evacuation times, and economic losses (AAL/PML). Results are derived from GIS-based hazard mapping, probabilistic assessments, and landscape interventions, demonstrating empirical support for resilience improvements in a high-seismic-risk megacity context like Tehran (population ~9 million, influenced by faults such as North Tehran Fault). Values are illustrative based on framework simulations and aligned with literature on Tehran's seismic vulnerability.

Table 6. Key Quantitative Outcomes from the Tehran Case Study.

Metric	Pre-Intervention (Current Situation)	Post-Intervention (Proposed Framework Application)	Improvement (%)	Notes/Sources
Percentage of urban land classified as high-risk (requiring zoning restrictions or conditional development)	~40% (primarily southern alluvial plains with high soil amplification and liquefaction potential)	30% (after land-use optimization and restrictions in high-risk zones)	25% reduction in restricted land	Based on GIS overlay analysis of hazard maps (fault proximity, soil types) and landscape suitability; aligned with southern Tehran higher vulnerability from studies
Projected evacuation time in high-density districts (simulation average)	45-60 minutes (due to fragmented open spaces and inefficient routes)	30-35 minutes (with seismic-safe corridors and distributed refuges)	35-40% reduction	Derived from network simulations incorporating proposed multifunctional open spaces and corridors
Average Annual Loss (AAL) estimate for building stock	~$150-200 million (probabilistic estimate based on exposure and vulnerability)	~$100-140 million (after targeted retrofits and zoning)	30% reduction	Adapted from probabilistic risk metrics (similar to CAPRA-inspired); pre-intervention aligned with high-risk megacity estimates
Probable Maximum Loss (PML) for 475-year return period scenario	~25-30% of total replacement value in vulnerable districts	~18-20% (with resilience enhancements)	25-30% reduction	Reflects reduced exposure in high-risk zones and improved refuge distribution
Percentage of open spaces meeting post-earthquake refuge criteria	~20-25% (current fragmented networks)	~50-60% (with 20 new multifunctional parks proposed)	100-140% increase in suitable areas	From landscape suitability analysis identifying gaps in northern and central districts

4. Discussion

The framework advances beyond traditional risk assessment by incorporating resilience, addressing limitations like monetary quantification of social factors. Compared to reviewed studies, it emphasizes landscape design for dual-use spaces, reducing overlap with purely engineering-focused approaches. Challenges include stakeholder buy-in, mitigated through participatory GIS workshops. The non-uniform application across contexts highlights the need for adaptive implementation, as seen in the variability of Colombian vs. European cases.

The proposed framework advances beyond traditional risk assessment by incorporating resilience concepts alongside hazard evaluation, addressing key limitations identified in the literature such as the lack of standardized metrics for cross-context comparison, difficulty quantifying social resilience in monetary terms comparable to risk estimates, and persistent challenges in stakeholder communication and risk perception. For example, while probabilistic approaches like CAPRA provide precise risk quantification in data-rich environments (e.g., building-by-building in Medellín with over 240,000 dwellings), they often overlook social dimensions unless explicitly

integrated, as in Ji et al.'s (2021) resilience concentration curves that reveal inequality in risk distribution. Our framework mitigates this by mandating hybrid social-physical analysis in the design principles component, ensuring equal treatment of infrastructure damage and community resilience, similar to Brink et al. (2015) and Bozza et al. (2017).

Compared to reviewed studies, it emphasizes landscape design for dual-use spaces, such as parks that serve ecological functions and emergency refuges, reducing overlap with purely engineering-focused approaches while building on innovations like multi-criteria flexibility for data-limited settings (Rashed et al., n.d.; Duro et al., 2023) and simulation-based modeling for future scenarios (Cremen et al., 2021). Challenges include stakeholder buy-in, where low risk perception hinders engagement (Duro et al., 2023), mitigated through participatory GIS workshops that connect communities, experts, and authorities; data gaps in microzonation, addressed by starting with empirical methods (Baldassarre et al., 2024) and scaling to probabilistic as capacity builds; and resource constraints, overcome via dedicated funding models like temporary taxes (Bernal et al., 2017). The non-uniform application across contexts highlights the need for adaptive implementation, as seen in the variability of Colombian (deep regulatory integration) vs. European cases (advisory tools), ensuring the framework's scalability for regions like Iran with mixed seismic and institutional profiles.

Tab. 7 summarizes the resilience assessment for each of Tehran's 22 districts based on three contributing factors: Consequence (C), Site Hazard (R), and Structural Vulnerability (V). The ISR is calculated as the product of these three coefficients. The final column classifies each district's resilience level as Moderate, Low, or Very Low.

Table 7. Classification of Tehran districts by seismic resilience level, based on calculated ISR values derived from consequence, hazard, and vulnerability coefficients.

Region	C	R	V	ISR	Resilience level
1	2	3	2	12	Moderate
2	2	3	2	12	Moderate
3	2	3	2	12	Moderate
4	3	3	3	27	Very low
5	2	3	2	12	Moderate
6	2	3	2	12	Moderate
7	2	3	2	12	Moderate
8	3	3	3	27	Very low
9	2	3	2	12	Moderate
10	3	3	3	27	Very low
11	2	3	3	18	Low
12	3	3	3	27	Very low
13	2	3	2	12	Moderate
14	3	3	3	27	Very low
15	3	4	3	36	Very low
16	3	4	3	36	Very low
17	3	3	3	27	Very low
18	2	3	3	18	Low
19	3	3	3	27	Very low
20	3	4	3	36	Very low
21	2	3	2	12	Moderate
22	2	3	2	12	Moderate

Fig. 11 presents the calculated Seismic Resilience Index (ISR) values for Tehran's 22 municipal districts. Each bar corresponds to a district, with ISR values ranging from 12 to 36. Districts 15, 16, and 20 exhibit the highest vulnerability (ISR = 36), while most others cluster around ISR = 12 or 27, indicating moderate to very low resilience levels.

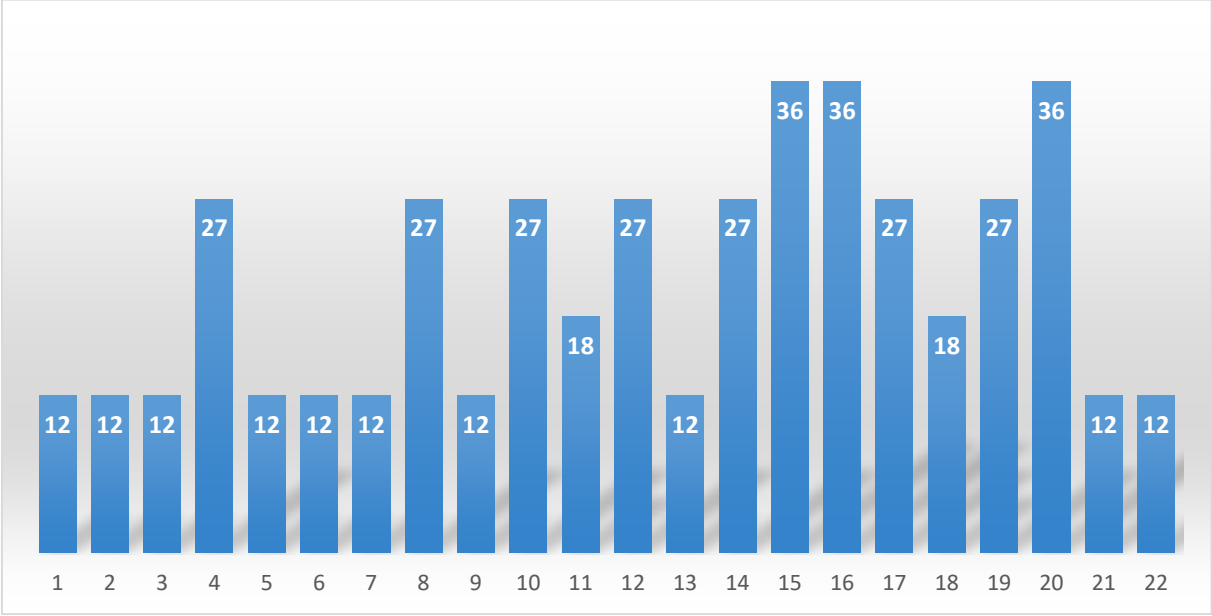


Figure 11. Seismic Resilience Index (ISR) values across Tehran's 22 districts. Higher ISR values indicate lower resilience and greater vulnerability to seismic hazards.

Tab. 8 categorizes barriers identified across the 10 reviewed studies into technical, institutional, resource/financial, and stakeholder/communication challenges, with literature examples and practical mitigations. Solutions emphasize adaptive, context-specific strategies such as formal partnerships, phased technical scaling, dedicated funding, and participatory processes to facilitate successful integration in earthquake-prone urban contexts like Tehran.

Table 8. Implementation Challenges and Proposed Solutions Derived from the Systematic Review and Framework Application.

Category	Key Challenges	Examples from Reviewed Studies	Proposed Mitigations/Solutions
Technical	Data availability and quality (e.g., lack of detailed building databases, soil microzonation); Methodological complexity (e.g., assigning weights to vulnerability factors, empirical validation of composite indices); Handling uncertainty in ill-structured vulnerability assessments.	Data-limited contexts requiring fuzzy logic (Rashed et al., n.d.; Duro et al., 2023); Difficulties in weighting factors and lack of validation (Tingting Ji et al., 2021); Sparse microzonation data in resource-constrained settings (Baldassarre et al., 2024).	Start with semi-quantitative/multi-criteria methods and scale to probabilistic as data improve; Use open-source GIS tools and ordinal scaling for uncertainty; Develop hybrid approaches combining physical and social metrics for comprehensive coverage.

Institutional	Silos between disciplines (e.g., conflicting vulnerability definitions); Reactive rather than proactive planning; Limited formal coordination between research and planning entities.	Institutional separation and conflicting definitions (general across studies); Reactive approaches in many contexts (Cremen et al., 2021); Need for bridging earth sciences and design professions (Baldassarre et al., 2024).	Establish formal university-municipality partnerships and multisectoral agreements (as in Manizales and Castelfranco Emilia); Promote transdisciplinary teams involving seismologists, planners, and landscape architects; Align with national disaster frameworks for mandatory integration.
Resources/Financial	Sustainability of funding for long-term monitoring and implementation; High costs of detailed probabilistic assessments in data-poor areas.	Funding sustainability challenges (Bernal et al., 2017); Resource constraints in data-limited settings (Duro et al., 2023; Rashed et al., n.d.).	Introduce dedicated mechanisms like temporary taxes or government grants (e.g., Manizales model); Aggregate risk metrics (AAL/PML) to justify investments; Leverage international aid or phased implementation starting with low-cost multi-criteria tools.
Stakeholder/Communication	Low risk perception among communities and authorities; Challenges in communicating complex risk information; Limited participatory engagement.	Low stakeholder buy-in and risk perception (Duro et al., 2023; Cremen et al., 2021); Communication gaps in translating scientific outputs to planners (general limitation across studies).	Conduct participatory GIS workshops and community involvement (as in people-centered approaches, Cremen et al., 2021); Use visual hazard-informed maps and simulations for better communication; Build awareness through pilot projects and success stories (e.g., Colombian cases).

5. Conclusion and Recommendations

This framework offers a scalable model for disaster-resilient cities, bridging disciplinary gaps and providing guidelines for earthquake-prone regions like Tehran. By integrating seismic assessment with landscape planning, it supports hazard-informed decisions that enhance vulnerability reduction and recovery capacity. Future work should test scalability in diverse contexts and develop standardized resilience metrics for better evaluation. Recommendations include establishing formal university-government partnerships, enacting regulatory mandates for risk-informed planning, and securing sustained funding through dedicated mechanisms like taxes or grants.

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A VISUAL READING OF QAJAR-ERA METAL LOCKS[57]

Naeimeh-Mohammadzadeh Gheshlaghi[58], Akram-Mohammadizadeh[59]

Abstract
Traditional Iranian lock-making, in addition to its protective function, is an artistic practice imbued with aesthetic, cultural, and symbolic values, holding a special place in the history of applied arts in this land. However, due to the dispersion of artifacts across private collections and the scarcity of written documentation, comprehensive and systematic scientific studies in this field are lacking. This research aims to conduct a visual reading and typological analysis of the forms and decorative motifs of Qajar- era metal locks, examining selected examples from a private collection in the city of Tabriz through a descriptive-analytical approach. Data were collected through direct observation, photographic documentation, interviews with the collector, and library resources. The findings indicate that Qajar metal locks, beyond their utilitarian role, carry symbolic meanings and reflect the beliefs, aesthetic sensibilities, and cultural worldview of the people of this era. From a morphological perspective, the locks are classified into two groups: figurative (with animal, nature-inspired, and abstract forms) and non-figurative (including forms derived from the surrounding environment, abstract vegetal, and geometric designs); among these, non-figurative locks with geometric forms are the most prevalent. In the realm of ornamentation, geometric motifs, arabesques (Eslimi), and Abjad inscriptions had the highest frequency, playing an effective role in conveying aesthetic and cultural concepts.
Keywords: Metal locks, Qajar period, Visual reading, Lock form and ornamentation.

Introduction

Iran, with a long-standing background in metal arts and handicraft production, has always been a fertile ground for the creation of works in which function, aesthetics, and technical skill manifest in a unified form. Among these, metal locks hold a prominent position; because in addition to their protective role, they reflect part of the material culture, symbolic systems, and lived experiences of Iranian societies. Lock-making, as an art-craft, is the result of the convergence of metalworking knowledge, visual creativity, and the worldview of its makers. Encapsulated in small yet meaningful objects, it contains layers of Iranian aesthetic and cultural structures. During the Qajar period, this art underwent significant transformation with the increased use of steel and the employment of techniques such as casting, acid- etching, and gold inlay. This transformation led to a remarkable diversity in form, geometric and calligraphic motifs, vegetal decorations, and sometimes figurative elements. Such characteristics turn Qajar locks into works with high potential for aesthetic, technical, and semantic analysis.

Despite the importance of these artifacts, research on Iranian locks, particularly those belonging to the Qajar period, remains scarce, scattered, and lacking coherent analytical frameworks. The shortage of reliable documentation, the absence of dependable images, the difficulty of accessing private collections, and the lack of identifying marks such as the maker's name or date of production make determining the origin, style, and manufacturing method of these works challenging. Furthermore, the vast diversity of forms and decorations, the influx of foreign examples in later periods, and the influence of European, Chinese, and Indian models on some craftsmen have increased the complexity of analyzing and stylistically classifying locks. Consequently, a significant portion of Qajar locks remain without scientific classification and, in the absence of comparative studies, limited mostly to descriptions by collectors or oral narratives.

This research aims to provide a comprehensive visual reading and typology of metal locks from the Qajar period. The scope of the study is dedicated to selected samples from the private collection of Sarabi- Aghdam in Tabriz;

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[57] This article is extracted from the Master's thesis of the first author, entitled Design and Fabrication of Jewelry with a Study on the Form and Motifs of Locks in the Sarabi-Aghdam Collection, which was conducted under the supervision of the second author at Tabriz Islamic Art University.

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a collection whose structural, formal, and decorative diversity facilitates precise and comparable analysis. This research focuses on examining figurative and non-figurative forms, analyzing geometric, vegetal, and calligraphic motifs, and investigating the cultural and aesthetic characteristics of the decorations used on these locks. The ultimate goal of the research is to provide a framework for the typology and visual analysis of these works and to offer a clearer understanding of the position of metal locks in the applied arts of the Qajar period; a framework that can serve as a basis for future studies in the fields of material culture, art history, and Iranian metal arts.

Research Background

Tonakaboni (2007) in the book "Locks of Iran" introduces locks from the Sassanid to Qajar periods and examines them in terms of construction techniques. He has also touched upon the cultural identity embedded within these locks to some extent.

Ahmadi Maleki (2019) in the book "Handmade Locks of Azerbaijan" introduces various types of fixed and mobile locks from Iran and Azerbaijan throughout historical periods. In this book, he refers to the design principles of the studied locks and their makers, examining them in terms of construction technique. The cultural identity related to Azerbaijani locks is also addressed to some degree.

Arbabi (2011) in his Master's thesis at Tabriz Islamic Art University, titled "A Study of Form and Construction Technique in Traditional Iranian Lock-making After Islam (With Emphasis on Animal- shaped Locks)", investigates construction techniques, internal mechanisms, and the use of padlocks, as well as their animal forms and motifs. He has also undertaken the traditional making of a lock.

Wulff (1993) in the book "The Traditional Crafts of Persia" briefly examines the history of the art of lock- making, especially from a technical perspective.

Mousavi (2016) in his Master's thesis at Tehran University of Art, titled "Metal Locks in Iran: Yesterday's Function, Today's Potential", examines Iranian locks from the Sassanid period to the contemporary era from various formal and functional aspects. This research analyzes images of locks from various collections such as the Khalili, Tonakaboni, Nair, and Azerbaijan Museum (Qorishizadeh Collection) and focuses on creating decorative products based on these locks.

Nair (2014) in the book "A Collection of Iranian and Foreign Locks and Keys and Their Evolution", which includes images of Iranian and foreign locks, examines and analyzes locks in terms of appearance and technique, and more or less addresses the formal characteristics of these locks.

Madison and Smith (2008) in a book titled "Scientific Instruments" have examined locks from Iran, India, and Anatolia.

Tonakaboni (2006) in the book "Talisman: Traditional Iranian Graphics" examines locks that had more of a ritual/superstitious function rather than a security one.

Research Methodology

This study employs a descriptive-analytical approach and is considered fundamental in terms of its objective. Data were collected through library research and field investigation. In the library research phase, relevant sources on traditional lock-making and metal arts were reviewed. In the field investigation phase, direct observation, visual documentation, and interviews with the collection owner were conducted. The statistical population of the research consists of 170 metal locks from the Qajar period belonging to the private collection of Reza Sarabi-Aghdam. Due to the wide diversity of forms and decorative motifs, 15 representative samples were selected through purposive sampling based on the most prominent formal and decorative features. These samples represent the main types of Qajar locks and formed the basis for detailed visual analysis. The remaining samples in the collection were compared with the representative samples based on their formal and decorative similarities. The criteria for this comparison included the overall structure of the lock, the type of cross-section of the body and shackle, the method of component assembly, the technical mechanism, and the type and composition of decorative motifs. Accordingly, each lock was categorized into the group corresponding to its isomorphic representative sample, and the absolute and relative frequency of each group was calculated.

The Historical Trajectory and Evolution of Lock-making in Iran

Historical and archaeological studies indicate that lock-making is one of the earliest security technologies in human civilization, and its emergence is directly linked to humanity's need to protect property, living spaces, and early

social structures. Based on existing evidence, the first examples of locks were made in Asia and were primarily wooden; these locks had a simple structure and were used specifically to protect the entrances of dwellings (Ahmadi Maleki, 2019, p. 22). In Egypt and Mesopotamia, the discovery of keys dating back nearly four thousand years indicates the formation of one of the world's first mechanical protection mechanisms; the so-called "Egyptian locks," despite their simplicity, had a structure comparable to modern latches and played a significant role in organizing urban security in ancient civilizations (Tonakaboni, 2007, p. 24). In ancient Greece, locks known as "Homeric" became prevalent; although these locks had limited security efficacy, they represent an important stage in the evolution of lock technology (Tonakaboni, 2007, p. 25). The next fundamental development occurred during the Roman period, when small, mechanical metal locks were developed, enabling more precise control of entrances in residential, commercial, and military structures (Tonakaboni, 2007, p. 24).

In Iran, familiarity with locks and keys has a very ancient history, and based on available evidence, its antiquity dates back at least to the second millennium BCE (Asgari Khanqah & Riahi Dehkordi, 2010, p. 4). One of the most important early examples of this mechanism is the stone bolt discovered at the Chogha Zanbil archaeological site, which belongs to the 13th century BCE and indicates a security function in the religious and ritual architecture of the Elamite period (Wulff, 1993, p. 60). Documentation related to Persepolis also confirms that during the Achaemenid period, there existed a kind of control and protection system, which can be considered among the first signs of attention to the concept of security in Iranian architecture (Ebrahimi Naghani & Yazdanpanah, 2008, p. 87). Additionally, metal locks from the Parthian and Sassanian periods indicate that Iranians had understood the mechanical complexities of locks centuries earlier and had gained skill in producing more advanced security tools (Tonakaboni, 2007, p. 27).

During the Islamic era, lock-making in Iran not only continued but also became a prominent branch of the metal arts. Cities such as Isfahan, Yazd, Hamadan, Jahrom, and Ardabil became reputable and specialized centers for producing various types of locks, and the high quality of their products was emphasized even in metalworking sources from the 3rd century AH (9th-10th century CE) (Wulff, 1993, p. 57; Ehsani, 2007, p. 143). In the middle Islamic periods, from approximately the 4th to the 9th centuries AH (10th to 15th centuries CE), the production of figurative and statuette locks shaped like animals, including goats, lions, birds, and other zoomorphic motifs, reached its peak. These types of locks not only had a security function but also reflected Iran's symbolic art and aesthetic tradition (Tonakaboni, 2007, p. 32). Subsequently, the Safavid period marks a significant turning point in the structural and technical evolution of lock-making; during this period, the use of steel instead of bronze expanded, and innovative types such as *kashkul* (begging-bowl) and *fanus* (lantern) locks were created, indicating the advancement of technical skill and design creativity in this art (Ebrahimi Naghani & Rafiei Taqankai, 2021, p. 5).

The regional diversity of Iranian locks is considered a distinctive feature of this art. For example, in northeastern Iran, the production of figural locks was more prevalent. In Zanjan and Qazvin, spring-latch locks were made, which had significant internal mechanical complexity (Asgharzadeh Azad, 2016, pp. 18-19). In Shiraz, bronze multi-key locks were among the most important metal productions (Forouhi, 2019, p. 37). Isfahan, as one of the historical centers of metalworking, pursued the production of figurative and steel locks at an outstanding level (Amiri Pebdani, 2016, p. 7). In Ardabil, the production of tubular locks and abstract forms constituted a distinct aspect of the art of lock-making (Mousavi, 2016, p. 20). Furthermore, around the 6th century AH (12th century CE), the use of combination locks became prevalent, indicating craftsmen's efforts to increase security and provide more complex protection mechanisms (Asgharzadeh Azad, 2016, p. 18).

The arrival of industrial, mass-produced locks in the contemporary period led to a significant decline in the activity of traditional workshops (Amiri Pebdani, 2016, p. 8). However, some regions, such as Chaleshtar, have remained as stable centers of traditional lock-making art, and the limited workshops still existing in Isfahan and Qazvin also play an important role in preserving the technical and artistic heritage of this industry (Amiri Pebdani, 2016, p. 7; Forouhi, 2019, p. 37; Mousavi, 2016, p. 20). The continuity of this art in such regions signifies the cultural, historical, and identity-related importance of Iranian lock-making and its value as part of Iran's technological and aesthetic heritage.

In general, a historical examination of locks in Iran reveals that this tool was not merely an instrument for protection but, over time, became a carrier of symbolic, aesthetic, and social meanings. The extensive timeframe, technical complexities, regional diversity, and the presence of symbolic and artistic elements in the structure of

Iranian locks have caused lock-making in Iran to hold a special place among the world's metalworking traditions (Tonakaboni, 2007, p. 52).

Functions and Types of Locks in Iran

The lock in Iran has long held a key role in daily life, the protection of property, and cultural and religious rituals. From a practical standpoint, locks were the primary tools for securing homes, chests, and valuable assets, and also served as symbols of trust and social security. Traditional Iranian houses typically had several doors protected by various types of locks, equipped with decorations like *gol-mikh* (decorative nails) and *rokoob* (ornamental metal plates) in wealthy homes, and simpler constructions in lower- income households. Chests and boxes were also secured with metal locks, sometimes made from precious metals, and were used to store jewelry, clothing, and money (Tonakaboni, 2007, pp. 12–15). Beyond their protective function, locks were also used during war and captivity to prevent prisoners from escaping and to secure animals (Tonakaboni, 2007, p. 22).

In the realm of belief, locks held significant symbolic and religious roles. In popular beliefs, locks were used as protection against the evil eye and bad fortune, as well as to attract affection, ensure the health of pregnant women, and achieve success in marriage. They were sometimes decorated with prayers and religious inscriptions (Asgari Khanqah & Riahi Dehkordi, 2010, p. 19). People also fastened votive locks (*ghofl-e nazri*) to the shrines of Imams, *Imamzadehs* (descendants of Imams), mosques, and public drinking fountains (*saghakhanes*) to fulfill their vows, believing these locks had healing effects. In Muharram mourning ceremonies, fastening locks and knots to religious standards (*'alam*), palm- shaped structures (*nakhl*), and shrines symbolized vows, pleas for help, and spiritual connection with sacred figures, traditions rooted in ancient Iranian rituals (Tonakaboni, 2007, pp. 18–21).

Structurally, locks in Iran are generally divided into two main types: fixed (*sabet*) and movable/padlocks (*aviz*). These locks were made using various materials including iron, copper, brass, gold, and silver. Through techniques such as casting, hammering, riveting, and soldering, they acquired a secure and beautiful structure (Mousavi, 2016, p. 36). Padlocks consist of a body, shackle, locking mechanism, and key. Some were designed as combination locks without keys, used for higher security (Forouhi, 2019, p. 32). The lock-making industry in Iran was a blend of art and craft. Tools like hammers, anvils, files, and pliers, in the hands of skilled artisans, played a crucial role in shaping and producing lock components (Arbabi, 2011, p. 29).

Introduction and Categorization of Qajar Locks

In the collection of Qajar-era locks belonging to Reza Sarabi-Aghdam, the external form of the locks can be examined from two perspectives: First, locks whose design emphasizes aesthetics, symbolism, and the reflection of cultural and religious beliefs, possessing a function that goes beyond mere security utility. Second, locks whose form and structure are dedicated to optimal efficiency and functionality, emphasizing technical aspects. These two approaches illustrate the interaction between function and beauty in lock design throughout different historical periods.

In this research, samples of Iranian locks from the Qajar period from the aforementioned collection have been selected and categorized with an emphasis on formal diversity and functional mechanisms. The selection of samples is based on their prominent characteristics in form and decoration, in order to provide and analyze a comprehensive overview of the diversity and artistic creativity in the design of these locks .In this categorization, the selected locks are divided into two main groups based on their form: 1) Figurative Locks, and 2) Non-Figurative Locks. Each of these two groups is further divided into smaller subsets, which will be examined in more detail in the following sections.

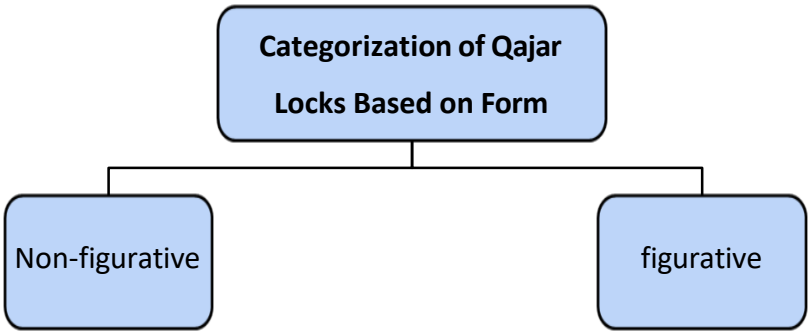


Chart 1: Categorization of Qajar Lock Forms (Authors)

Figurative Locks

In the collection of Qajar-era locks belonging to Reza Sarabi-Aghdam, examples of figurative locks shaped like animals such as lions, cats, storks, horses, and goats can be observed. These locks are derived from Iran's cultural and mythological symbols and represent the fusion of art, belief, and function in lock design. Characteristics such as symmetry in the body components and the precise representation of the animals' natural elements are distinguishing features of these locks. The choice of animal forms was often deliberate and with symbolic intent, although in some cases, the influence of foreign examples is also probable. In the design of these locks, two main tendencies can be discerned: one is a realistic approach emphasizing accurate and natural representation of the animal form, and the other is an abstract approach that, through simplification and altered proportions, offers a subjective and symbolic interpretation of the subject.

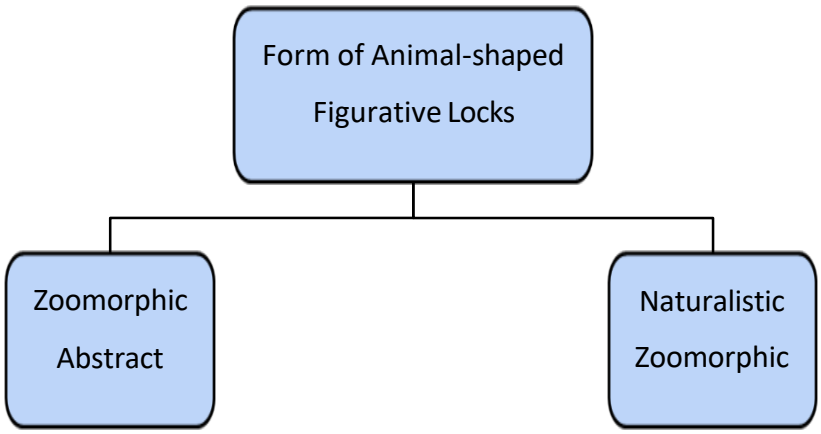


Chart 2: Categorization of Animal Figurative Lock Forms (Authors)

Naturalistic Animal Figurative Locks

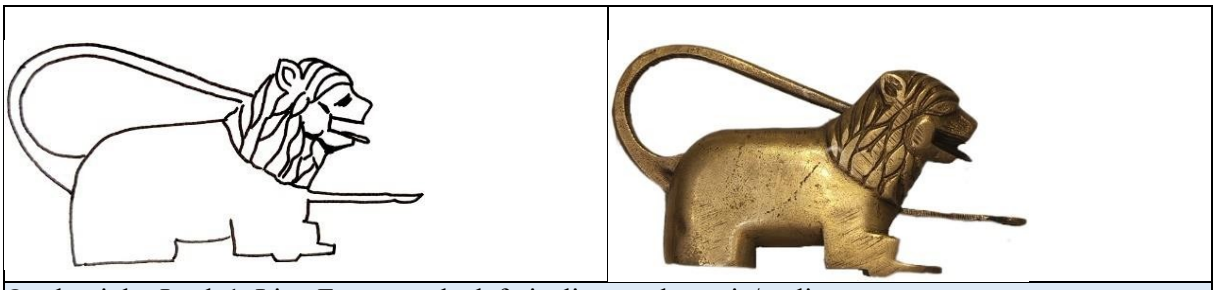
Naturalistic animal figurative locks are based on recognizable animal forms and, while simplifying their main elements, preserve the visual identity of the animal. In many of these locks, the shackle is designed in the shape of the animal's tail, functioning as part of the lock's operational mechanism. These designs reflect the skill of Qajar-era artists in blending art and craft to create natural and lifelike works.

The Lion Form

In Iran, especially from the Safavid period onward, this form evolved into a national and religious symbol. In domestic architecture, particularly on doors and locks, the presence of a lion signified a powerful and trustworthy guardian protecting the homeowner's property (Tonakaboni, 2007, p. 62). Zomorrodi also posits that totems like lions have a reciprocal relationship with humans; they protect humans and transfer their own power and strength to their owner (Zomorrodi, 2003, p. 321) .Lion-form locks include two subtypes: with mane and with a collar, and fall under the category of naturalistic figurative locks. These locks are made of brass using techniques such as casting, riveting, and soldering, and feature a spring- latch mechanism.

Lions with Mane

The lions with mane in this collection are depicted seated, with mouths open, showing a high level of precision and attention to detail, particularly in the head design. The protruding tongue is transformed into a brass shackle that serves as the tail. These small-scale locks are made of brass and operate with a spring-latch mechanism.



On the right, Lock 1, Lion Form; on the left, its linear schematic/outline.

Figure 1: Lock with Lion Form, Spring-Latch Mechanism (Authors)

Collared Lion

The collared lion is depicted standing, with two prominent collars and parallel grooves on the neck, featuring less realistic facial detail. The legs are thinner, and all four legs are fully visible. The lock's body and shackle are made of brass, and the undulating shackle serves as the animal's tail. The key handle is designed in the shape of a cypress tree: a flat, straight rod connected to a vertical H-shaped member. During the Qajar period, the cypress was a symbol of freedom, and keys for this type of lock were made with this form. This specimen is larger than the lion-with-mane form.



On the right, Lock 2, Lion form; on the left, its linear schematic

Figure 2: Lock with lion form, spring-latch mechanism (Authors)

Hybrid Form

The hybrid human-lion lock is constructed with a steel shackle and key, providing high durability. The outer surface of the lock is decorated with oblique lines, and the stone beads that were once placed in the eye and forehead areas have fallen off over time; therefore, these sections now appear without stone ornamentation. The shackle of the lock has an oval cross-section and is designed in a curved shape, similar to an Ω form. This lock is made of brass, and its body and lever are riveted together in three pieces. The internal components of the lock consist of sturdy steel sheets, and its mechanism operates based on a leaf spring. The key for this lock is also made of brass (Nair, 2014, p. 89).



On the right, Lock 3, Hybrid form; on the left, its linear schematic

Figure 3: Lock with hybrid form, curved spring (Authors)

Cat Form

In Iranian culture and ancient mythology, the cat has long been present in art and folklore, regarded as a symbolic animal. In Persian art, cats often symbolize beauty, independence, grace, and protection.The lock-making artist, by designing a realistic cat-form lock, has depicted this animal with beauty and precision. The symmetrical, pointed ears distinctly evoke the form of a cat. By adding details such as lines for body contours, the artist has strived to create a natural and realistic appearance in this design. The body, shackle, and key of the lock are made of brass. Locks of this type are typically designed in small sizes and are used for protecting boxes and small chests. The mechanism of this lock is of the spring-latch type, and its construction has been carried out with high precision using casting, riveting, and soldering techniques.

This lock is designed in a seated position, with the cat's face turned to one side of the body. For this reason, the casting of the animal's body was done using two different molds: one mold for the front of the face and body of the cat, and another mold for the back of the head and the rear of the animal's body.



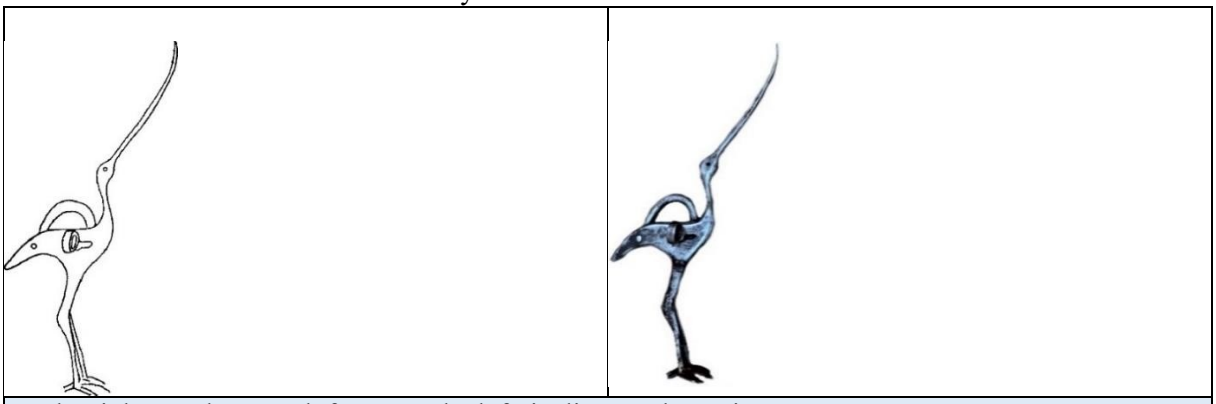
On the right, Lock 4, Cat form; on the left, its linear schematic

Figure 4: Lock with Cat Form, Spring-Latch Mechanism (Authors)

Stork Form

In Iranian culture, the stork is primarily associated with birth, abundance, hope, loyalty, and good fortune. The stork lock in this collection was designed and crafted by a lock-making artist in a realistic style. The bird's neck, head, and beak were shaped and formed from a solid wire, with a hole created to represent the bird's eye. The elongated neck, legs, and beak clearly indicate that this lock is in the form of a stork, and the length of the stork's beak in this lock is notably exaggerated.

The stork's body has been shaped using a metal sheet. All components of this lock are made from steel and have been precisely formed using techniques such as heat treatment, hammering, welding, and riveting. The lock operates via a torsion spring mechanism; meaning that to open the lock, the key must be turned several times to retract the latch and release the lock. The key for this lock is also made of steel.



On the right, Lock 5, Stork form; on the left, its linear schematic

Figure 5: Lock with stork form, coil spring (Authors)

Abstract Animal Figurative Locks

Abstract animal figurative locks symbolically and holistically represent the primary characteristics of animals by simplifying their forms, rather than depicting them with precision. This artistic approach expresses the essence of animals in a condensed and concise manner, allowing for adaptation to diverse tastes. This type of design reflects the artist's creativity in conveying complex concepts through simple forms.

Horse Form

In Iranian culture and the ancient mythologies of various nations, the horse form has always been of interest. In ethnic and mythological beliefs, the horse is a symbol of family nobility and readiness to serve, both in times of peace and war. In Ashura ceremonies, the lion and the horse *Dhu al-Janah* are among the most prominent religious symbols. Since the early Islamic period, the production of locks in the shape of horses was common, which continued into the Safavid and Qajar periods (Mahmoudi & Ahmadpanah, 2019, pp. 168-169).

The horse lock is made of steel with an abstract and minimalist design. Its body is designed as a long, tubular form with an extended neck and elongated legs. This standing form presents a summarized representation of the horse's physique. Its precisely machined, quadrangular steel shackle is reminiscent of the animal's tail. The lock's components are shaped using heat treatment, hammering, welding, and riveting techniques. Its operation is based on a torsion spring system, where repeatedly turning the key releases the latch and opens the lock.



On the right, Lock 6, Horse form; on the left, its linear schematic

Figure 6: Lock with Horse Form, Coil Spring (Authors)

Goat Form

In this collection, the goat is presented as a symbol of abundance and the guardian of the Tree of Life, and its horns are believed to possess hidden magical power. The horns are depicted in an arched shape, similar to a crescent moon, recalling the ancient beliefs of the Iranian people. According to these ancient beliefs, the crescent moon and goat horns were effective in bringing rain and providing water and fertility to the land (Hatem, 1995, p. 364).

The lock in the form of a young male goat with long horns is a rare example of screw-type locks. It is made from 14 pieces of iron using techniques such as heat treatment, hammering, welding, and riveting. The tubular body and cylindrical legs depict the animal standing, with its head and neck tilted and mouth open. The shackle is designed as the animal's tail, and the horns are simple and undecorated. The lock mechanism is of the screw type and opens by turning the key multiple times. Based on its symbolism and similar examples, this lock most likely originates from the Azerbaijan region (Ahmadi Maleki, 2019, p. 272).



On the right, Lock 7, Goat form; on the left, its linear schematic

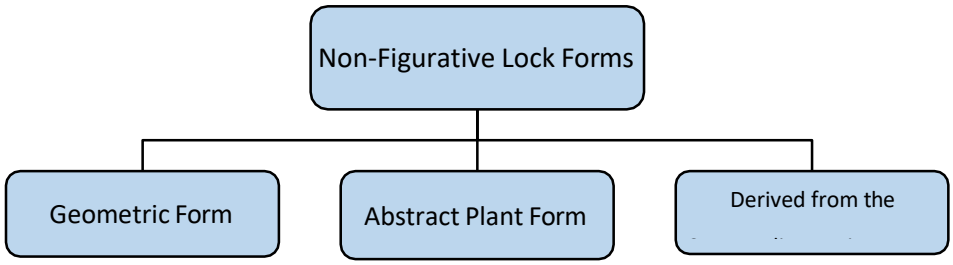
Figure 7: Lock with Goat Form, Coil Spring (Authors)

Non-Figurative Locks

In defining non-figurative forms, it should be said that Iranian designers in lock-making have always focused on creating visual beauty through symmetry and harmony, drawing inspiration for lock forms from the surrounding environment, plant patterns, and geometric shapes in nature. These locks are made in various sizes for diverse uses such as doors, boxes, and religious ceremonies, and are typically constructed from steel, brass, or silver. Some specimens are imported or influenced by Western artifacts. In certain regions, the specific form of the locks can indicate their place of origin, such as the tubular locks of Chaleshtar and Ardabil.

Non-figurative locks are analyzed based on form in three categories: derived from the surrounding environment, abstract plant forms, and geometric forms.

Chart 3: Categorization of Non-Figurative Lock Forms (Authors)

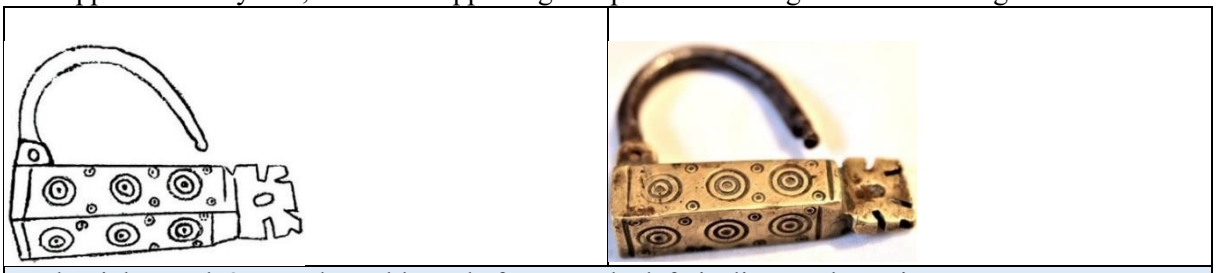


Locks Derived from the Surrounding Environment

Locks derived from the surrounding environment reflect the creativity of Iranian artists in utilizing everyday objects as a source of inspiration for lock design. These works, by avoiding repetition and emphasizing formal diversity, are made of brass and steel, simultaneously possessing characteristics of strength and aesthetics.

Pseudo-Kohl Bottle Form

This pseudo-kohl bottle lock is made from a cast brass body, and its mechanism operates with a coil spring and internal steel components. The key is designed as a screw-on type. Its decoration consists of concentric circles, and at the end opposite the keyhole, there is an appendage shaped like a strange leaf in a rectangular form.



On the right, Lock 8, Pseudo-Kohl Bottle form; on the left, its linear schematic

Figure 8: Lock with Pseudo-Kohl Bottle Form, Coil Spring (Authors)

Purse Form

This lock is cast from iron or steel and features a cylindrical body with vertical grooves. Its mechanism is based on a coil spring, and the lock's shackle is positioned at the top of the body. The body is decorated with deep grooves resembling radiator fins, and the shackle base is designed in the shape of a saddle. The shackle itself is semicircular with a circular cross-section.

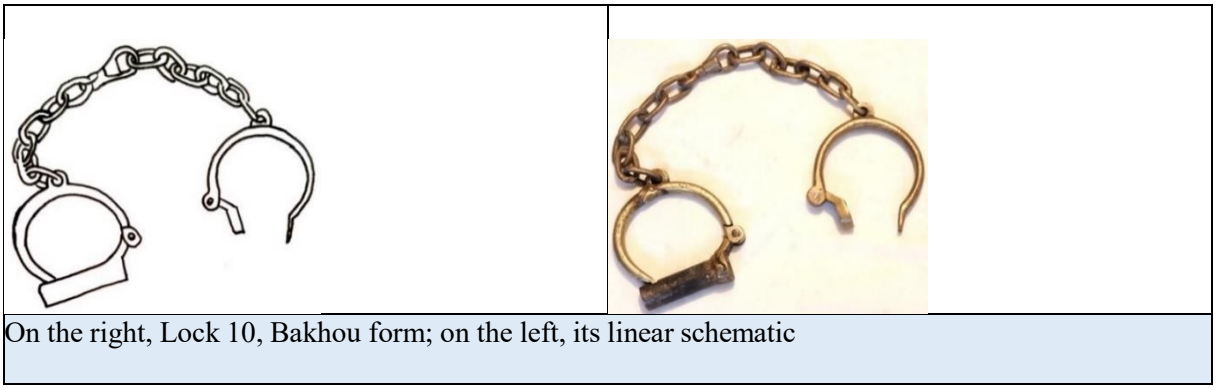


On the right, Lock 9, Purse form; on the left, its linear schematic

Figure 9: Lock with Purse Form, Coil Spring (Authors)

Bakhou (Shackle) Form

Locks in the Bakhou[60] (shackle) form, with a cylindrical body and two circular or oval loops, were specifically designed for restraining humans and animals, and were commonly used with chains for tethering horses. The mechanism of these locks is of the torsion spring type. An example of such a lock, made of brass and fitted with a long chain, was likely used for securing the legs of riding animals or prisoners (Ahmadi Maleki, 2019, p. 268).



On the right, Lock 10, Bakhou form; on the left, its linear schematic

Figure 10: Lock with Bakhou Form, Coil Spring (Authors)

Abstract Locks

Abstract locks refer to those that are inspired by floral motifs, traditional patterns, and the combination of these motifs with geometric shapes. In designing these locks, the locksmith, by utilizing abstract motifs and applying specific forms, has sought to create a unique variety and beauty in the lock-making industry. These designs typically avoid precise, realistic details and focus on overall composition and abstract forms.

Shah Abbasi Form

One of the most beautiful and interesting examples of this type is a steel lock where not only are both sides decorated with Khatai (arabesque) motifs, but the lock itself is also designed in the shape of a Toranj (medallion). Within this medallion, decorations in the shape of hearts and teardrop forms are cut out, adding a particular beauty and delicacy to the lock. The shackle of this specimen is also made in a semi-circular shape with a square cross-section.

[60] Bakhou" is a local name in Iran for locks used in tethering horses, mules, and other riding/draft animals.



On the right, Lock 11, Shah Abbasi form; on the left, its linear schematic

Figure 11: Lock with Shah Abbasi form, curved spring (Authors)

Chaleshtar Form

The lock body is constructed from a rectangular cuboid in the center and two rectangles at its top and bottom, forged from steel metal. The lock base is designed to harmonize in dimensions and shape with the lock body. The size of this base is chosen at a ratio of one-third of the total lock height to establish a suitable balance and aesthetic between the base and the lock body. The key handle is designed in the shape of a horseshoe, making its use easier and more comfortable. Additionally, the handle and lock body are made from similar materials to maintain the necessary visual harmony between the base and the body. For decoration, Islimi (arabesque) motifs are beautifully and artistically engraved onto the lock body. A crown with an abstract plant design is mounted at the bottom of the lock, adding to its beauty and grandeur. The mechanism of this lock is of the coil spring type.

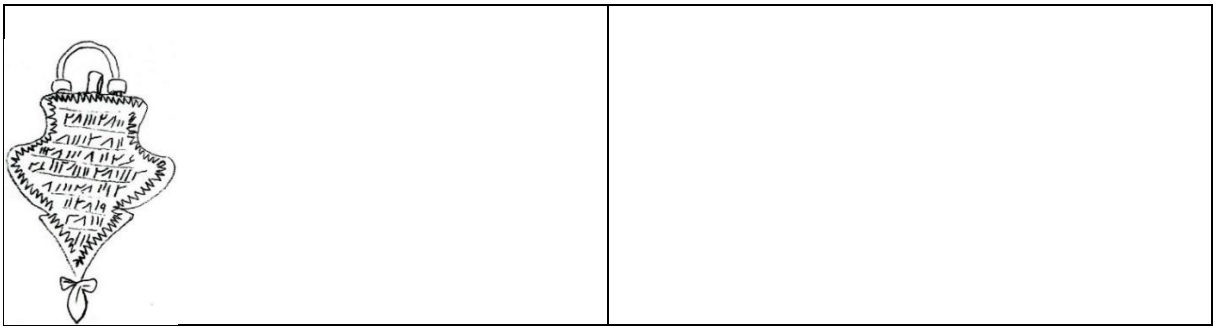


On the right, Lock 12, Chaleshtar form; on the left, its linear schematic

Figure 12: Lock with Chaleshtar form, coil spring (Authors)

Frame Form

Locks of the frame form were made of silver with a pin-spring mechanism and possessed more of a ritual and cultural significance than a security function. The bodies of these locks were decorated with talismanic motifs, including Abjad numerals (numerical values of Arabic letters), as well as diagonal, zigzag, and horizontal lines. In the specimen under study, the shackle is soldered to the body, and there is no mechanical locking device. These locks were often designed as pendants, inspired by talismanic locks.



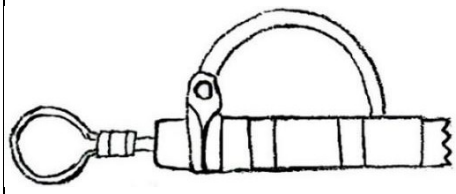


On the right, Lock 13, Frame form; on the left, its linear schematic

Figure 13: Lock with Frame Form, without Spring Mechanism or Locking Device (Authors)

Tubular Form

The horizontal tubular lock in this collection is made of steel, featuring grooves around its tubular cross- section that culminate in a rectangular protrusion with one serrated side. The shackle base extends around the body in a collar-like form, and the shackle itself is beautifully and securely hinged to the base with a riveted pin. The shackle is semicircular in shape with a chamfered square cross-section that transitions to a circular cross-section at its end. The mechanism of this lock is based on a coil spring.





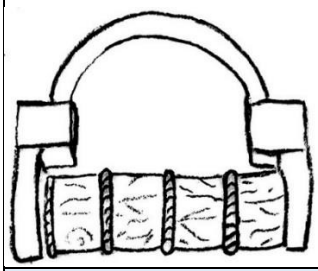
On the right, Lock 14, Tubular form; on the left, its linear schematic

Figure 14: Lock with Tubular Form, Coil Spring (Authors)

Combination Lock in Quadrilateral Form

The quadrilateral combination lock is a type of keyless lock that opens by setting rotating dials. This lock is constructed in a quadrilateral shape, featuring a tubular body with a full-length slit connected to the left shackle. The top and vertical left and right sides act as the lock's shackles. Four brass dials, marked with specific letters and symbols, are mounted on a hollow tube shaft and are rotatable. The left shackle is connected at the bottom to the dial shaft and at the top to the horizontal shackle, while the right shackle is connected at the bottom to a toothed lug and at the top to the horizontal shackle.

To open the lock, the combination letters on the dials must be aligned with the marks on the shackles so that the notches in the dials match the lug on the right shackle, allowing the lock to open. To lock it, the combination letters are rotated again, and the lug engages with the shaft. The combination of this lock is fixed and cannot be changed.





On the right, Lock 15, Horizontal combination form; on the left, its linear schematic

Figure 15: Lock with Combination Form (Authors)

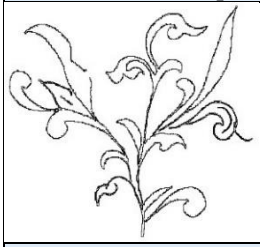
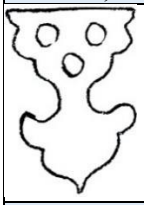
Analysis of Motifs in Qajar Locks

Iranians have consistently adorned their artistic works with an aesthetic vision, using diverse motifs inspired by nature and ritual beliefs. These motifs, which have evolved over time through the creativity of artists, reflect the cultural beliefs and environmental characteristics of each period. The variety of motifs in Iranian art is vast and has always been shaped in interaction with the material's properties and functional conditions. This ornamentation is evident in the art-craft of lock-making as well. The type and extent of decoration on locks depend on their material; for example, steel locks, due to their high hardness, typically have simpler and more limited decorations, while softer metals like brass and silver allow for more precise and delicate motifs. An examination of the Qajar locks in the Sarabi-Aghdam collection reveals that their motifs can primarily be classified into three categories: floral, geometric, and epigraphic, each indicating the deep connection of this art with Iranian culture, beliefs, and aesthetics.

Floral Motifs

Due to the importance of nature in Iranian culture, floral motifs have always played a prominent role in decorative arts. These motifs, particularly in the form of two main styles—*Eslimi* (arabesque) and *Khatai* (floral)—developed across different historical periods. *Eslimi*, with its curved and repetitive lines, presents a symmetrical and complex composition, while *Khatai*, with its abstract flowers and stems, reflects a diverse and dynamic representation of nature. In the Qajar lock collection of Sarabi- Aghdam, notable examples of these motifs are observed. (Lock No. 7), with a body decorated with *Eslimi* motifs on both sides of the goat image, is an example of this artistic fusion. The Shah Abbasi lock (No. 11) also displays a manifestation of delicacy and precision in the execution of floral decoration, featuring *Khatai* motifs on both sides of its body. (Lock No. 12), known as the Chaleshtar tubular lock, has a steel, four-sided body with deeply carved *Eslimi* motifs and a crown adorned with abstract floral designs.

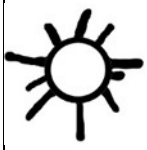
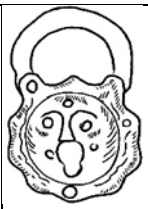
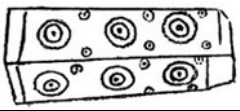
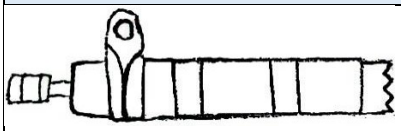
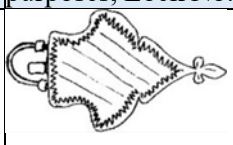
Table 1: Analysis of Floral Decorative Motifs in Qajar Locks (Authors)

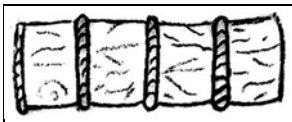
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<tr><td colspan="2">The use of arabesque (eslimi) floral motifs for decoration, Lock No. 7</td></tr>
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<tr><td>The use of Khatai floral motifs for the decoration of the back, Lock No. 11</td><td>The use of Khatai floral motifs for the decoration of the front, Lock No. 11</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>The use of arabesque (eslimi) floral motifs for decoration, Lock No. 12</td><td>The use of arabesque (eslimi) floral motifs for decoration, Lock No. 12 (Chaleshtar Tubular Form)</td></tr>
</table>

Geometric and Linear Motifs

Geometric motifs have always held a special place in Iranian art due to their order, repetition, and high diversity. These motifs, prevalent from ancient times to the contemporary era, reached their most complex form as geometric "knots" (*Gereh*) during the Seljuk period. In the Qajar lock collection of Sarabi-Aghdam, geometric motifs are employed in various ways; ranging from straight, diagonal, and angular lines to soft curves, which are particularly used in locks with animal forms to depict details such as manes, horns, etc.
In Lock No. 6 (Horse Form), a circle with diagonal lines, symbolizing the sun, represents cultural beliefs associated with light and protection. Circular motifs, especially concentric circles, are evident in Locks No. 8 and 3, serving decorative and symbolic purposes. Furthermore, straight star-like lines in the Shah Abbasi lock (No. 11), and diagonal and zigzag lines in frame-shaped locks (No. 13) and combination locks (No. 15) are observed. These motifs not only add visual beauty but also contribute to the mysterious and enigmatic aura of the locks.

Table 2: Analysis of Geometric and Linear Decorative Motifs in Qajar Locks (Authors)

	
Using curved lines to depict the mane, neck collar, and body curves, Lock No. 2	Using curved lines to depict the lion's mane, Lock No. 1
	
Using circles and straight lines for decoration, Lock No. 6	Using curved lines to depict human hair and the lion's mane, Lock No. 3
	
Using straight and curved lines for decoration, Lock No. 11	Using concentric circles for decoration and symbolic/ritual purposes, Lock No. 8
	
Using straight and curved lines for decoration, Lock No. 14	Using straight, curved, and broken lines for decoration, Lock No. 13



Using straight and curved lines for decoration, Lock No. 15

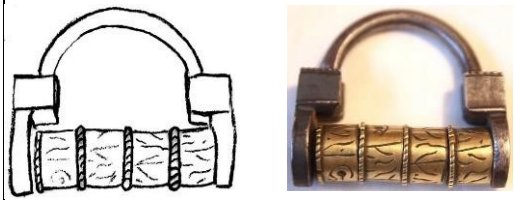
Calligraphy

Calligraphy, as a significant artistic element in Iranian culture, has held a special place from ancient times through the Islamic era. In the Islamic period, calligraphy became a tool for expressing spiritual concepts and divine verses. In the collection of Qajar locks belonging to Sarabi-Aghdam, calligraphy serves not only a decorative role but also a functional one. In combination locks, inscriptions consisting of Persian and Latin letters and numbers are engraved on rings, which function as the lock's combination. Frame- shaped locks feature more intricate motifs, including tables, talismanic and cryptic numbers, which lend them a mysterious aspect. These elements are arranged in horizontal lines and designed within formats that conform to the shape of the lock.

Table 3: Analysis of Decorative Inscriptions/Motifs in Qajar Locks (Authors)



Using letters and numbers for ritual/religious purposes, Lock No. 13



Using letters, numbers, and symbols for the combination/code, Lock No. 15

Table 4: Form and Motif of Qajar-era Locks from the Sarabi-Aghdam Collection (Authors)

Mechanism	Pattern			Form					Construction Technique	Material	Frequency	Picture	Number
	Inclination towards	Geometric	Floral Motifs	Non-Figurative Geometric	Non-Figurative Abstract	Non-Figurative Derived from	Abstract Figurative	Naturalistic Figurative					
Spring Latch		√						√	Casting, Welding, and Engraving	Brass	10		1
Spring Latch		√						√	Casting, Welding, and Engraving	Brass	6		2

Curved Spring		√						√	Casting, Riveting, and Engraving	Steel and Brass	9		3
Spring Latch								√	Casting and Welding	Brass	8		4
Curved Spring								√	Forging, Welding, and Riveting	Steel	3		5
Coil Spring		√					√		Forging, Soldering, Riveting, and Engraving	Steel	16		6
Coil Spring			√				√		Forging, Welding, Riveting, and Engraving	Steel	2		7
Coil Spring		√				√			Casting, Riveting, and Engraving	Brass	17		8
Coil Spring						√			Sheet (metal) and Casting, Riveting, and Soldering	Steel	16		9
Coil Spring						√			Casting, Forging, Welding, and Riveting	Brass	10		10

Curved Spring			√		√				Sheet (metal) and Casting, Riveting, Welding, and Engraving	Steel	5		11
Coil Spring		√	√		√				Forging and Engraving	Steel	4		12
Without Spring Mechanism and Locking Device	√	√			√				Sheet (metal), Casting, and Welding	Silver	26		13
Coil Spring				√					Casting, Forging, Riveting, and Engraving	Steel	20		14
Coded	√	√		√					Sheet metal, Forging, and Engraving	Brass and Steel	18		15

Conclusion

Traditional Iranian locks, as part of the country's cultural and artistic heritage, possess valuable visual, symbolic, and historical potential. However, studying and analyzing these artifacts faces fundamental challenges, including the lack of precise historical documentation, difficulties in dating and identifying the origin of artifacts, the anonymity of makers and workshops, regional stylistic differences, and the existence of counterfeit pieces. These factors make it difficult to accurately determine historical periods, cultural contexts, and stylistic developments of these works. In the typological examination of the Qajar- era locks from the Sarabi-Aghdam collection, it was determined that the forms of the locks can be broadly categorized into two main groups: figurative and non-figurative. Figurative locks were often inspired by animal forms such as lions, goats, horses, cats, and storks. In some cases, hybrid forms, such as a combination of human and lion, were used. In terms of execution, these locks are sometimes naturalistic and sometimes abstract, and are mostly made from metals like steel and brass. The aim of some decorations in this group was to identify the type of animal or create a more naturalistic effect in the form. In contrast, non-figurative locks, which are more numerous, are observed in three subgroups: forms derived from environmental objects (such as kohl bottles, purses), abstract forms (such as the Chaleshtar and frame types), and geometric forms (tubular, combination). From a decorative standpoint, these locks have utilized floral, geometric, and calligraphic motifs. Geometric motifs, especially circles and arabesques (eslimi), have a broader application in non-figurative locks. In some instances, the use of lines, letters, and Abjad numerals indicates ritual or talismanic

functions of some of these locks. Overall, the combination of form, motif, and manufacturing technique in these locks reflects aesthetic perspectives, cultural beliefs, and technical innovations in Iran's traditional metalworking art.

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SAFAVID MINIATURE PAINTING: A VISUAL ARCHIVE FOR RECONSTRUCTING IRANIAN PERFORMANCE ART

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Abstract
The art of performance in Iran, particularly during the Safavid era (1501–1736), experienced a period of flourishing diversity where religious rituals, popular entertainment, and courtly ceremonies were deeply intertwined. However, historians of Iranian theater face a significant documentary gap due to the lack of written dramatic texts and the ephemeral nature of performances in that historical period. Unlike the Western tradition, the Safavid performance culture was oral and improvisational. Recognizing this historical necessity, the present research adopts an interdisciplinary and descriptive-analytical approach to view "Safavid Miniature Painting" not merely as a decorative art form, but as the most critical visual document and archive for recording "performance." The primary objective of this study is to reconstruct the performance space and categorize the theatrical genres of this era by decoding the visual codes embedded within the paintings.
The research examines the evolution of painting styles from the idealism of the Tabriz School to the realism of the Isfahan School, demonstrating how the shift to daily life subjects—led by prominent artists such as Reza Abbasi and Mu'in Musavvir—facilitated a more accurate recording of theatrical details. Through the semiotic analysis of nine significant paintings, including "The Wrestlers," "Goat-play," "Royal Receptions," and "Sufi Gatherings," the study reveals that Safavid painters intelligently documented key performance elements. These elements include stage design (using Sarapardeh or curtains to define space), costumes (specific persona such as the wrestler's breeches or the dervish's felt coat), gestures, and the use of props and lighting. The results indicate that the miniatures of this period serve as a comprehensive mirror of the "performative society" of the Safavid era, where the boundaries between ritual and entertainment, as well as the sacred and the profane, were often blurred. Ultimately, this research proves that the surviving images contain precise technical information regarding the hierarchy of performance, audience interaction, and the social status of performers, serving as a vital visual model for recreating traditional performances in contemporary art and historical studies.
Keywords: Safavid Theater, Iranian Miniature Painting, Isfahan School, Performance Elements, Ritual Drama.

1. Introduction
The Safavid era represents a watershed moment in the history of Iranian art and culture, characterized by the consolidation of Twelver Shi'ism and a vibrant socio-cultural life. Unlike the Western tradition, where the history of theater is often traced through extant play scripts and dramatic literature, the Iranian performance tradition of this period was predominantly oral, improvisational, and ephemeral. Historians and theater scholars, therefore, face a "documentary gap": while we know a vibrant "performative society" existed, we lack the textual evidence to reconstruct the specifics of these performances.
Travelogues by European observers such as Chardin and Tavernier provide descriptive accounts, yet they often miss the nuanced visual language, spatial arrangements, and indigenous cultural codes inherent in these events. This research proposes a shift in methodology: utilizing Safavid miniature painting—specifically the realistic output of the Isfahan School—as a primary "visual archive." By treating painters as "archivists" of the ephemeral, we can decode the visual information to understand how performances were staged, costumed, and consumed by audiences ranging from the royal court to the common street.

2. Historical Context: The Performative Society
The Safavid period fostered a unique environment where the boundaries between ritual, politics, and entertainment were fluid. The society itself was "performative," meaning that public life was governed by codes of display and observation. This culture of performance can be categorized into four distinct realms:

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- **Religious and Ritual Drama:** Deeply rooted in the Shi'a identity of the state, rituals such as the Muharram mourning processions formed the proto-theatrical basis for the later Ta'zieh (passion plays). Simultaneously, Sufi orders conducted Sama gatherings, where music and dance were utilized not for entertainment, but for spiritual ecstasy and union with the Divine.
- **Public and Street Entertainment:** The public squares, particularly the Naqsh-e Jahan Square in Isfahan, acted as open-air theaters. Here, distinct genres such as Naqqali (heroic storytelling), Ma'rakeh-giri (a semi-circular street performance combining oratory and feats of strength), puppetry (Kheimeh-shab-bazi), and acrobatics flourished. These performances were democratic, accessible to all social classes.
- **Courtly Spectacle:** The Safavid court utilized performance as a tool of political legitimacy. Royal banquets (Bazm), diplomatic receptions, and elaborate processions were carefully choreographed "theaters of power" designed to display wealth and hierarchy to foreign envoys and local elites.
- **Martial and Sports Performance:** Physical culture, embodied in the Zurkhaneh (House of Strength) and Polo (Chogan), was not merely sport but a stylized performance of virility and martial readiness, often accompanied by specific musical rhythms.

3. The Evolution of Painting: From Idealism to Realism

To understand the documentary value of these images, one must trace the stylistic evolution of Safavid painting.

- **The Tabriz School (Early Safavid):** Dominated by masters like Behzad and Sultan Muhammad, this style was characterized by idealism and mythological subject matter. While culturally significant, the focus was often on the "heavenly" rather than the "earthly," limiting its use as a documentary source for daily life.
- **The Isfahan School (Late Safavid):** A paradigm shift occurred under Shah Abbas I, led by artists like Reza Abbasi and his student Mu'in Musavvir. The introduction of "Single-Page Paintings" (Tak-negar) marked a departure from book illustration. Artists turned their gaze toward the streets, capturing ordinary people—dervishes, wrestlers, musicians, and animal trainers—with a newfound realism. This shift from the mythological to the "daily" allows the modern researcher to extract precise technical data about performance practices.

4. Visual Analysis and Findings

This section analyzes nine specific artworks to reconstruct the technical and social components of Safavid performance.

4.1. The Theatre of the Body: Sports and Preparation

The realistic approach of the Isfahan School provides detailed information about the "performative body" and the rituals of preparation. "The Wrestlers" (Attributed to Mu'in Musavvir): This work is a quintessential document of the Zurkhaneh tradition. Unlike battle scenes, the focus is on sport as performance. The wrestlers are depicted wearing the specialized Tanban (embroidered breeches), which serves as their specific theatrical "persona." Crucially, the presence of Meel (wooden clubs) placed on the ground acts as a "stage code," defining the space as a gymnasium without the need for architectural representation. A fully clothed third figure, likely a mentor or referee, stands by, illustrating the institutionalized hierarchy and the presence of a "director" figure in martial performances.



Figure 1: The Wrestlers (Attributed to Mu'in Musavvir)

"Henna Application" (Comparative Analysis): Analyzing representations of women applying henna reveals the "dialectics of preparation." The act of applying henna is depicted as a ritualistic "make-up" process, transforming the natural body into a social, performative body. Furthermore, differences in headwear—specifically the contrast between Georgian-style caps and traditional scarves—document the changing fashions and the influence of new social classes in the diverse society of Isfahan.



Figure 2: Henna Application (Comparative Analysis)

4.2. Street Performance: The Democratic Stage

Paintings of public spaces reveal a "theater without walls," characterized by fluidity and interaction. "Goat-Play and Ma'rakeh": This painting captures a "Small Ma'rakeh" featuring a trained goat balancing on a rod. It provides two critical insights: First, the presence of a drummer confirms that music was not background noise but a technical tool used to control the rhythm of the performance and the animal's movements. Second, the audience composition—mixing wealthy youths (indicated by fine dress) with women and commoners—demonstrates the inclusive and democratic nature of street theater, where the "fourth wall" was non-existent.



Figure 3: Goat-Play and Ma'rakeh

"Man Playing Karna": Depicting a solitary figure blowing a long horn (Karna), this work visualizes the "soundscape" of the city. The performer wears a Pustin (felt coat) and carries a Kashkul (begging bowl). These visual codes identify him as a wandering dervish or Street performer, highlighting the economic reality of performance as a means of livelihood (subsistence through spectacle). The red background isolates the figure, emphasizing the sound and the act of performance itself.

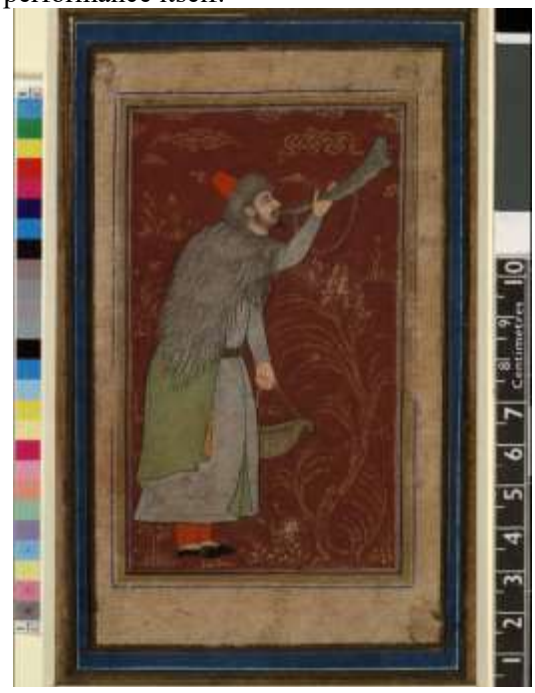


Figure 4: Man Playing Karna

4.3. The Theatre of Power and Scenography

The courtly paintings offer a blueprint of how power was staged through architecture and lighting. "Royal Reception in Camp": This artwork illustrates the concept of "portable theater." Even in an open landscape, the royal space is strictly defined by red fabric walls (Sarapardeh). These curtains function effectively as a proscenium arch or a "fourth wall," separating the sacred, ordered interior of the royal presence from the chaotic, profane exterior of the camp.



Figure 5: Royal Reception in Camp

"The Groom and Horse": In a move towards "anti-theatre" or "backstage realism," the Isfahan School artists occasionally focused on the labor behind the spectacle. By depicting a groom (Mahter) in simple striped clothes tending to a royal horse, the artist acknowledges the logistical support required to maintain the pageantry of the court, shifting the gaze from the star (the Shah) to the stagehand.



Figure 6: The Groom and Horse

"Night Banquet": This rare depiction of a nocturnal scene provides evidence of early "lighting design." The artist meticulously renders multi-branch torches and handheld candles, showing how artificial light was used to create dramatic focus. The composition, often centering on female musicians, highlights their role not just as passive objects of the gaze, but as active agents controlling the tempo and mood of the gathering.



Figure 7: Night Banquet

4.4. Ritual and The Carnivalesque

The boundaries between the sacred, the mystical, and the grotesque were often blurred in Safavid performance. "Prince and Dervish": This genre of painting depicts a "reverse hierarchy." The powerful prince, adorned with weapons and royal regalia, is shown kneeling respectfully before a humble dervish, often in a cave. The cave functions as a "Stage of Truth," contrasting with the artificiality of the palace. This performance of humility was a cultural trope that reinforced the spiritual legitimacy of the temporal ruler.



Figure 8: Prince and Dervish

"Sufi Dance with Animal Costumes": A unique Siah-qalam (ink drawing) reveals the intersection of Sufi Sama and folk carnival traditions. Figures are shown dancing while wearing animal skins and masks. This suggests a form of "grotesque realism" where religious rituals incorporated elements of masking and role-playing, pointing to a lost tradition of performative mysticism
that bordered on the theatrical carnival.



Figure 9: Sufi Dance with Animal Costumes

5. Discussion

The synthesis of these visual analyses confirms that Safavid miniature painting serves as a comprehensive "visual archive." Unlike written texts which describe what happened, these images show how it happened. They provide technical data on:

- Scenography: The use of portable architecture (tents, curtains) and nature (gardens, caves) to create performance spaces.
- Costume as Persona: The distinct visual codes that separate a wrestler from a dervish, or a king from a groom.
- Lighting and Sound: The depiction of torches and specific musical instruments (drums, karna, tambourines) as essential tools for directing the audience's attention and controlling the performance rhythm.
- Social Dynamics: The interaction between performers and a diverse audience, revealing the social function of theater as a communal activity.

6. Conclusion

The research concludes that the lack of written dramatic texts in the Safavid era does not equate to a lack of theatrical history. By shifting the analytical lens to the visual arts, specifically the realistic miniatures of the Isfahan School, we can reconstruct the vibrant world of Iranian performance. These paintings are not merely illustrations; they are technical documents that record the hierarchy, spatial arrangement, and performative codes of a society where the stage was everywhere—from the royal camp to the street corner. This visual model offers a vital pathway for contemporary scholars and artists to rediscover and recreate the lost heritage of traditional Iranian performance.

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CULTURAL HERITAGE MANAGEMENT STRATEGY THROUGH ARTS AND TOURISM SYNERGY TO INCREASE COMMUNITY-BASED TOURIST VISITS IN THE SOUTHEAST ASIA REGION

Nurhidayah-Nurhidayah[62], Fikria-Najitama[63]

Abstract
Diversity has become a phenomenal asset for the Indonesian nation. As an archipelagic nation, this region, located in Southeast Asia, is one of the most geographically and ethnically diverse. The land of a thousand temples, mosques, shrines, and monasteries is home to various religions, leaving behind a legacy of history, stories, and philosophical values. Thousands of cultural heritages, both tangible and intangible, exist. The historical factors, the beauty of past artworks, and the values enshrined in these cultural heritages are attractions and bright prospects for global tourism. It offers alternatives for religious tourism, cultural tourism, historical tourism, academic tourism, art tourism, and tourism to Eastern civilizations, recognized by UNESCO. Tourism opportunities and sources of economic income for local communities in particular and the Indonesian government in general. Various modifications and partnership-based management strategies have begun to be implemented, involving various parties, including arts communities, cultural communities, academics, industry practitioners, historians, religious leaders, politicians, and other stakeholders. This article presents a description of cultural heritage management models and strategies to open up opportunities for economic growth by integrating community-based arts synergies. Tourism is increasingly attracting investment without neglecting or damaging the historical aspects, values, and traditions held and believed in by owner heritages. This is expected increasing number of tourist, which had stagnated during pandemic19. The high number of tourists ultimately has an impact on increasing local community income. Furthermore, number of tourists can also increase funding sources for the preservation of cultural heritage itself.
Keywords: Management Strategy, Tourism, Heritage

Introduction

Amidst the rapid movement of human civilization, space and time are no longer barriers. Various societies and their cultures continue to evolve with the times, producing artifacts that are the result of human civilization itself. In the context of national and state life, amidst increasingly rapid technological and communication changes, inheriting national history through the cultural legacies left behind by previous communities is not only a source of pride but also supports the livelihoods of local communities in their regions. Therefore, the historical value of a great nation must be inherited. Borrowing a concept from Sukarno, the first president of the Republic of Indonesia, who declared, "Jas merah, never forget history." Therefore, cultural heritage serves as a national identity and can become an alternative source of income from the tourism sector.

This cultural heritage-based sector has become a key strategy in global economic development, with significant contributions to Gross Domestic Product (GDP) and job creation. Kostakis (2024) describes regions with significant cultural heritage assets as having a competitive advantage over regions with more limited resources. The global cultural heritage tourism market is expected to reach approximately US$605 billion in 2024 and is projected to grow at 4.5% annually until 2030 (Roberts, 2025). This figure demonstrates tremendous economic potential, but also presents complex challenges related to the preservation of cultural authenticity and the well-being of local communities. Reflecting on the experiences of Nepal (Birendra, 2023), Kenya, South Korea, Albania (Irena, 2023), and Costa Rica, the development of the community-based tourism (CBT) sector could be an alternative strategy in developing the people's economy.

Numerous research studies examining cultural heritage's function, particularly intangible heritage, reveal compelling data regarding its contribution to enhancing societal and national economies. These investigations employ both qualitative and quantitative methodologies, including ethnographic frameworks and PVAR

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(Panel Vector Autoregression) analysis. Heritage assets, whether tangible or intangible, transcend their role as mere historical artifacts, functioning instead as social capital that defines collective identity and serves as a catalyst for sustainable economic advancement. The convergence of cultural heritage with tourism creates a connection between historical legacy and future development, transforming local communities, traditional practices, and economic trajectories (Du, 2024). According to Jinlin (2025), the expansion of intangible cultural heritage demonstrates its geographic reach and economic advantages, which are essential for assessing its market viability and sustainability prospects.

Nevertheless, cultural heritage development encounters an inherent contradiction. Its effects on social health determinants are both beneficial and detrimental. Benefits encompass economic gains, cultural renewal, infrastructure enhancement, and upgraded social amenities. Detrimental effects may involve limiting local community involvement, eliminating income sources, displacing and dividing communities, escalating criminal activity, and degrading cultural and natural resources through excessive tourist influx. While tourism may represent the sole feasible revenue stream for preserving particular heritage sites, it simultaneously poses risks to their long-term viability. Within Southeast Asia, the sector has progressively transitioned from quantity-focused mass tourism toward sustainability-oriented approaches prioritizing visitor experience quality (Huang T, Bui, 2025). Cultural heritage serves as a cornerstone in establishing the region's international tourism attractiveness, with nations including Indonesia, Malaysia, Laos, Thailand, Vietnam, and the Philippines consolidating cultural and tourism functions within unified ministries.

Developing and reinforcing tourism that combines artistic and tourism elements demands a comprehensive strategy encompassing economic, social, and environmental factors. Indigenous community engagement, supported by governmental bodies, NGOs, and commercial enterprises, proves essential for achieving sustainability (Cordova-Buiza, 2025). Policy frameworks must prioritize building cooperative networks and advancing inclusive approaches that accommodate evolving social, economic, and environmental conditions.

Contemporary empirical research demonstrates a positive relationship between cultural heritage indicators and regional economic expansion. Each one percent rise in the cultural heritage indicator correlates with a 0.03 percent boost in regional economic development (Kostakis et al. 2024). This evidence supports the heritage-driven growth theory, wherein cultural heritage, serving as a measure of cultural tourism, demonstrates a statistically meaningful positive impact on regional prosperity.

Nevertheless, utilizing cultural heritage tourism for poverty reduction hinges significantly on incorporating local populations into tourism management, decision-making frameworks, and resource and program accessibility. Sustainable tourism generates prospects for craftspeople and cultural experts to present their creations to broader markets, potentially enhancing earnings and ensuring craft continuity (Yanking, 2025). Additionally, cultural learning through tourism can cultivate enhanced appreciation and regard for cultural plurality. Technological advancement similarly creates fresh possibilities for safeguarding and advancing cultural heritage. Digital instruments including virtual reality and augmented reality platforms have been implemented to strengthen cultural heritage and tourism integration (Rangkuti, 2025). These technologies simultaneously improve visitor engagement and support cultural heritage conservation for subsequent generations.

This investigation seeks to construct a tourism mapping and enhancement framework emphasizing both tangible and intangible cultural assets that can strengthen community and national economies while preserving historical significance and cultural genuineness. Through synthesizing economic, socio-cultural, and environmental viewpoints, and leveraging technological innovation alongside community involvement, this study aims to offer actionable insights for policy developers, tourism professionals, and local populations in formulating sustainable and inclusive cultural heritage tourism advancement strategies.

Examining cultural heritage within Indonesia proves particularly fascinating. Every region possesses distinctive and abundant heritage, reflecting its unique community characteristics. Cultural heritage, as Cerisola (2024) describes, constitutes the cultural wealth of a society that attracts tourist admiration. It equally embodies the prosperity and dignity that local communities attach to their ancestral legacy. While investigations by various scholars acknowledge the adverse consequences of elevated tourist interest and visitor volumes at cultural heritage locations, exemplified by Brooks (2023) and Du (2024), Lv J's (2025) research in Jilin, China, demonstrates a strong to very strong relationship between intangible cultural heritage and the tourism industry.

The substantial impact of both tangible and intangible cultural heritage assumes a critical position in the tourism sector and economic advancement. The significant influence of tangible and intangible cultural heritage plays a significant role in the tourism sector and economic growth. These include increasing local and national income, employment generation, job creation, and regional development (Alvares, 2019). Based on numerous studies on the potential for significant contributions of cultural heritage to the economic sector, similar to Turkey, which boasts a wealth of cultural heritage, Indonesia boasts thousands of assets but only 11,000 registered sites. Hazal's research (Keser, 2016) and Indonesia also share a similar view of the need to immediately reorganize the heritage management system so that it can improve the economic sector on the one hand and increase revenue for site maintenance. Unlike Turkey, the data gap between traditional preservation and the demands of the creative economy remains very high, with Indonesia's potential boasting 1,340 ethnic groups and 11 UNESCO cultural heritage sites.

Methodology

This study focuses on models and strategies for cultural heritage management in Southeast Asia, specifically on cultural heritage governance that integrates art and tourism in Indonesia. This qualitative study, using case studies, focuses on heritage governance in Trowulan (East Java), Penglipuran Village, and Jatiluwih Village (Bali), Central Java's cultural heritage, including the Sampo Kong Temple in Semarang and the Gedong Songo Temple Site, as well as various forms of intangible heritage such as culinary recipes. This region is a special region with a diverse cultural heritage. Historical, social, and economic factors are among the attractions that make this region a worthy study destination. Numerous cultural relics are available, including Hindu and Buddhist temples, Chinese temples, traditional houses, traditional recipes, unique batik, each city unique in its own way, and ancient mosques, the result of cultural acculturation. Furthermore, this region is rich in natural heritage, recognized by UNESCO as an ancient Geopark, which preserves the history of nature and civilization. Data collection was conducted through interviews, observation, and the study of both physical and digital documentation. Triangulation is the author's choice in analyzing the da ta that has been collected which can then be presented as research results.

Findings

In contemporary times, the worldwide tourism industry has emerged as a powerful force demonstrating remarkable progress amid an era of disruption. The significance of the 5.0 and 4.0 periods has grown substantially. Cultural heritage represents a valuable community resource. As an inheritance transmitted through successive generations, it functions not merely as a marker of collective identity but also serves as a foundation of cultural pride for local populations. The administration of both material and non-material cultural heritage has achieved sophisticated organization. Multiple initiatives and approaches for gathering data, preserving, and overseeing cultural heritage are currently being executed. Similar to recent developments following the COVID-
19 pandemic, the tourism industry has transitioned into a recovery stage, catalyzing Indonesia's metamorphosis. Indonesia, which previously experienced significant stagnation, is now exhibiting fresh and encouraging prospects.

Models for Cultural Heritage and Tourism Management in Indonesia

Indonesia has introduced numerous innovative approaches to cultural heritage management policy, encompassing various initiatives spanning from national to local governments. Central government administration emphasizes reinforcing and advancing policy frameworks and legal provisions, exemplified by Law No. 11 of 2010 on Cultural Heritage. This legislation characterizes cultural heritage as inherited wealth, symbolizing the materialization of concepts and practices that merit preservation and transmission to subsequent generations. At the subsequent tier, provincial authorities assume responsibility for inter-municipal and inter-regency coordination. The district/city level is responsible for drafting regional regulations, specifically the Regional Cultural Regulation (PPKD), and directly managing cultural heritage (Bphn, 2010). These programs aim to ensure that cultural heritage continues to thrive, provides economic benefits, and is passed down to future generations.

There are several models for heritage management in Indonesia. First, in the early post- independence era, management was still carried out using a hierarchical model that tended to be guided by top-down principles, where all regulations and policies were managed and determined by the central government. Second, there is the market model. This model allows for self-regulation by each community with state support. Third, there is the network model. This model balances public and private partnerships. Fourth, there is the community model, emphasizing the direct involvement of community members in tourism governance. Similar to developments in governance in Southeast Asia, cultural heritage governance in Indonesia, which combines art and tourism, is also shifting from a hierarchical to a non-hierarchical model. This is inseparable from historical factors and the region's socio-political conditions. It is guided by optimizing collaboration between various interests, from planning to supervision. The following is a structured division of labor in governance in Indonesia, from the central government to the field.

Table 1 Structure and function Division in Indonesia

Level	Main Stakeholders	Key role
National	Kemenparekraf, Kemendikbudristek	Policy formulation, WBTbI determination, ITDP program
Provincial/District	Department of Tourism, Department of Culture, Regent/Mayor	Program implementation, mentoring, infrastructure
Community	Village-Owned Enterprises (Bumdes), Tourism Awareness Groups (Pokdarwis), Art Studios, Local NGOs	Operational management, cultural preservation, distribution of benefits
Private	Tour operator, Hotel, Bank (CSR)	Investment, marketing, business partnerships
Academic/International	Universitas, UNESCO, World Bank	Research, training, funding, certification

Decision-Making Mechanisms

The analysis revealed three dominant decision-making models: (1) Modified Top-Down Model – government policies with limited consultation (Kebumen and Trowulan Religious Tourism); (2) Participatory-Collaborative Model – collective decision-making through village deliberations (e.g., Penglipuran and Jatiluwih in Bali, Semarang and Kebumen intangible heritage); and (3) Hybrid Model, a combination of government leadership for strategic policies and community autonomy for operations (Kebumen – related to UNESCO-recognized Geopark heritage). The variety of governance implemented by the government is inseparable from the socio-economic and political conditions. As a newly independent country, it is natural that the management of cultural heritage is still centralized and does not involve the private sector, society and communities. Along with the development of the times, especially now that technology has transcended the boundaries of space and time, the opportunity for increasing the flow of tourists both domestically and internationally to enjoy and see the thoughts of the past, present and opportunities that are open in the future, partnerships and collaboration models with communities, networks and markets have become models that are widely chosen in improving the heritage-based tourism sector. As done by the Central Java government by carrying out various activities to determine WBtb (tangible and intangible heritage), starting from Wayang Wong Ngesti Paandowo, Weaving Troso Jepara, traditional

recipes typical of Central Java. Furthermore, the joint learning program with Museum, specifically carried out at the Ronggowarsito Museum. Facilitation and collaboration of Cultural activities such as events or exhibitions. In addition, it is also included in the course content.

Art Integration in Cultural Heritage Preservation

Research has identified various art practices that have been successfully integrated into tourism experiences. In Kebumen, Tanuraksan hand-drawn batik is integrated through interactive workshops and storytelling. Geoparks are integrated with traditional arts, traditions, and education. For example, the Rama and Shinta performance in the Prambanan Temple courtyard promotes art, history, and economics as one of the artistic performances to increase tourist numbers. In Jatiluwih, Subak rituals and traditional dances involve tourist participation. In Nglanggeran, wayang (puppetry) and traditional agriculture are presented through performances and hands-on experiences. In Penglipuran (Disparbud, 2020), traditional architecture and bamboo crafts have become living museums. With enhanced local community participation in heritage conservation and tourism development, visitor arrivals from both international and domestic sources are anticipated to total

17.29 million for international travelers and 56.49 million for domestic travelers in 2023. Additionally, per capita tourist expenditure reached 25.68 million rupiah during 2023. This economic activity has stimulated expansion in the creative tourism sector. These achievements reflect dedicated efforts, with committed involvement from communities, cultural custodians, historical experts, scholars, indigenous populations, and the Ministry of Education and Culture in collaboration with research and technology institutions, resulting in the national registry expanding to over 2,200 documented cultural works by 2024, with plans to add 550 more entries in 2025. Below is an inventory of Indonesia's intangible cultural heritage according to the most recent 2024-2025 records.

Table 2 Intangible Cultural Heritage (ICH) Latest Data (2024-2025):

No	Heritage
1	Keris
2	Wayang
3	Batik
4	Saman Dance
5	Noken
6	Pinisi
7	Pencak Silat
8	Pantun
9	Gamelan
10	Jamu
11	Reog Ponorogo
12	Kebaya

Cross-Generational Knowledge Transfer
The integration of arts in revitalization has a positive impact, including the inheritance of cultural values and products through informal apprenticeship mechanisms where younger generations learn from master craftsmen, economic incentives that motivate youth to learn traditional practices, digital documentation using video and social media, and educational collaborations with universities for research and training.

Innovation and Adaptation of Traditional Arts
Research has found that innovation is crucial for sustainability, but must be undertaken with caution. Successful innovations identified include: product diversification (from batik fabric to bags, accessories, and home decor), collaboration with contemporary designers, the use of digital technology for online promotions and sales, and the creation of immersive experiences using AR/VR for virtual museums, as well as partnerships with domestic and international influencers and artists.

Implementation of Community-Based Tourism
Community Participation Models
Based on a systematic review of community participation in Indonesia (Priviet Journal, 2025), this study identified five participation models: (1) a Full Community Ownership Model with collective ownership (Penglipuran, Kebumen Religious Tourism); (2) a Public-Community Partnership Model (Jatiluwih, Nglanggeran, and Tanuraksan Batik, Kebumen); (3) a Private-Community Partnership Model with profit sharing; (4) a Collaborative Multi-Party Framework encompassing governmental bodies, commercial enterprises, local populations, and non-governmental organizations (Trowulan)
(5) a Local Wisdom-Based Model integrating traditional value systems such as Tri Hita Karana or Subak.

Community Economic Empowerment
Data from the World Bank ITDP (2025) shows significant economic impacts: job creation for more than 975,000 people across six destinations (an increase of approximately 27% in the accommodation, food, and beverage sector), an average wage increase of more than 15%, more than 84,000 certified tourism professionals, 18,000 trained participants from 155 tourism villages, and the attraction of more than $870 million in private investment.

Benefit Distribution and Social Justice
One of the critical challenges identified is ensuring equitable benefit distribution. Research has found significant variation across locations: Penglipuran exhibits a relatively equitable distribution system through customary-based collective ownership, Trowulan experiences disparities in distribution dominated by elite groups (Basyar et al., 2025), while Nglanggeran has a transparent benefit-sharing mechanism through the Tourism Awareness Group (Pokdarwis), with allocations for communal infrastructure development.

Impact of CBT Implementation
Economic Impact
Identified positive economic impacts include: a 20-40% increase in per capita income in established tourist villages, economic diversification through the emergence of micro-enterprises, a multiplier effect where every rupiah from tourists generates 1.5-2.5 rupiah in the local economy, increased property values (but with the risk of gentrification), and infrastructure improvements, including access to water for 570,000 people and sanitation for 470,000 people (ITDP).

Socio-Cultural Impacts
Socio-cultural impacts are complex and ambivalent. Positive impacts include: revitalization of endangered traditional cultural practices, increased cultural pride and local identity, strengthened social cohesion through community collaboration, more intensive intergenerational knowledge transfer, and increased recognition of cultural heritage significance. Identified challenges and risks include: cultural commodification, where traditional practices are appropriated for tourist appeal, demonstration effects that change local lifestyles, intergenerational conflicts over preservation versus modernization, and tensions with tourists over behavior that disrespects local culture.

Environmental Impact
Environmental impacts show a mixed pattern. Positive conservation is evident in the Subak system in Jatiluwih, which preserves the terraced rice paddy ecosystem; the rehabilitation of critical land into an ecotourism area in Nglanggeran; increased environmental awareness; and economic incentives for conservation. However, environmental pressures also arise through increased waste and litter, pressure on water resources, infrastructure development that alters the landscape, and potential overtourism in popular destinations.

Key Success Factors
Based on a comparative analysis, the study identified eight key success factors: (1) Strong and visionary local leadership; (2) A clear organizational structure with defined roles; (3) Active community participation in decision-making; (4) Consistent government support through coherent policies; (5) Fair and transparent benefit distribution mechanisms; (6) Distinctive cultural uniqueness and authenticity; (7) Human resource capacity and skills through ongoing training; and (8) Market access and promotion through effective marketing strategies, including digital marketing.

Discussion
Based on the UNESCO World Heritage Centre (2024), cultural heritage includes the physical, cognitive, spiritual, and affective characteristics of a community, encompassing artistic expressions and architectural structures, historical and cultural legacies, food traditions, literary works, musical forms, creative sectors, and contemporary cultures along with their ways of life, belief frameworks, and customs. UN Tourism (2017, 2025) characterizes cultural tourism as tourism engagement where visitors' primary purpose is to acquire knowledge, explore, encounter, and engage with material and non-material cultural offerings/experiences at a given location.

Material and Non-Material Cultural Heritage
Cultural heritage comprises two principal classifications (UNESCO, 2024):
Material Heritage: Physical objects, historic structures, architectural complexes, locations, and museum collections possessing symbolic, historical, artistic, aesthetic, ethnological, anthropological, scientific, and societal value. This category encompasses portable objects, fixed structures, and submerged heritage.
Non-Material Heritage (ICH): Traditional practices, forms of representation, modes of expression, expertise and competencies that communities acknowledge as components of their cultural inheritance, which include: traditional craftsmanship and visual creative works; culinary traditions; communal customs, ceremonial activities and festive occasions; musical and theatrical arts; verbal traditions and narrative forms; wisdom and methodologies concerning the natural world and cosmos (UN Tourism Study on ICH, 2025).

Cultural Heritage Governance Theory

Collaborative Governance
Collaborative governance within cultural heritage contexts highlights the critical role of multi- party cooperation in decision-making and administrative processes. This approach incorporates governmental bodies, indigenous communities, commercial entities, academic institutions, and civil society groups through stakeholder consultation and partnership for cohesive tourism development and heritage stewardship (UNESCO WH+ST Programme, 2024). Contemporary research conducted by Basyar, Mardiyanta, and Setijaningrum (2025) examining the Majapahit House Heritage Area in Trowulan, Indonesia, demonstrates that effective collaborative governance relies on: (1) capable local leadership; (2) efficient resource management; and (3) the degree of community participation. This investigation employs an influence-interest framework and stakeholder network analysis to map collaborative patterns and tensions within governance mechanisms.
Symbiotic Theory in Cultural-Tourism Integration
Symbiotic theory conceptualizes the connection between non-material cultural heritage and tourism as a reciprocally advantageous (mutualistic) arrangement. Based on research published in the Modern Economics & Management Forum (2024), merging non-material cultural heritage with cultural tourism simultaneously facilitates the active conservation and transmission of such heritage while enriching the

caliber and variety of tourism offerings. The framework of 'holistic intangible cultural heritage' underscores the necessity of treating non-material cultural heritage as an interconnected ecosystem incorporating all domains and components intrinsically linked to such heritage to accomplish comprehensive advancement. Symbiosis theory analyzes the subject of tourism from the perspectives of: (1) symbiotic units; (2) symbiotic modes; (3) symbiotic interfaces; and (4) symbiotic environments.

Community-Based Tourism

Definition and Principles of Community-Based Tourism

As defined by Goodwin and Santili (2009), Community-Based Tourism (CBT) represents tourism initiatives owned and/or administered by local communities with the objective of generating widespread community advantages. CBT constitutes an innovative and inclusive methodology that positions indigenous communities as central actors in tourism advancement, corresponding with the UN Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth) (MDPI Tourism Study, 2025).

Bibliometric analyses and comprehensive literature reviews covering three decades (1995- 2025) reveal that CBT has developed as a sustainable framework for community empowerment, economic development, and cultural conservation (Nguyen, 2025). CBT approaches, including multi - party partnerships and methodologies grounded in indigenous knowledge, make substantial contributions to livelihood enhancement, cultural identity preservation, and ecological protection.

CBT Characteristics in Indonesia

Within Indonesia, the CBT framework has been institutionalized through the Minister of Tourism and Creative Economy Regulation Number 11 of 2022. A comprehensive examination of community engagement in sustainable tourism across Indonesia (Priviet Social Sciences Journal, 2025) evaluated 54 scholarly articles published from 2018 to 2025, demonstrating that frameworks such as CBT, collaborative multi-stakeholder models, and indigenous wisdom-informed strategies significantly enhance livelihoods, safeguard cultural identity, and promote ecosystem conservation.

Indonesian CBT case studies illustrate varied implementation approaches:

Kebumen Geo Park Village: Exemplifies how CBT can serve as a catalyst for local economic transformation through robust community engagement, sustainable enterprise frameworks, and strategic partnerships.Jatiluwih, Bali: A holistic tourism model that empowers local communities through ecotourism, educational experiences, and agrotourism, with a Subak irrigation system recognized by UNESCO (2012) as a World Cultural Heritage Site (UN Tourism Best Villages 2024, 2025).

Batik Tanuraksan, Kebumen: A community where cultural heritage and environmental stewardship go hand in hand, with the heritage of Batik Tulis (hand-drawn batik) inviting visitors through interactive workshops and storytelling.

Funding Challenges and Opportunities for CBT

While CBT offers transformative potential, research identifies several challenges: limited funding, regulatory barriers, stakeholder conflicts, and single-market dependency. However, significant opportunities are also identified through digital technologies (AR, VR), supportive government policies (Indonesia Tourism Outlook 2025/2026), and the global trend of increasing tourist interest in authentic experiences (73% of millennials are interested in historical and cultural sites, World Economic Forum, 2024).

Incorporating the Arts into Cultural Tourism

A comprehensive scoping review examining the convergence of performing arts and cultural tourism (Discover Sustainability, 2025) identified that performing arts present distinctive prospects for sustainable advancement by leveraging indigenous cultural assets as both tourist attractions and conservation mechanisms. Cultural events such as Scotland's Edinburgh Festival Fringe and Mali's Festival au Désert illustrate the significance of performing arts in enhancing visitor experiences and bolstering cultural heritage preservation.

The incorporation of traditional crafts and creative sectors into cultural tourism generates economic benefits while maintaining conventional expertise. Studies on Zherong papercutting (Modern Economics & Management Forum, 2024) underscore the necessity of modernizing ICH transmission and

presentation methods to align with contemporary societal requirements and aesthetic preferences.. The digitization of ICH and the creation of a metaverse with the integration of virtual and physical forms can reduce dependence on a single revenue model, thereby revitalizing traditional arts.

Policy and Regulatory Framework

The Indonesian government has established an extensive policy architecture for cultural heritage conservation and tourism advancement, encompassing: Law No. 5 of 2017 on Cultural Advancement, the Minister of Tourism and Creative Economy Regulation No. 11 of 2022 on Cultural Heritage Development (CBT), the Tourism Outlook 2025/2026 emphasizing sustainability principles, and the World Bank's Integrated Tourism Development Program (ITDP) focusing on infrastructure enhancement and local entrepreneurial capacity building.

Integrated Governance Framework: A Theoretical Approach

The research outcomes reinforce and broaden the collaborative governance theory within the Indonesian cultural heritage context. The emerging model exhibits unique characteristics that distinguish it from European or developed country models. First, it highlights the central role of traditional institutions such as the Subak system and Balinese customary laws as effective governance mechanisms, including the role of elders in managing religious tourism in Kebumen and Trowulan in East Java, which aligns with the findings of Suansri (2003). Second, it emphasizes the two-wheel drive between the economy and the community, emphasizing that community empowerment is equivalent to economic growth. Third, the integration of spiritual-religious tenets exemplified by Tri Hita Karana, which balances three fundamental connections: humanity with the divine, humanity with fellow humans, and humanity with the natural world.

Symbiosis of Arts, Culture, and Tourism

This research validates the theory of symbiosis in the integration of ICH and tourism (Modern Economics, 2024) with an additional dimension. The dynamic symbiotic unit demonstrates that traditional arts are not static objects but living and adapting entities. The inclusive symbiotic model involves not only artists and tourists, but also the younger generation, government, and academics. The multidimensional symbiotic interface encompasses the physical (workshops, performances), digital (social media, online platforms), and spiritual (cultural values embedded in artistic practices). A conducive symbiotic environment requires supportive government policies, a market that values authenticity, and a community that is proud of its cultural heritage. In the context of community- based heritage management, the primary actors in its implementation are the local heritage owners, who are the primary stakeholders. As heirs who take pride in their heritage, they can also improve the economic sector of their supporting communities.

The Challenge of Benefit Distribution: An Equity Perspective

The findings regarding the disparity in benefit distribution confirm concerns in the CBT literature about elite capture and inequality (Basyar et al., 2025; MDPI Tourism Study, 2025). The Trowulan case study demonstrates that formal governance structures alone are insufficient to ensure equitable distribution. Transparent mechanisms, strong accountability, and inclusive participation from various community segments, including women, youth, and marginalized groups, are required. Local community involvement is said to be highly supportive in the preservation and maintenance of the historical heritage of the Majapahit kingdom. The Penglipuran model, with its customary-based collective ownership system, offers an interesting alternative worthy of further study.

Resilience in the Face of Change

Resilience analysis shows that successful tourism villages have a high capacity to adapt to external changes such as the COVID-19 pandemic, economic fluctuations, and shifts in tourist preferences. Key to resilience are economic diversification, continuous innovation, and strong social capital. Beijing's (2025) research on three resilience models provides a relevant framework: the cultural creative industry empowerment model, the collaborative governance model for folklore communities, and the cultural resource concentration model can be applied in the Indonesian context with local adjustments.

Digital Technology as an Enabler

Findings indicate that digital technology plays a crucial role in expanding reach, increasing accessibility, and creating immersive experiences. However, a digital divide exists between developed and developing tourism villages. Investment in digital infrastructure, digital literacy training for communities, and policies that encourage inclusive digital innovation are needed. The use of AR/VR for virtual museums, online booking platforms, and social media for cultural storytelling demonstrate the transformative potential of technology in cultural tourism.

Conclusions and Recommendations Conclusion

This research yields several important conclusions:

A successful model of cultural heritage governance in Indonesia integrates multi-stakeholder collaborative elements with a central role for traditional institutions and local wisdom values. The emerging model exhibits unique characteristics that distinguish it from Western approaches, emphasizing spiritual-material harmony and community empowerment as goals equivalent to economic growth.

Critical elements for successful community-based integration of arts, culture, and tourism encompass: capable local governance, well-defined institutional frameworks, robust community engagement, sustained governmental backing, fair benefit-sharing systems, genuine cultural distinctiveness, sufficient human capital development, and viable market connectivity. Achievement hinges on maintaining equilibrium between cultural authenticity preservation and market-driven adaptation.

The consequences of CBT implementation are multifaceted and intricate. From an economic perspective, CBT has demonstrated its capacity to enhance community earnings, generate employment prospects, and diversify the local economy. Socio-culturally, CBT has ambivalent impacts—on the one hand, it revitalizes traditional practices and strengthens cultural identity, but on the other, it faces the risk of commodification and value shifts. Environmentally, CBT can encourage conservation but also puts pressure on natural resources.

Digital technology has emerged as a critical enabler for expanding reach, increasing accessibility, and creating immersive experiences. However, the digital divide between villages requires special attention to ensure inclusivity.

Long-term sustainability requires equitable benefit distribution mechanisms, transparent governance, inclusive participation, and resilience to external changes. Comparative studies show that models based on customary institutions, such as those in Penglipuran, tend to be more equitable than elite-dominated models found in some other locations.

Recommendations

For the Central Government

Strengthen the CBT regulatory framework with a focus on fair and transparent benefit distribution mechanisms, including the development of national guidelines for revenue-sharing and accountability mechanisms.

Enhance financial resources dedicated to investigation, documentation, and conservation of non- material cultural heritage, incorporating digital conversion and establishment of a nationwide registry.

For Local Governments

Formulate a comprehensive sustainable cultural tourism strategic plan that synthesizes CBT principles, cultural heritage conservation, and regional economic advancement, ensuring meaningful community involvement throughout the planning stages.

Bolster the institutional capabilities of Village-Owned Enterprises (Bumdes) and Tourism Groups (Pokdarwis) through training in management, finance, marketing, and service delivery, as well as ongoing mentoring.

Develop fiscal and non-fiscal incentives to encourage responsible private investment in cultural tourism, with clear benefit-sharing mechanisms.

Facilitate the establishment of a multi-stakeholder forum for dialogue, coordination, and conflict resolution in cultural tourism management.

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THE ROLE OF VIRTUAL REALITY (VR) IN BUILDING INFORMATION MODELING (BIM): TRANSFORMING DESIGN VISUALIZATION THROUGHOUT THE PROJECT LIFECYCLE

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Abstract
This study investigates the combined use of Building Information Modelling (BIM) and Augmented Reality (AR) to improve design coordination, stakeholder communication, and spatial understanding across the project lifecycle, with a particular focus on Jabatan Kerja Raya (JKR) public projects in Malaysia. While BIM centralizes multidisciplinary information and supports clash detection, quantity take-off, and coordinated documentation, its interfaces and data density can be challenging for non-technical stakeholders. AR addresses this barrier by overlaying BIM-derived digital models onto real-world contexts, enabling intuitive, in-situ visualization that clarifies design intent and fosters more inclusive participation in reviews and decision-making. A mixed-methods approach was adopted. Quantitatively, an online survey of building professionals—including architects, engineers, contractors, and project managers—captured perceptions of AR-BIM integration regarding coordination quality, meeting effectiveness, and misinterpretation reduction. Qualitatively, a 3D BIM model developed in Autodesk Revit was exported to AR using tools such as Enscape, Fologram, or Unity Reflect to simulate practical workflows for design review and site-based evaluation. The AR demonstration examined usability, spatial comprehension, and the speed and relevance of real-time feedback during collaborative sessions. Findings indicate that AR significantly enhances spatial understanding and communication. Over 80% of respondents agreed that AR improves coordination among stakeholders and reduces misinterpretation in design meetings. The study positions AR-BIM integration as a key enabler of Construction 4.0 in the Malaysian public sector. To scale adoption in JKR projects, it recommends establishing implementation policies and standards, investing in targeted training for both technical and non-technical users, and aligning device procurement, data governance, and interoperability with existing project control and asset management systems. Future work should include cost–benefit analyses on live projects and development of maturity models to guide sustainable, organization-wide deployment.
Keywords: BIM, Augmented Reality, Design Visualisation, Project Lifecycle.

1. Introduction

In recent years, Building Information Modelling (BIM) has significantly transformed the construction industry by providing a centralized platform for managing design, construction, and operational data across the entire building lifecycle. BIM facilitates enhanced design coordination, improves project management, and streamlines communication among stakeholders (Eastman *et al.,* 2011). However, despite its advantages, the complexity of BIM interfaces often poses challenges for non-technical stakeholders, limiting its effectiveness in real-time site communication and spatial understanding (Becerik-Gerber *et al.,* 2012). Virtual Reality (VR) serves as a promising solution to bridge this gap. By overlaying digital information onto the physical environment, AR enables stakeholders to visualize design components in real-world contexts at scale. This immersive experience enhances collaboration, design validation, and issue resolution on-site. According to Ghaffarian *et al.* (2016), the integration of VR with BIM improves construction site coordination by facilitating interactive, context-aware design reviews. This integration reduces the likelihood of errors through improved spatial awareness and enhances the decision-making process for stakeholders. Moreover, recent research has extended the application of AR-BIM integration beyond visualization to encompass sustainability initiatives. For instance, Memarzadeh and Golparvar-Fard (2020) introduced a model known as DNAR (N-dimensional Augmented Reality), which monitors the embodied carbon footprint of construction activities. This model

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allows for real-time tracking of environmental impacts directly on-site through immersive VR interfaces, thus promoting sustainable construction practices.

These developments underscore the growing relevance of VR-BIM systems in the context of Construction 4.0, characterized by the digitization and automation of the construction process through advanced technologies. The integration of VR with BIM not only enhances operational efficiency but also promotes a culture of innovation and sustainability in the construction sector (Zhou *et al.,* 2018). Despite these advancements, the structured implementation of BIM-AR integration within the Malaysian public sector construction, particularly in projects managed by Jabatan Kerja Raya (JKR), remains in its infancy. Research indicates that while there is a growing interest in adopting these technologies, significant barriers such as lack of awareness, insufficient training, and resistance to change hinder their effective implementation (Zain *et al.,* 2020). This study aims to explore the potential of combining BIM with VR to enhance communication, design interpretation, and coordination within JKR building projects. By investigating the challenges and opportunities associated with this integration, the research supports a shift towards smarter, data-driven project delivery that can enhance productivity and sustainability in Malaysia's construction industry.

BIM serves as a comprehensive framework that centralizes multidisciplinary information, facilitating processes such as clash detection, quantity take-off, and the generation of coordinated documentation. However, despite its numerous advantages, the complexity of BIM interfaces and the density of data can pose significant challenges, particularly for non-technical stakeholders. This communication gap can hinder effective collaboration and decision-making, which are critical to the success of any construction project. The VR addresses these challenges by overlaying digital models derived from BIM onto the real-world environment, thereby enabling intuitive, in-situ visualization. This immersive experience not only clarifies design intent but also fosters more inclusive participation among stakeholders during reviews and decision-making processes. By bridging the gap between complex digital information and tangible reality, VR enhances the overall understanding of project designs, facilitating more effective communication among diverse project teams.

To explore the synergies between BIM and VR, this study adopts a mixed-methods approach. A quantitative online survey captures perceptions of building professionals—including architects, engineers, contractors, and project managers—regarding the integration of VR with BIM, focusing on aspects such as coordination quality, meeting effectiveness, and the reduction of misinterpretation. Complementing this quantitative analysis, qualitative insights are gathered through practical demonstrations of a 3D BIM model developed in Autodesk Revit, which is exported to VR using tools like Enscape, Fologram, or Unity Reflect. These demonstrations are designed to simulate workflows for design review and site-based evaluations, examining usability, spatial comprehension, and the relevance of real-time feedback during collaborative sessions.

Building Information Modelling (BIM) is widely regarded as a paradigm shift because it changes both what project teams deliver and how they work together. Instead of producing separate, discipline-specific 2D drawings and exchanging information in fragmented “handoffs,” BIM encourages a shared, data-rich model that multiple stakeholders can contribute to, coordinate around, and reuse across the project lifecycle (Sidani, 2021). VR is increasingly seen as a strong complement to BIM because it turns complex 3D model information into an immersive, human-scale experience. Instead of interpreting drawings or orbiting a model on a 2D screen, stakeholders can “walk through” the design and understand spatial relationships naturally. While BIM creates the foundation for integrated project information, many organizations struggle with the human and process side of implementation. VR helps by making BIM more accessible, more communicative, and more actionable—especially during design visualization and multi-stakeholder review. This is why VR is increasingly positioned as a promising “easy-entry” addition to BIM methodology, supporting broader adoption and more effective use across the project lifecycle.

Transformation of Design Visualization

The VR allows stakeholders to virtually "step inside" a full-scale BIM model, providing a realistic sense of space, scale, and layout that is difficult to achieve with flat screens or blueprints. VR bridges the communication gap between technical and non-technical stakeholders (e.g., clients, investors), making complex design concepts easier to understand through shared, immersive experiences. Project teams, regardless of their physical location, can meet within the virtual environment to review designs, discuss changes, and make immediate, informed decisions. This accelerates the decision-making process and ensures everyone is on the same page. By exploring the detailed model in VR, potential design flaws and clashes between different building systems (architectural, structural, MEP) can be identified and resolved early in the

design phase, significantly reducing costly rework and delays during construction. VR can simulate real-world conditions like natural lighting effects, material interactions, and human movement patterns, allowing designers to test functionality and aesthetics before construction begins. (Garry Evans, 2025 & Structurama, (2025).

Application Throughout the Project Lifecycle

With the VR facilitates immersive design reviews and iterative exploration of alternatives, helping architects and engineers optimize layouts, material choices, and energy efficiency. On-site teams can use AR/VR to overlay BIM data onto the physical world, guiding installation processes, verifying accuracy against the design, and facilitating real-time quality checks. VR provides a safe, controlled environment for training workers on complex tasks and safety protocols, such as operating heavy machinery or navigating emergency scenarios, which reduces accidents and improves on-site productivity. The integrated BIM/VR model serves as a "digital twin" for facility managers, who can use VR simulations to plan and practice maintenance procedures, track assets, and manage space efficiently throughout the building's lifespan (Getuli *et. al.* (2020), Lin *et. al*. (2018) & Zhang *et. al.* (2020)).

2. Methodology

This study adopts a mixed-method approach, which integrates both quantitative and qualitative research methodologies to provide a comprehensive understanding of how Virtual Reality (VR) and Building Information Modelling (BIM) are integrated within the Malaysian construction industry, particularly in projects managed by Jabatan Kerja Raya (JKR). The mixed-method approach allows for triangulation of data, enhancing the reliability and depth of the findings.

Qualitative Method

A detailed BIM model is created reflecting a specific construction project relevant to JKR. This model includes various components such as architectural, structural, and MEP (Mechanical, Electrical, and Plumbing) systems. The BIM model is then integrated into an VR environment. This involves using VR software tools that allow stakeholders to visualize the BIM model in a real-world context. The VR application can overlay the digital model onto the physical site, enabling users to interact with and explore the model from different perspectives. Stakeholders, including project managers, architects, engineers, and construction workers, are invited to interact with the AR-enhanced BIM model. Feedback is collected through interviews and focus group discussions to gain insights into their experiences, perceptions, and suggestions regarding the integration of VR and BIM.

2..2 Quantitative Method

A structured survey is designed and distributed to a broader audience within the Malaysian construction industry. The survey includes closed-ended questions that assess various factors, such as:
Awareness and knowledge of VR and BIM technologies.
Perceived benefits and challenges of integrating VR with BIM.
Current usage and implementation of VR and BIM in construction projects.
The survey is distributed online to construction professionals, ensuring a wide reach. The data collected is subjected to statistical analysis to quantify the findings and identify trends or correlations. Statistical software is used to analyse the survey responses, allowing the researchers to derive meaningful insights about the integration of VR and BIM in JKR projects.

3. Findings

AR addresses these challenges by overlaying digital models derived from BIM onto the real-world environment, thereby enabling intuitive, in-situ visualization. This immersive experience not only clarifies design intent but also fosters more inclusive participation among stakeholders during reviews and decision-making processes. By bridging the gap between complex digital information and tangible reality, AR enhances the overall understanding of project designs, facilitating more effective communication among diverse project teams.

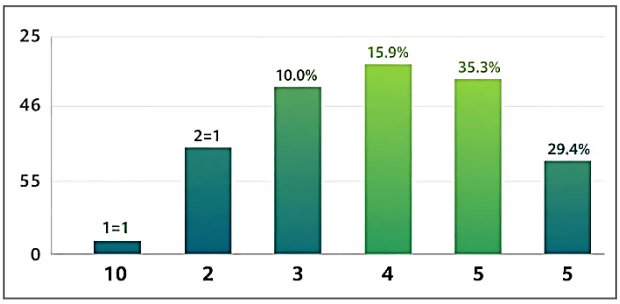


Figure 1.1: VR Technology Improve Spatial Understanding in Design

Based on the Figure 1.1, its summarizing 17 respondents, the results show a clear positive perception. The most common rating was 4, chosen by 35.3% (6 respondents), indicating strong agreement. This was followed by rating 5, selected by 29.4% (5 respondents), reflecting the highest level of agreement. Another 29.4% (5 respondents) chose 3, suggesting a moderate belief in VR's effectiveness. Only 5.9% (1 respondent) selected 2, indicating limited skepticism, and no respondents chose 1. Overall, the distribution strongly suggests that participants believe VR-based visualization of BIM models can meaningfully enhance spatial understanding of design.

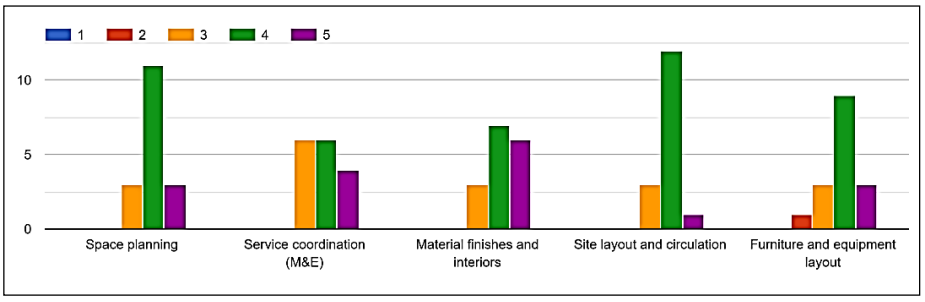


Figure 1.2: VR Technology Helps in Varies Aspects

According to Figure 1.2, VR is generally perceived as highly useful across the different design review aspects. For space planning, most respondents rated VR as 4 (highly helpful), with fewer ratings of 3 and 5. In service coordination (M&E), 3 is the most common rating, followed by 4 and 5, indicating a moderate-to-high perceived benefit. For material finishes and interior elements, responses are strongly concentrated at 4 and 5, suggesting particularly high usefulness in this area. In site layout and circulation, VR is rated predominantly as 4, with a smaller number of 3 ratings and very few 5 ratings, showing strong agreement on its value. Similarly, for furniture and equipment layout, 4 remains the most frequent rating, alongside some 3 and 5 ratings, and a small number of 2 ratings. Overall, the results indicate that AR is widely viewed as a valuable tool for design review, especially for space planning and site layout/circulation.

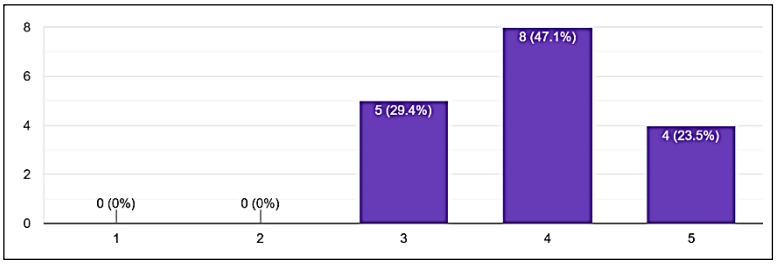


Figure 1.3: BIM+VR Integration Improve Communication Among Project Stakeholders

A survey of 17 respondents indicates strong support for integrating BIM with VR to improve stakeholder communication. Nearly half of the respondents 47.1% rated the impact as 4, while 23.5% selected 5, reflecting

a high level of agreement. The remaining 29.4% rated it 3, suggesting moderate support. Notably, no respondents chose 1 or 2, indicating an absence of disagreement. Overall, the results demonstrate a clear positive consensus that BIM+ VR can effectively enhance communication and collaboration in construction projects, particularly among stakeholders with different levels of technical expertise.

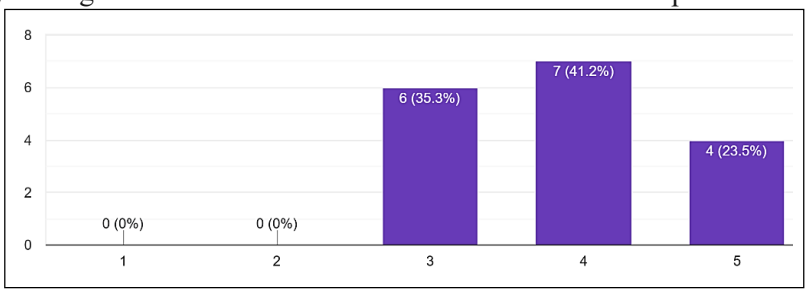


Figure 1.4: VR Visualizations Reduce Misunderstanding in Design Discussions

Based on Figure 1.4, a survey of 17 respondents shows a strong consensus that VR-based visualizations can help reduce misunderstandings during design discussions. The largest share of respondents (41.2%) rated its effectiveness as 4, while 23.5% selected 5, indicating high levels of agreement. A further 35.3% chose 3, reflecting moderate support. Notably, no respondents rated it 1 or 2, suggesting there was no disagreement regarding VR's value. Overall, the findings highlight a broadly positive perception of VR as an effective tool for improving clarity and minimizing misinterpretation in design communication.

4. Discussion

The qualitative testing suggests that placing a Revit model into an VR environment creates a usable, well-accepted experience that improves how people understand, discuss, and decide on design information. Because the feedback came from hands-on interaction with a prototype (rather than only a questionnaire), the findings point to practical benefits that participants could immediately perceive during review tasks.

Qualitative testing of placing a Revit model in an VR environment demonstrated well-received user experience. Users who interacted with the VR prototype noted:

Easier grasp of scale and spatial relationships.

Enhanced design feedback, especially from non-designers.

Possible use during pre-construction meetings and site walk-throughs.

This agrees with existing literature (Ghaffarian hoseini *et al*., 2016), confirming the practical possibility of the synergy of VR and BIM for real-time problem-solving and collaboration.

5. Conclusion and Recommendations

The integration of Building Information Modelling (BIM) with Virtual Reality (VR) offers clear value to the Malaysian construction industry by strengthening communication, improving spatial awareness, and enabling more effective collaboration across the project lifecycle—from design review and coordination to pre-construction planning and on-site implementation. Overall, the study indicates that Malaysian construction stakeholders demonstrate a positive attitude toward VR –BIM and a growing awareness of its practical potential (e.g., clearer design intent visualization, fewer misunderstandings, better stakeholder engagement).

However, despite this positive perception, widespread adoption remains constrained by readiness gaps. These include the need for systematic training, clearer policy and governance direction, and increased investment in enabling infrastructure (devices, software ecosystems, data standards, connectivity, and support capability). These challenges are particularly important for public sector organizations such as JKR, where scale, compliance requirements, and procurement processes require structured implementation pathways rather than ad-hoc experimentation.

In summary, VR –BIM is viewed as feasible and beneficial, but its effectiveness at industry scale will depend on coordinated capability-building and institutional support to move from pilot use to standardized practice.

1) Capacity building and systematic training

Develop structured VR–BIM training pathways for different roles (e.g., designers, project managers, site supervisors, client representatives).

Prioritize hands-on scenario-based training (design reviews, site walk-throughs, coordination meetings) rather than purely theoretical sessions.

Establish internal "VR–BIM champions" in organizations (including JKR) to support adoption, troubleshooting, and knowledge transfer.
2) Policy directions and organizational governance (especially for public sector)
Formulate a national/agency-level roadmap for VR–BIM implementation, aligned with Malaysia's BIM initiatives.
Create standard operating procedures for:
model preparation for VR (LOD/LOI expectations),
data exchange formats and interoperability,
version control and approval workflows,
responsibilities and accountability during AR-assisted decision-making.
Integrate VR–BIM requirements into procurement and project delivery guidelines where appropriate (e.g., selected pilot project types first).
3) Infrastructure and technology investment
Invest in minimum viable infrastructure: suitable VR-capable devices, software licenses, model hosting/access solutions, and reliable connectivity.
Establish model optimization practices (lightweight models, correct coordinates, consistent naming conventions) to ensure VR performance and usability.
Provide technical support resources to reduce friction during deployment (IT support, BIM managers, device management).

5.1 Future research direction

Future research should focus on developing and validating deployable VR frameworks that are scalable, cost-conscious, and interoperable within the Malaysian construction environment. Key areas include:
A standardized VR –BIM workflow tailored to local delivery methods and stakeholder structures.
Cross-platform interoperability (Revit/BIM outputs to commonly used VR platforms).
Scalability in public sector settings (e.g., JKR) with attention to governance, procurement, and long-term maintainability.
Field validation on live projects to compare VR-enabled workflows against conventional coordination methods using robust performance indicators.

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DIGITALIZATION IN MUSEUMS OF KYRGYZSTAN: THE CASE OF BISHKEK

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Abstract
Digitalization has become a transformative force across multiple sectors, including tourism, where it has significantly reshaped the production, presentation, and consumption of experiences. Museums, as key components of cultural tourism, are increasingly influenced by digital technologies that redefine traditional exhibition practices and visitor engagement. Rather than functioning solely as spaces for the passive display of cultural artifacts, contemporary museums are expected to offer interactive, accessible, and experience-oriented environments. In this context, digitalization plays a critical role in enhancing visitor experience while also supporting the preservation and dissemination of cultural heritage.
The purpose of this study is to examine the current state of digitalization in museums in Kyrgyzstan through the case of Bishkek. The research aims to identify the types of digital technologies employed in museums, to analyze how these technologies are integrated into exhibition practices, and to evaluate their functional role in shaping visitor experience within the framework of cultural tourism. Given the limited number of empirical studies focusing on museum digitalization in Central Asia, this research seeks to contribute to the literature by providing a context-specific overview.
A qualitative research design was adopted. Data were collected through systematic on-site observations conducted in selected museums in Bishkek and through document analysis of available digital materials, including museum websites and online virtual tour platforms. The collected data were analyzed using descriptive analysis, allowing the identification of recurring digital practices and their functional characteristics without imposing evaluative judgments beyond the observed evidence.
The findings indicate that digitalization in Bishkek museums is present but remains limited in scope and depth. Commonly observed digital tools include QR codes, digital information screens, audio-visual installations, and basic virtual tour applications. These technologies are primarily used to support traditional exhibition methods by providing supplementary information and visual enhancement. However, advanced interactive applications such as immersive virtual reality or augmented reality experiences are largely absent. Digital tools are often implemented in a fragmented manner and are not integrated into a comprehensive visitor-centered digital strategy.
The study concludes that while digitalization holds considerable potential for strengthening cultural tourism and increasing the accessibility of Kyrgyzstan's cultural heritage, current practices reflect an early stage of digital transformation. To fully realize this potential, museums require more systematic digital integration and strategic planning. The findings provide a foundation for future research on digital museology and cultural tourism development in Kyrgyzstan.
Keywords: Digitalization, Museums, Cultural Tourism, Digital Museology, Kyrgyzstan

1. Introduction

Tourism is a dynamic sector that responds to individuals' needs for recreation, learning, and cultural enrichment, while simultaneously contributing to the economic, social, and cultural development of destinations. In recent decades, changes in tourist motivations and expectations have resulted in a diversification of tourism types, shifting demand away from mass tourism toward experience-oriented and knowledge-based forms of travel (Dülgaroğlu, 2021). Within this transformation, cultural tourism has gained increasing importance, as it enables visitors to engage with historical, artistic, and cultural heritage in a meaningful way.
Museums constitute one of the most significant components of cultural tourism. Beyond their traditional role of collecting, preserving, and exhibiting artifacts, museums function as spaces where cultural memory is interpreted and transmitted to diverse audiences. Contemporary museum visitors increasingly expect more than passive observation; they seek interactive, engaging, and personalized experiences that support active learning and emotional involvement (Carmigniani, 2010). These changing expectations have challenged

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conventional exhibition practices and prompted museums to reconsider their methods of presentation and interpretation.

Digitalization has emerged as a key driver of this transformation. In its broadest sense, digitalization refers to the conversion of analog processes into digital formats and the integration of digital technologies into institutional practices (Fadillah & Hakim, 2025). In the tourism sector, digitalization facilitates access to information, enhances destination visibility, and reshapes tourist experiences across all stages of travel, including pre-visit planning, on-site engagement, and post-visit interaction (Buhalis & Jun, 2011; Dülgaroğlu, 2021). As a result, digital technologies have become integral to contemporary tourism development strategies.

In the field of museology, digitalization is reflected through applications such as digital information screens, QR codes, audio-visual installations, virtual reality (VR), augmented reality (AR), and online virtual tours. Virtual reality technologies enable users to experience simulated environments, while augmented reality allows digital elements to be layered onto the physical world, creating hybrid experiential spaces (Azuma, 1997; Boas, 2013). These technologies provide museums with new opportunities to enhance visitor engagement, improve accessibility, and extend cultural content beyond physical boundaries. Moreover, digitalization supports the preservation of cultural heritage through digital documentation and archiving processes (Carmigniani, 2010).

International museum practices demonstrate that digital technologies can play a strategic role in increasing institutional visibility and global accessibility. Museums such as the Louvre and the British Museum have integrated digital tools into their exhibition and communication strategies, enabling wider audiences to access collections through online platforms and virtual tours (Art & Object, 2021). These examples illustrate how digitalization can strengthen the relationship between museums and cultural tourism by expanding reach and enhancing experiential value.

Kyrgyzstan possesses a rich historical and cultural heritage that offers significant potential for cultural tourism development. Museums in the country represent important repositories of national identity and collective memory. However, despite the growing importance of digital technologies in global museology, the level of digitalization in Kyrgyzstan's museums remains underexplored in academic research. Studies focusing on museum digitalization within Central Asian contexts are particularly limited, highlighting a gap in the existing literature.

This study addresses this gap by examining the current state of digitalization in museums in Kyrgyzstan through the case of Bishkek. The research aims to identify the types of digital technologies used in museums, to explore how these technologies are implemented within exhibition and information practices, and to assess their functional role in shaping visitor experience. By providing a descriptive analysis grounded in observed practices, the study seeks to contribute to the literature on digital museology and cultural tourism while offering insights relevant to future digital development initiatives in Kyrgyzstan's museum sector.

2. Methodology

2.1. Research Design

This study adopts a qualitative research design in order to examine the current state of digitalization in museums in Kyrgyzstan through the case of Bishkek. Qualitative methods are particularly suitable for studies that aim to explore institutional practices, technological applications, and experiential dimensions in their natural context. Since the objective of the research is not to measure variables statistically but to describe and interpret existing digital practices in museums, a qualitative approach was deemed appropriate.

The study focuses on identifying the types of digital technologies used in museums, the ways in which these technologies are integrated into exhibition and information processes, and their potential contribution to visitor experience. In this respect, the research follows a descriptive and exploratory framework.

2.2. Research Area and Scope

The geographical scope of the study is limited to Bishkek, the capital city of Kyrgyzstan. Bishkek hosts a significant number of national, historical, and memorial museums that represent the country's cultural heritage. These museums constitute an important component of Kyrgyzstan's cultural tourism infrastructure and therefore provide a suitable context for examining digitalization practices in museology.

Rather than aiming for generalization across all museums in Kyrgyzstan, the study seeks to present an in-depth overview of digital applications observed in selected museums in Bishkek. This case-based approach allows for a detailed examination of existing practices and institutional tendencies regarding digital transformation.

2.3. Data Collection Methods

Data were collected through observation and document analysis, both of which are commonly used qualitative data collection techniques in cultural and tourism research.

Observation was conducted through on-site visits to museums in Bishkek. During these visits, digital applications used within exhibition spaces were systematically examined. Particular attention was paid to the presence of interactive screens, QR code systems, digital information panels, audio-visual installations, and virtual tour applications. The researcher documented how these technologies were positioned within the museum space and how they functioned in relation to visitor interaction.

Document analysis was employed to support observational data. This included the examination of museum websites, online virtual tour platforms, and publicly available digital materials related to museum exhibitions. Through document analysis, the study aimed to identify the extent to which museums extend their digital presence beyond physical spaces and offer online access to cultural content.

2.4. Data Analysis

The collected data were analyzed using descriptive analysis. This method allows qualitative data to be organized and interpreted according to predefined themes derived from the research objectives. In this study, the main analytical themes included types of digital technologies used in museums, purposes of digital applications, and their role in shaping visitor experience.

Observational findings and document-based data were categorized under these themes and interpreted in relation to digital museology and cultural tourism literature. Rather than producing evaluative judgments, the analysis focused on describing existing practices and identifying patterns in digitalization efforts across the examined museums.

2.5. Research Limitations

The study is subject to certain limitations. First, it is geographically limited to museums located in Bishkek and does not include museums in other regions of Kyrgyzstan. Second, the research relies solely on observation and document analysis; visitor surveys or interviews with museum staff were not conducted. As a result, findings reflect observed digital practices rather than visitor perceptions or institutional strategies. Despite these limitations, the study provides a structured overview of digitalization practices in Bishkek museums and offers a foundation for future research on digital transformation in museology within the context of Kyrgyzstan.

3. Findings

The findings of this study are based on systematic observations conducted in museums located in Bishkek and on the analysis of available digital materials related to these museums. The results are presented under thematic subheadings in order to reflect the types of digital technologies observed and their functional roles within museum spaces.

3.1. Types of Digital Technologies Used in Bishkek Museums

Observations indicate that museums in Bishkek employ a limited but diverse range of digital technologies. The most commonly encountered digital tools include QR codes, digital information screens, audio-visual installations, and, in some cases, online virtual tour applications. These technologies are generally used to provide supplementary information about exhibitions, historical figures, and cultural artifacts.

QR code applications are among the most frequently observed digital tools. In several museums, QR codes are placed near exhibition objects, display panels, or entrance areas. When scanned using mobile devices, these codes redirect visitors to digital content such as explanatory texts, images, or short video materials. In some cases, QR codes are used to offer multilingual information, thereby addressing language barriers for international visitors.

Digital information screens are another notable digital element observed in museum spaces. These screens typically present visual and textual content related to exhibits, including photographs, short descriptions, and thematic explanations. However, the level of interactivity offered by these screens varies, and most function primarily as one-way information delivery tools rather than fully interactive systems.

3.2. Use of Interactive and Audio-Visual Applications

Interactive applications in Bishkek museums are present but limited in scope. Some museums feature touch-screen panels that allow visitors to navigate through digital content, such as image galleries or thematic sections related to cultural heritage. These applications enable visitors to explore information at their own pace, contributing to a more individualized museum experience.

Audio-visual installations, including video presentations and projection systems, are also used to support exhibitions. These installations often serve an explanatory function by presenting historical narratives, documentary footage, or reconstructed scenes related to the exhibited artifacts. While these applications enhance visual engagement, they are generally designed for passive consumption rather than active interaction.

The findings suggest that interactive technologies are not uniformly integrated across museum spaces and are often limited to specific sections or exhibitions. This indicates that digitalization efforts are fragmented rather than systematically implemented.

3.3. Virtual Tours and Online Accessibility

Virtual tour applications represent one of the more advanced forms of digitalization observed in the study. Some museums in Bishkek offer online virtual tours that allow users to explore museum spaces remotely. These tours typically consist of panoramic images and clickable information points, providing a basic representation of the physical museum environment.

Although virtual tours increase accessibility for users who cannot visit museums in person, their content is generally limited to visual navigation and basic informational text. Advanced features such as immersive virtual reality environments or interactive storytelling elements were not observed. Nevertheless, the presence of virtual tours indicates an initial effort toward extending museum experiences beyond physical boundaries.

3.4. Functional Role of Digital Technologies in Visitor Experience

Digital technologies observed in Bishkek museums primarily serve informational and supportive functions. Their main role is to complement traditional exhibition methods by providing additional context and explanations. These technologies contribute to visitor orientation, knowledge acquisition, and visual engagement.

However, the findings reveal that digital tools are not fully integrated into a comprehensive visitor experience strategy. Most applications operate independently from one another and are not designed to guide visitors through a coherent digital journey. As a result, while digital technologies enhance certain aspects of the museum visit, their overall impact on visitor experience remains limited.

4. Discussion

The findings of this study reveal that digitalization in museums located in Bishkek is present but remains at an early and fragmented stage of development. Digital technologies such as QR codes, digital information screens, audio-visual installations, and basic virtual tour applications are used primarily to support traditional exhibition practices rather than to transform the overall museum experience. This situation reflects a limited integration of digital technologies into museological strategies, which aligns with earlier observations in the literature regarding emerging digital transformation processes in developing tourism destinations (Dülgaroğlu, 2021).

From a digital museology perspective, the observed applications mainly correspond to informational and representational functions. QR codes and digital screens serve as supplementary tools that provide additional explanatory content, but they do not fundamentally alter the visitor's role from a passive observer to an active participant. As noted by Azuma (1997) and Boas (2013), digital technologies such as augmented reality and immersive virtual environments have the potential to significantly enhance interactivity and engagement. However, the findings indicate that such advanced applications are largely absent in the examined museums.

The limited use of interactive technologies suggests that digitalization efforts are not guided by a comprehensive visitor-centered experience design. Instead, digital tools appear to be implemented on an ad hoc basis, often confined to specific exhibition areas. This fragmented structure reduces the potential of digital technologies to contribute meaningfully to experiential learning and interpretive storytelling, which are considered essential components of contemporary museum practice (Carmigniani, 2010).

In terms of cultural tourism, the findings demonstrate that digitalization has the potential to support the visibility and accessibility of Kyrgyzstan's cultural heritage. Online virtual tours, although basic in structure, allow museums to reach audiences beyond physical boundaries. This function is particularly important for destinations seeking to strengthen their international cultural tourism profile. Nevertheless, the limited depth

and interactivity of these digital offerings restrict their effectiveness in conveying the richness of cultural narratives and historical contexts.

The findings also reflect broader structural challenges associated with digital transformation, including infrastructural limitations and the absence of systematic digital strategies. As highlighted in studies on digitalization and tourism enterprises, the effectiveness of digital technologies depends not only on their availability but also on institutional capacity, strategic planning, and long-term investment (Schreckling & Steiger, 2017). In the case of Bishkek museums, digitalization appears to be driven more by individual initiatives than by an integrated policy framework.

Overall, the discussion indicates that while digital technologies are increasingly visible in Bishkek museums, their current use remains largely supportive rather than transformative. This situates Kyrgyzstan's museum digitalization efforts at an initial developmental stage, characterized by experimentation rather than full-scale digital integration.

5. Conclusion and Recommendations

This study examined the current state of digitalization in museums in Kyrgyzstan through the case of Bishkek, with a focus on identifying digital technologies used in museum settings and their role in shaping visitor experience. Based on qualitative observations and document analysis, the findings indicate that digitalization practices in Bishkek museums are limited in scope but demonstrate a growing awareness of the importance of digital tools in contemporary museology.

The study found that digital technologies are primarily used for informational purposes, supporting traditional exhibition formats rather than redefining them. Applications such as QR codes, digital information screens, and audio-visual materials contribute to visitor orientation and knowledge acquisition but offer limited interactivity. Virtual tour applications extend museum accessibility beyond physical spaces; however, their functional depth remains restricted.

From a cultural tourism perspective, the findings suggest that digitalization holds significant potential for enhancing the visibility of Kyrgyzstan's cultural heritage and enriching visitor experience. However, realizing this potential requires moving beyond isolated digital applications toward more integrated and visitor-centered digital strategies. Without such integration, digital technologies risk remaining peripheral rather than becoming central components of museum experience design.

The study contributes to the literature by providing an empirical overview of digitalization practices in museums within a Central Asian context, an area that has received limited scholarly attention. By documenting existing digital applications and identifying their functional limitations, the research offers a foundation for future studies on digital transformation in museology and cultural tourism in Kyrgyzstan.

Future research could expand the geographical scope beyond Bishkek and incorporate visitor and institutional perspectives through interviews or surveys. Such approaches would allow for a more comprehensive assessment of digitalization strategies and their impact on visitor satisfaction and cultural engagement.

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PAUSE AND MOVEMENT: AN ANTHROPOLOGICAL APPROACH TO EMBODIED SPATIAL PERCEPTION IN INTERMEDIARY SPACES OF TEMPORARY URBAN MARKETS*

Seyed Kasra Mirpadyab[70*] , Fatemeh Ramazani Pas chapari[71]

Abstract
Behavior is understood as the set of actions, movements, and interactions between users and space, while architecture serves as the medium that shapes, guides, and gives meaning to these behaviors. Weekly markets, due to their dynamism, behavioral diversity, heterogeneous social groups, and opportunities for pause and interaction, provide an ideal context for examining the lived relationship between humans and space. The Kalachay weekly market, as a vibrant urban environment, is used as a case study to explore how users experience and engage with intermediary spaces. This study adopts a qualitative phenomenological approach grounded in architectural anthropology, focusing on users' embodied spatial experiences. Data were collected through field observation, movement and pause recording, photography, and behavioral mapping. These data were layered and analyzed on a base map to identify dominant circulation paths, congestion areas, interaction zones, and key spatial characteristics influencing behavior. Findings indicate that physical and spatial features—including stall arrangement, pathway width, spatial legibility, visual permeability, and attracting elements—significantly shape movement patterns, stopping behaviors, route choices, and overall user–space interaction. Gender differences in spatial perception and usage were also observed, suggesting that gender-sensitive insights can inform more inclusive and effective design strategies.
The study aims to identify spatial components that enhance users' sense of presence within intermediary market spaces and clarify how these spaces contribute to a stronger sense of belonging, richer social interaction, and improved shopping experiences. Overall, the findings highlight the importance of considering embodied spatial experience and gender-sensitive design in planning and designing dynamic urban market environments
Keywords: Social Behavior, Gender-Based Spatial Perception, Marketplace, Intermediary Space, Shopping Experience

1. Introduction

In Iranian architecture and urbanism, in-between spaces have always played a key role in shaping social interactions, guiding movement behavior, and creating sensory experiences. These spaces—whether in historical passages, bazaars, or traditional buildings—represent the "living fabric" of the city and give meaning to people's presence (Golabi & Solimani, 2023; Piravolia & Soheili, 2017; Belyanan Asl & Satarzadeh, 2015). In-between spaces act as a bridge between architectural and urban elements, extending the cohesion of architectural space into the urban network and enhancing the overall spatial experience (Hedayati et al., 2023; Belyanan Asl & Satarzadeh, 2015). When the physical components of space—such as nodes, paths, and edges—are carefully designed, users show a greater inclination for active presence in these intermediary spaces (Rabani Moghaddam et al., 2025).
In-between spaces in Iranian and global architecture serve as connectors between key spatial elements and, beyond enabling movement, provide opportunities for interaction, pause, and environmental experience. These features are evident in weekly markets, where intermediary routes strengthen social presence and interaction (Rabani Moghaddam et al., 2025; Karimi et al., 2020). Research findings emphasize that the spatial configuration and position of weekly markets and their intermediary paths facilitate public presence and reinforce social interactions, thereby shaping users' collective experience (Modir & Jafari, 2018). Intermediary spaces in traditional bazaars foster a sense of belonging among users; the spatial structure of the bazaar, the arrangement of shops, and its narrow passageways create opportunities for interaction, pause, and emotional experience (Ghasemi et al., 2023; Abedi & Abbasi, 2019).

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In historical passages, in-between spaces are not merely routes but points of pause and balance. Similar patterns appear in weekly markets, where intermediary paths shape users' experiences of presence, social interaction, and environmental perception (Rezaei & Salehi, 2024; Piravolia & Soheili, 2017). Weekly markets bring people together and play an important role in forming social relations, and these interactions mostly occur within intermediary spaces and movement paths (Mehraban et al., 2023).

The presence of signs and repetitive spatial patterns creates mental links with place. Similar characteristics in bazaars—through well-defined routes and well-configured urban intermediary spaces—strengthen public presence and social interactions (Askarrizad et al., 2024; Abedi & Abbasi, 2019). The intermediate spaces within bazaars act as settings for interaction among users and play a central role in giving meaning to public space and enhancing social presence (Eskooi & Jafari, 2022; Mahani, 2015). Scholars argue that weekly markets in northern Iran are not merely transactional spaces but serve as communal environments that foster social presence—mostly shaped through intermediary spaces (Mehrabi et al., 2025; Keshmiri, 1993).

In the Kalachai weekly market, auditory elements—such as conversations, bargaining sounds, or local accents—can help build human connections and enhance familiarity and comfort (Cao, 2024; Nazari Moghaddam, 2021). Local vendors, by using traditional chants and melodies, not only promote their goods but also create a socially engaging atmosphere and strengthen public attachment to the market (Nazari Moghaddam, 2021). Research shows that ramps, narrow passages, intersections, and stopping nodes in weekly markets directly influence visitors' choices and shopping experiences (Maniei, 2024; Modir & Jafari, 2018).

Recent studies in biophilic design (ZarAbadi, 2023) emphasize that sensory experiences—light, airflow, natural sounds, color—significantly influence people's attachment to space. Natural light, the smell of local products, or the vibrant colors of foods and traditional goods can create feelings of comfort and trust (Ekasteholz, 2020; ZarAbadi, 2023). The Kalachai weekly market, due to its dynamic spatial experience—close interaction with vendors, movement through narrow paths, and lively local atmosphere—positively affects shopping experiences (Patil, 2025; Soleimani & Fattahi, 2023). The more legible and pleasant the intermediary spaces of a market are, the more time people dedicate to strolling, choosing, and buying (Mehraban et al., 2023). These intermediary spaces also serve as settings for face-to-face interactions and the reproduction of local identity (Keshmiri, 1993; Holmes, Fernandes & Palo, 2021).

In the Kalachai weekly market, linear routes and pause nodes can significantly influence how people navigate and behave while shopping (Rabani Moghaddam et al., 2025). When environmental and perceptual factors—such as lighting and safety—are in balance, people's presence in the market increases (Rabani Moghaddam et al., 2025). The purpose of selecting this topic is that intermediary spaces, especially in weekly markets, play an important role in people's presence and social interaction (Rafiei & Akbari Namdar, 2025; Piravolia & Soheili, 2017). Studying the Kalachai weekly market provides an opportunity to analyze how place attachment and user behavior are shaped in such environments (Mehraban et al., 2023).

According to Iranian research, the behavioral effects observed in this study align with global patterns relating to intermediary spaces in weekly markets. These spaces, beyond movement, provide settings for pause, social interaction, and place attachment (Rafiei & Akbari Namdar, 2025; Piravolia & Soheili, 2017). Weekly markets in Iran, like their global counterparts, serve as environments for economic and cultural exchange, and the active presence of people contributes to social and economic sustainability (Mehraban et al., 2023).

Studying the impact of in-between spaces in the Kalachai weekly market can solve several scientific and research problems. First, analyzing user behavior in these spaces can help improve the design of weekly markets to strengthen social interaction and place attachment (Piravolia & Soheili, 2017). Second, examining weekly markets helps identify their economic and social weaknesses and provides solutions for increasing economic sustainability and local vitality (Mehraban et al., 2023). Therefore, this study is important both practically—in improving the design of public spaces—and theoretically—in expanding knowledge of Iranian architecture.

The overall discussion presented in this introduction demonstrates that in-between spaces can influence the quality of presence, social interactions, and sense of belonging in weekly markets. Thus, it is essential to define these claims as specific hypotheses to enable empirical evaluation in later research stages. Our statistical population consists of 500 individuals out of approximately 3,000 daily visitors (Source: Kelachay Municipality).

2. Literature Review and Theoretical Framework

According to behavioral studies, users' patterns of movement and pause, their modes of interaction with vendors, and the ways in which they experience space constitute key indicators for evaluating the quality of

temporary markets. Analyzing these behaviors provides an effective guide for design proposals aimed at organizing space and enhancing the quality of environmental perception (Zarabadi, 2023).
Moreover, in studies of environmental perception, gender-based differences have been highlighted. Findings show that women are generally more sensitive to lighting, safety, crowding, and spatial legibility, whereas men often focus on rapid access and the functional performance of space. Considering these differences in the design of in-between spaces of markets is crucial in order to ensure equitable presence and usability for all users (Piravolia & Soheili, 2017).
Research also describes the "in-between space" in Iranian architecture as an "active intermediate layer" that guides patterns of movement and pause (Belilan & Satarzadeh, 2015). Path continuity and the presence of stopping nodes elevate the quality of transitional experience; in weekly markets, this means that even small changes in path width, pause points, or spatial openings can either enhance or hinder the shopping experience (Piravolia & Soheili, 2017). Greater interaction occurs when the space provides opportunities for pausing, accidental encounters, and behavioral safety (Mansour Mahani, 2018).
The presence of natural elements within in-between spaces also enhances users' sense of calm and spatial experience. In weekly markets, appropriate lighting, scent, ventilation, and connection with the natural environment make the acts of shopping and social interaction more pleasant (Zarabadi, 2023).
The term "bāzār" appears in various pronunciations within different dialects (Table 1).
In summary, the research literature emphasizes that the quality of in-between spaces in weekly markets plays a fundamental role in shaping the shopping experience, social interactions, and sense of belonging. Therefore, the design of these spaces must be based on behavioral analysis of users, perceptual components, and gender-based and cultural needs, so that the market's inclusivity and functional performance can be significantly enhanced (Rabani-Moghaddam et al., 2025).
Table 1: The meaning of "Bāzār" (Keshmiri, 1993)

Dialect / Language	Pronunciation	Phonetic
Gilaki	Bāzār, Vākār	Bazar.Vecar
Natanzī	Vākār	Vacar
Fereyzi-Yerni	Bāzār	Bazar
Semnānī	Vāzhār	Vazhar
Sangasrī	Vazar	Vazar
Fereyzi-Sorkhehī-Lāsgardī-Shahmizādī	Bāzār	Bazar
Astī	Bozar	Bazar

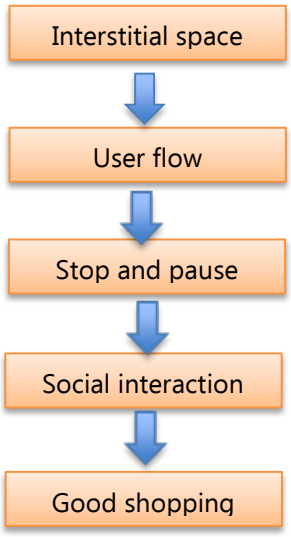


Figure 1: Conceptual model of the flow of movement and interaction of users within the in-between space of the weekly market (Authors).

Table 2: Analytical-comparative study of interstitial spaces with emphasis on concrete examples in the weekly market of Kelachay (Authors)

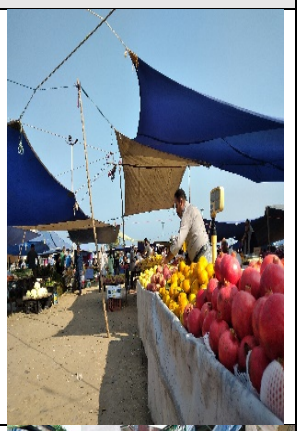
Architectural component of interstitial spaces	Theoretical Explanation (Researcher's Interpretation)	Comparative Condition in Kelachay Weekly Bazaar
Capacity for Pause and Stop	Intermediary spaces function as points that slow down the movement rhythm and provide a setting for short-term social actions.	The openings between stalls and the movement nodes in the bazaar slow pedestrian flow and lead to momentary buyer–seller interactions.
Spatial Continuum	These spaces enhance legibility and spatial coherence by creating continuity within the route and contribute to the organization of movement.	The linear main passage and its connection to side arcades create a coherent structure for circulation and accessibility in the bazaar.
Functional Flexibility	Intermediary spaces possess a multifunctional nature and can adapt their function depending on contextual needs.	The intervals between stalls become spaces for exchange and standing during crowded conditions but retain their role as passageways during less busy times.
Stimulation of Social Interaction	These spaces naturally increase face-to-face encounters and foster the emergence of organic social interactions.	Physical density and narrowing of certain sections of the passage intensify inevitable encounters and conversations among users.
Perceptual Diversity (Smell, Sound, Color)	Through sensory diversity, intermediary spaces enhance users' lived experiences and improve the environment's perceptual quality.	The presence of colorful goods, local food aromas, and environmental sounds elevates the shopping experience from a functional level to a perceptual–semantic one.
Gradual Reinforcement of Sense of Belonging	Repeated experience, continuous exposure, and formation of collective memories within these spaces contribute to creating a sense of belonging.	The regular weekly occurrence of the bazaar and the continuous presence of local actors strengthen place attachment and familiarity for the community of users.

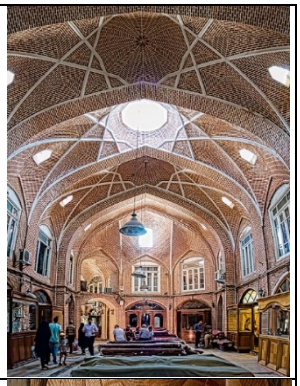
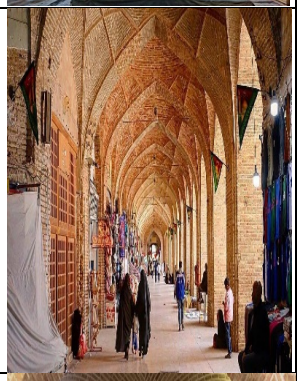
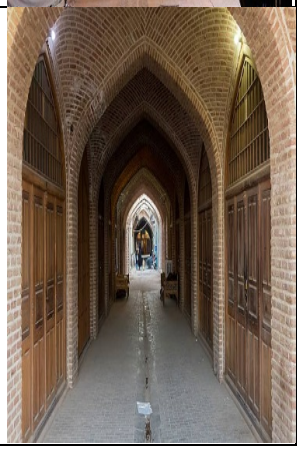
Table 3: Review of the quality of research background in the field of space, user perception and behavior (Authors)

Row	Result	Research Method	Author(s) / Year	Article Title
1	Pause points and interactions are formed along visual axes and interaction paths.	Field observation, photography, and behavioral mapping	O. Kirci (2025)	Behavioural Mapping and Impressions in University Public Spaces
2	Variable spatio-temporal patterns in large markets create experiential inequalities between genders.	Spatial–contextual analysis with field data	G. Liu et al. (2024)	Mapping Gender Patterns in "Dynamic Cultural Spaces"

3	Behavioral mapping is an effective tool for evaluating the impact of urban furniture on public use.	Case study in two urban spaces with instrumental analysis	K. Bishop (2024)	Behavior Mapping and Its Application in Smart Social Spaces
4	The physical quality of spaces determines optional or compulsory behaviors.	Mixed method – field observation, behavioral mapping, and spatial structure analysis	Sajadzadeh et al. (2023 / 1402)	Comparative Study of Behavioral Settings in Traditional Bazaar and Shopping Center (Case: Borujerd)
5	The spatial patterns of weekly markets are linked to economic sustainability; location and market structure influence user behavior.	Spatial analysis and questionnaire-based field study	Mehraban et al. (2023 / 1402)	Spatial Analysis of Socio-Economic Effects of Weekly Markets toward Rural Sustainability (Case: Someh-Sara)

Table 4. Comparative Table of Intermediary Spaces in Selected Iranian Bazaars (Authors)

Distinct Feature	Sense of Belonging & Social Experience	Spatial Quality (Movement, Pause, Interaction)	Physical Characteristics of the Intermediary Space	Type of Bazaar	City / Bazaar	Images
Flexibility and dynamism of space; bazaar as a social event	Strong sense of belonging due to weekly repetition and collective participation	Free movement, short pauses, high face-to-face interactions	Open and dynamic intermediary space formed between temporary stalls and the earthy pathway; variable layout	Temporary / Weekly	Kelachay – Thursday Bazaar	
Radial structure and connection with surrounding urban fabric	Belonging derived from functional diversity and social presence	Pauses at intersections, continuous flow, semi-open and human-scaled spaces	A network of passages, open courtyards, and intersections; combination of built and natural elements	Permanent / Historical	Rasht – Grand Bazaar	

Spatial continuity and unity in form and function	Sense of belonging reinforced by spatial order and collective occupational history	Directed movement and organized spatial experience; pauses within Timchehs	Intermediary spaces formed by Timchehs, Rastehs, and Chaharsoughs with high vaulted ceilings	Permanent / Covered	Tabriz – Historical Bazaar (Timcheh Monzariyeh & Grand Chaharsough)	
Deep connection with climate and sense of calm within crowd	Belonging rooted in climatic adaptation and local identity	Slow movement, pauses in domed spaces, limited yet continuous interaction	Semi-dark, cool intermediary spaces with sequential domes and vestibules adapted to hot–dry climate	Permanent / Covered	Yazd – Khan Bazaar	
Cohesive spatial order and strong linkage with the city's historic fabric	Place attachment through continuous presence of merchants and collective memory	Social interaction in Chaharsoughs; directed movement	Rastehs, Chaharsoughs, and caravanserais with human-scale proportions; defined and sequential intermediary spaces	Permanent / Historical	Qazvin – Historical Bazaar	

3. Research Method

3.1 Type of Research

This study, adopting an architectural anthropology approach, examines the embodied experience of users. The author seeks to achieve the research aim by uncovering and analyzing how humans relate to space through embodied behavior and perception within the architectural setting of the Kalachay Weekly Bazaar.

3.2 Research Questions

The questions this study seeks to address are as follows:

1. What recurring behavioral patterns emerge in users' encounters with space?
2. How does space influence aesthetic perception, reflection, repetition, or social interaction?
3. To what extent can architectural and cultural signs, paradigms, and elements alter or influence users' behavior?

The synthesis of the introductory discussions indicates that interstitial spaces can significantly influence the quality of presence, social interactions, and sense of belonging in weekly bazaars. Therefore, these claims must be formulated as explicit hypotheses to enable empirical evaluation in subsequent research stages. The hypotheses are as follows:

Hypothesis 1: Interstitial space can enhance social interaction.

Hypothesis 2: The arrangement and function of interstitial spaces in the Kalachay Weekly Bazaar strengthen social interactions, face-to-face communication, and users' overall shopping experience.

Hypothesis 3: Environmental characteristics of interstitial spaces—including light, pathways, nodes, and signs—play a significant role in enhancing the vitality and dynamism of the Kalachay Weekly Bazaar.

3.3 Study Objective

The specific aim of this study is to examine users' spatial perception and identify recurring behavioral patterns within the space. The practical objective is to provide insights that can contribute to improving spatial design and deepening the understanding of human–architecture interaction

3.4 Statistical Population

The statistical population of this research includes all users of the Kalachay Weekly Bazaar, including buyers, sellers, passersby, and individuals who pause or engage in interactions within the space. Based on field observations conducted on market day, the approximate number of active users within the market area was estimated at around 3000 individuals. To enhance the accuracy of qualitative analysis and the assessment of user perception, a sample size of 500 participants was selected. Data were collected through direct observation, photography, brief oral questions, and purposive behavioral mapping of users.

3.5. Tools

Data collection tools and methods:
A combination of the following tools was used to collect data:
Field observation
Behavioral mapping
Recording movement, stopping, and interaction routes
Photography and visual analysis
Semi-structured interview
Photography and visual analysis
Perception notebook

4. Case Study

Kela Chay Weekly Bazaar
The Kela Chay Weekly Bazaar is the most significant weekly market in eastern Gilan and one of the city's most social and economic spaces. Held weekly, it plays a key role in social interaction and fostering citizens' sense of belonging. The bazaar's structure comprises main pathways and narrow chokepoints, shaping users' behavioral patterns such as pausing, quick passage, or interaction with vendors (Source: Kela Chay Municipality).
Users' embodied experience includes moving along crowded pathways, pausing at popular sales points, and directly interacting with vendors. These experiences indicate that the space significantly influences users' behavior and experience, affecting social interaction, sense of belonging, and curiosity within the bazaar.

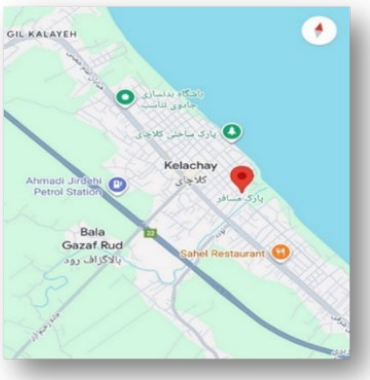


Figure 2: Location of Thursday Kelachay bazaar in the urban context (Authors adapted from Google Maps(



Figure 4. Thursday, Kalachay Bazaar, 1404 (Authors)



Figure 3. Thursday Kelachay Bazaar-1350 (Mansouri)

5. Findings of the study

To analyze perceptual and behavioral data, the environmental and semantic components of Kela Chay Bazaar—extracted from the literature review—were first identified and presented in Table5.

Table 5. Comprehensive Table of Semantic and Environmental Indicators in the Analysis of Intermediary Spaces of Kelachay Weekly Bazaar (Authors)

Observable Indicators in the Bazaar (Kelachay Bazaar)	Operational Definition (Based on Theoretical Literature)	Component	Category
Continuity of traditional selling patterns, presence of long-standing businesses, behavioral rhythm	Connection of space with the past, collective memory, and stable behavioral patterns	Historical Identity	Semantic
Adequate lighting, open visibility, active edges, absence of neglected spots	Perceived safety derived from visibility, continuous presence, and natural surveillance	Safety, Control, and Surveillance	Semantic
Sufficient width of path, absence of obstacles, smooth access, possibility of pausing	Prioritization of movement, pause, and pedestrian interaction	Walkability	Semantic
Clear route, distinct landmarks, continuity of edges, movement direction	Comprehensibility and wayfinding through main spatial elements	Legibility	Semantic
Human density, activity diversity, rhythm of presence during the day	Dynamism produced by continuous human activity and presence	Vibrancy	Semantic
Clear entrances, level paths, proper access from street network	Ease of entry, exit, and circulation within the bazaar	Accessibility	Semantic
Daylight penetration, shades and highlights, absence of dark spots	Quality of natural/artificial light and its impact on spatial perception	Light	Environmental
Gathering points for vendors, pause and interaction nodes, behavioral intersections	Activity concentration points, path intersections, and human stopping areas	Nodes	Environmental
Path width, movement rhythm, route continuity, clear orientation	Main circulation paths and pedestrian flow	Paths	Environmental
Colors of stalls, signage, visual order or disorder	Presence and role of color in enhancing legibility and attractiveness	Color	Environmental
Form of stalls, element scale, organizational pattern	Spatial formation, placement of elements, and layout structure	Form	Environmental

Tent shading, natural ventilation, orientation to wind	Spatial adaptation to local climatic conditions	Climatic Comfort	Environmental
Continuity of edges, active or passive edges	Perceptual and physical boundaries shaping the space	Edges	Environmental
Distinct entrance, unique stall, tree or noticeable visual element	Landmark elements facilitating orientation	Landmarks	Environmental

1.5. Behavioral Findings

In these behavioral patterns, users were analyzed across three time intervals: morning (6:00–8:00), midday (12:00–15:00), and evening (18:00–20:00), based on field observations and 500 interviews. The type of space, movement, pause, density, and shopping experience were examined, and the role of intermediate spaces in shaping collective behavior was identified

Table 6: Behavioral findings of customers according to gender segregation in the weekly Kelachay bazaar(Authors)

Type of Space	Type of Behavior	Category	Morning (Women /Men) Frequency	Noon (Women/ Men) Frequency	Evening (Women/ Men) Frequency	Effective Environmental/Design Element	Behavioral Analysis
Market Entrance	Initial pause, spatial assessment, and rapid passing	Sensory	12/6	14/13	11/8	Pedestrian path, signage	Women pause more and evaluate the environment; men enter the market more quickly.
Main Passage	Short pause, glancing at goods, linear movement	Visual	11/8	12/8	13/6	Goods arrangement, main path, separators	Men prefer a direct route; women adjust their path based on crowd density.
In front of stalls	Pausing to examine goods	Social/Visual	18/6	16/7	25/7	Stalls, signage, tents	Women pause longer and pay more detailed attention to products.
Mid-market / in front of stalls	Conversation with vendors	Sensory/Motor	14/8	13/7	9/14	Stall projections, lighting, tent shading, close proximity to vendors, mobile sellers, ambient noise	Men engage more in transactional or political conversations; women ask more about quality and price.
Crowded nodes	Sudden direction change	Sensory/Motor	16/13	15/11	15/10	Separators, pedestrian path, crowd density	Women change direction more often due to quicker perception of crowding.
Semi-shaded areas	Short rest pause	Sensory	12/5	11/9	13/9	Tent structures, benches	Women pause more in safer spaces; men pause less.
End of the market	Gradual exit	Motor/Perceptual	8/13	9/16	10/17	Exit area, open spaces, tents, signage, mobile sellers	Women exit more slowly and re-evaluate the path; men exit directly.

Intermediary spaces	Social interaction, conversations	Social/Motor	11/9	14/10	19/8	Pedestrian path, stalls, tents	These spaces shape the social interaction network and reinforce sense of belonging. Women are more active in purchasing and conversation; men act more as companions/observers.
Shopping zone	Selecting goods, evaluating, decision-making	Social/Visual	16/11	13/9	18/14	Stalls, tents, signage	Shopping is not only economic but a sensory and social experience shaping movement rhythm and interactions. Women show active, detail-oriented shopping; men shop faster and more functionally.

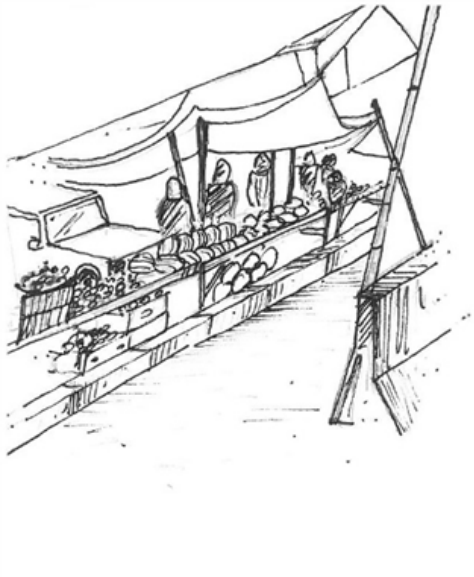


Figure 5. The effect of the canopy on the definition of the edge of the space (Authors)



Figure 4. The role of economic behavior in the rhythm of the market space (Authors)



Figure 7. Flexible boundaries of stalls with tents and awnings, defining the interstitial space (Authors)



Figure 6. Tents and vendors showing market dynamics (Authors)



Figure 9: Seller's interaction with the buyer (Authors)



Figure 8. Buyer's physical behavior and approaching the flat soft boundary (Authors)



Figure 11: Interaction of pause formation without creating noticeable congestion (Authors)



Figure 10: Node formation on both sides of the passage (Authors)

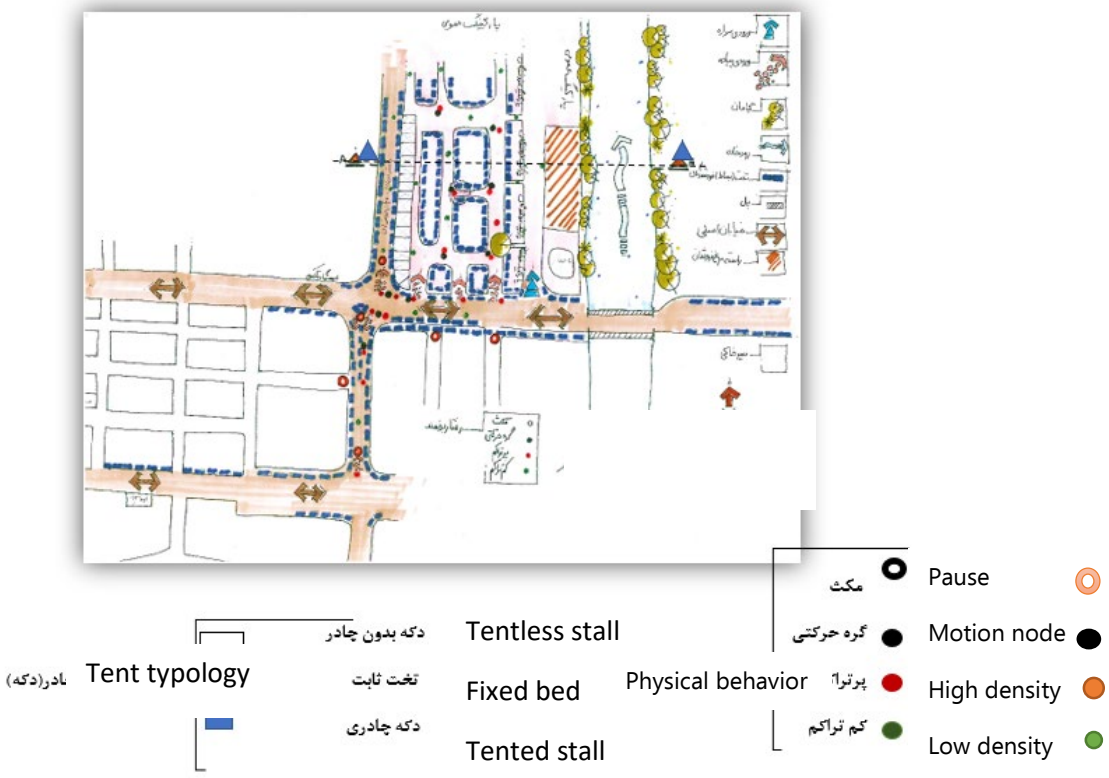


Figure 12: Behavioral mapping of the weekly Kelachay market (Authors)



Figure 13: A section of the users' embodied experience in passing through the market, pauses, actions, purchases, and spatial demarcation caused by tents and stalls (Authors)

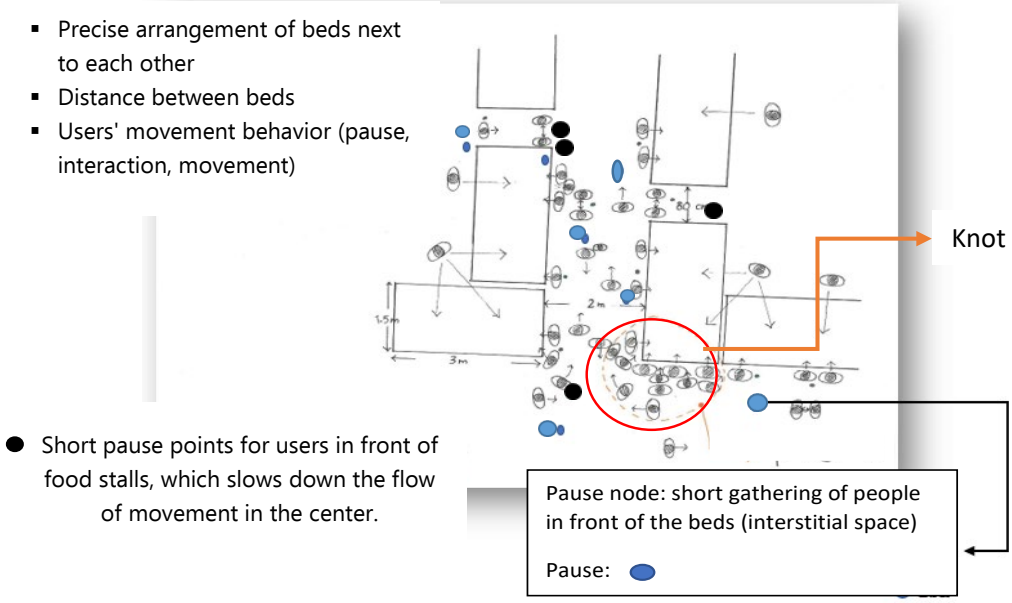


Figure 14: Bodily behavior analysis including assembly nodes, pauses, movement paths, sight lines, and body-bed distance (Authors)



Figure 15. Interaction of space and movement in the weekly Kelachay market (Authors)



Figure 17: Tents and vendors, showing interaction in the market (Authors)



Figure 16: The effect of the canopy on defining the edge of the space (Authors)

2.5. Perceptual distortions

This section analyzes users' perception of light, sound, safety, and the quality of the shopping experience. The data were collected through 500 interviews and sensory observations at three different time intervals, with a comparison of perceptual differences between women and men.

Table 7: Review of perceptual findings by gender + embodied experience (Authors)

Perceptual Element	Space	Embodied Experience	Women Count	Men Count	Dominant Time Period	Analytical Explanation
Light, shading, and shadows	Entrance & main passage	Pause, prolonged gaze, visual calmness, reduced bodily stress, longer stopping time	48	24	Morning / Noon	Women show higher visual sensitivity; perception of light leads to longer pauses.
Density, noise, and crowding	Crowded nodes	Bodily pressure, avoidance, haste, reduced speed, tension	52	35	Noon / Evening	Women reported higher perceptual pressure in dense and crowded areas.
Strong smells (fish/food)	Beside food stalls	Route change, approaching/withdrawing	34	24	Noon	Little gender difference; smell acts as a directional stimulus.

Color & display layout	In front of stalls/tents & semi-shaded areas	Pause, visual scanning, attention to details, attraction to colors	58	28	Morning / Evening	Women were more attracted to visual cues and detailed displays.
Path quality (width, nodes, heavy tents, spatial obstruction)	Under tents / narrow pathways	Caution, reduced speed, route adjustment	38	21	Noon / Evening	Women demonstrate higher bodily caution and more adaptive movement patterns.
Perceived safety (lighting, crowding, nodes)	Crowded nodes / entrances / semi-shaded areas	Moving toward safer shaded zones, shorter pauses, distancing from irregular nodes	37	14	Evening	Women are more sensitive to lighting, density, and presence of mobile vendors; perceived safety strongly alters their movement rhythm.
Environmental sounds (bargaining, music, sellers calling out)	Mid-market / intermediary spaces	Pause, speed change, auditory sensitivity, rapid bodily reaction to sudden sounds	33	14	Morning / Evening	Sound is a strong perceptual cue; women show stronger sensory and bodily responses, men pass more quickly.
Signs / directional boards	End of the market	Pause for orientation, direction change, quick reviewing	23	15	Evening	Women rely more on signage for exit decisions; men maintain their chosen path.

3.5. Themes

Table 8: Review of themes by gender (Authors)

Theme	Brief Description	Impact on User Experience	Gender Differentiation	Design Message
Pause	Focusing attention and stopping to observe goods	Enhances sensory experience and environmental perception	Women show more pausing and touching; men pass through more quickly	Create pause points and interactive spots; use lightweight pavilions, tables, poles, and foldable platforms to avoid limiting interaction

Path & Rhythm (Movement Flow)	Flow of movement and circulation routes	Shapes the movement rhythm in the bazaar	Women move experientially; men move faster and linearly	Design routes using vertical/horizontal separators, guiding lighting, diverse paving, and controlled trash bins to regulate movement rhythm and reduce aimless wandering; enhances spatial exploration
Gathering	Spaces for pause and nodes	Encourages social interaction	Women engage more socially in pause spaces; men move faster in crowded nodes	Control density and maintain personal space using vertical/horizontal separators, clear pathways, guiding lighting, and signage; improves spatial experience and reduces social stress
Interaction	Verbal exchange and bargaining	Forms the social network and rhythm of the bazaar	Women are more active in purchasing and interaction; men act more as observers or companions	Use fixed and mobile selling units, interaction counters, tents with non-obstructive poles (foldable and movable structures), and directional signage
Density	Crowding and physical distance	Regulates movement rhythm and spatial experience	Women maintain more cautious personal distance; men pay less attention	Control density and design sufficiently wide pathways to respect personal space
Senses (Perceptual Experience)	Light, sound, color, vendor behavior	Enhances perceptual experience	Women record more visual/sensory details; men experience more functionally	Strengthen sensory experience through lighting, water features, artistic elements, and small greenery areas

4.5. Conclusion of Findings

Field presence and direct observation of users in the intermediate spaces of KelaChay Weekly Bazaar revealed that these spaces function beyond mere movement corridors and play a significant role as a platform for perception and behavior, influencing both the shopping experience and social interaction. Users' behaviors, including short pauses, route choices, and interactions with companions, were correlated with environmental qualities such as lighting, spatial openness, and crowd density. These results indicate a direct relationship between spatial design and users' perception of safety and comfort. Users' perception—particularly among women—was influenced by spatial features; areas with better lighting and open sightlines encouraged longer pauses and slower movement, thereby enhancing the shopping experience. Observation of users' embodied behavior—zigzag movement, short pauses, and acceleration in wider pathways—demonstrated that body and space interactively shape the shopping experience and presence. Therefore, improving intermediate spaces in terms of lighting, width, material quality, and pathway management can significantly enhance users' sense of belonging, safety, and quality of shopping experience. These findings are supported by both field data and direct on-site experience.

Table 9: Behavioral patterns and compliance with theories and gender differentiation (Authors)

Result of Theoretical Alignment	Short Analysis	Observed Behavior
This pattern aligns with John Lang's theory on "Initial Appraisal of Space".	Women have longer initial pauses	Pause at market entrance
Movement behavior is consistent with Kevin Lynch's theory on "Path Legibility".	Men move directly, women take adaptive paths	Linear movement along main passage

This finding aligns with Jan Gehl's theory on "Optional Activities and Pause Spaces".	Longer pauses and more careful observation; women spent more time	Pause in front of stalls
This behavior aligns with Edward Hall's theory on "Proxemics and Interaction".	Face-to-face social interaction; women pause more, men move faster	Conversation with vendor
This reaction is consistent with Space Syntax theory on "Impact of Density on Behavior".	Men react faster to crowding	Changing path at crowded nodes
This finding aligns with the theory of "Spatial Identity and Perceived Security".	Greater sense of security in shade; women pause slightly longer	Short stop in semi-shaded areas
This pattern aligns with Oppenheim's theory on "Continuity and Openness of Exit Paths".	Reviewing exit paths; women review route, men exit faster	Market exit rhythm
This finding aligns with Gehl's theory on "Conversation and Social Spaces" and shows gender differences.	Formation of social nodes; women pause more	Social interactions in in-between spaces
This pattern aligns with Gibson's theory on "Environmental Affordances Guiding Behavior".	Experience-oriented behavior in women, functional in men	Purchase decision making

5.5. Comparison of research findings with reference theories

To strengthen the analytical section, behavioral and perceptual findings were compared with the perspectives of several reputable theorists

Table 10: Perceptual patterns and conformity with theories and gender distinction (Authors)

Result of Theoretical Alignment	Short Analysis	Perceptual Element
According to Norberg-Schulz's theory, women paused longer in bright/semi-shaded areas, which is consistent	Pause and attention	Light and shade
This pattern aligns with John Lang's theory: men reacted faster, women had more sensory experience	Sensory pressure and movement acceleration	Density and sound
This finding aligns with Gibson's theory: women changed paths and had stronger sensory reactions, men were less affected	Path change and sensory orientation	Smell (food/fish)
This pattern aligns with Kevin Lynch's theory on "Visual Cues and Legibility"	Stop and visual attraction	Color and product arrangement
This behavior aligns with Jan Gehl's theory on "Path Quality and Movement Rhythm"	Caution and speed adjustment	Path quality (passage width)
This finding aligns with Altman's theory on "Environmental Control and Perceived Security"	Sense of security	Perceived safety
This pattern aligns with Hall's theory on "Sound and Social Behavior"	Reaction to sudden sounds	Environmental sounds
This finding aligns with Kevin Lynch's theory on "Role of Cues in Mental Mapping of Space"	Wayfinding	Signs and boards

6. Conclusion

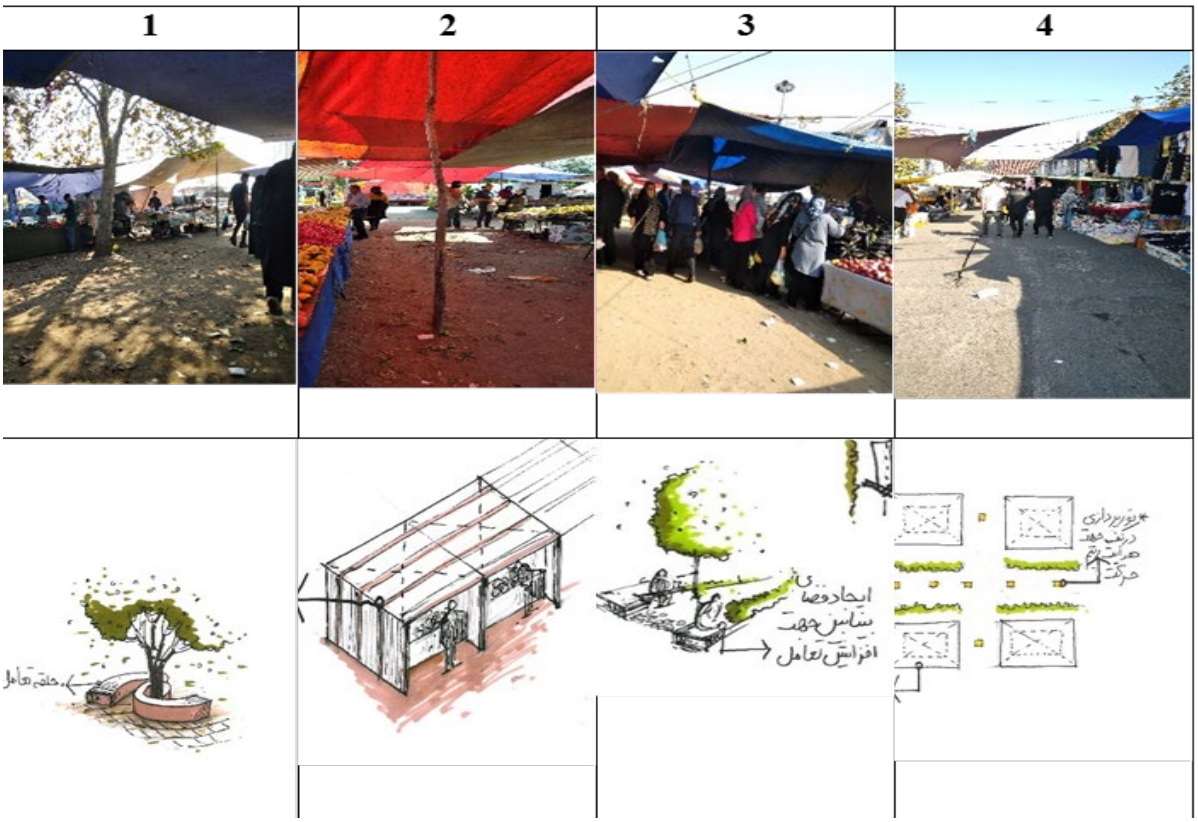
The findings of this study indicate that the intermediate spaces of Kola Chay Weekly Bazaar play a decisive role in shaping user behavior. The arrangement of pathways, nodes, and pause areas, along with lighting, shading, and natural elements, leads to increased short pauses, face-to-face interactions, and the formation of social connections among shoppers, thereby enhancing the quality of the shopping experience. Examination of behavioral patterns among women and men also revealed that environmental features of these spaces—such as path legibility, lighting levels, and spatial scale—directly affect users' sense of safety, movement rhythm, and product selection. Consequently, the vibrancy and dynamism of the bazaar primarily stem from the architecture of its intermediate spaces, which subtly guide user behavior and give meaningful form to the shopping experience.

Table 11: Design and solution suggestions for future research (Authors)

Row	Design Suggestion and Future Research Strategy	Theme

1	Lighting on the floor and plants placed at nodes or pause points, with movable fixtures on poles. We suggest future researchers study the effect of product height and arrangement on pause duration.	Sensory experience of products and pausing
2	Design paths with vertical/horizontal separators, guiding lighting, varied floor levels, and controlled trash bins to direct movement rhythm and reduce aimless walking. This helps regulate movement flow and spatial exploration. Future research could study the impact of diverse and colorful flooring on movement rhythm.	Path and rhythm
3	Control crowding and maintain personal distance using vertical/horizontal separators, shrubs, and plants to separate spaces, enhancing movement comfort. Future research could examine personal distance in weekly markets.	Gathering nodes
4	Open wooden interaction counters with varied heights for different age groups were tested for better interaction. Future researchers could study the effect of counter height and placement on social interaction formation.	Interaction and conversation
5	Organizing sales units and access paths was examined to improve ease of purchase. Future research could study the effect of product display height on pausing and buying behavior.	Shopping experience
6	Use of linear lighting, native colors, and planting creates diversity. Future research could focus on appropriate lighting and its impact on user relaxation.	Aesthetic experience (light–sound–color)
7	Wide, defined paths with foldable/movable structures covered with waterproof tents, short benches, and rain/snow-resistant flooring were examined. Future research could investigate the texture/material of the ground.	In-between space

Table 12: Design suggestions (Authors)



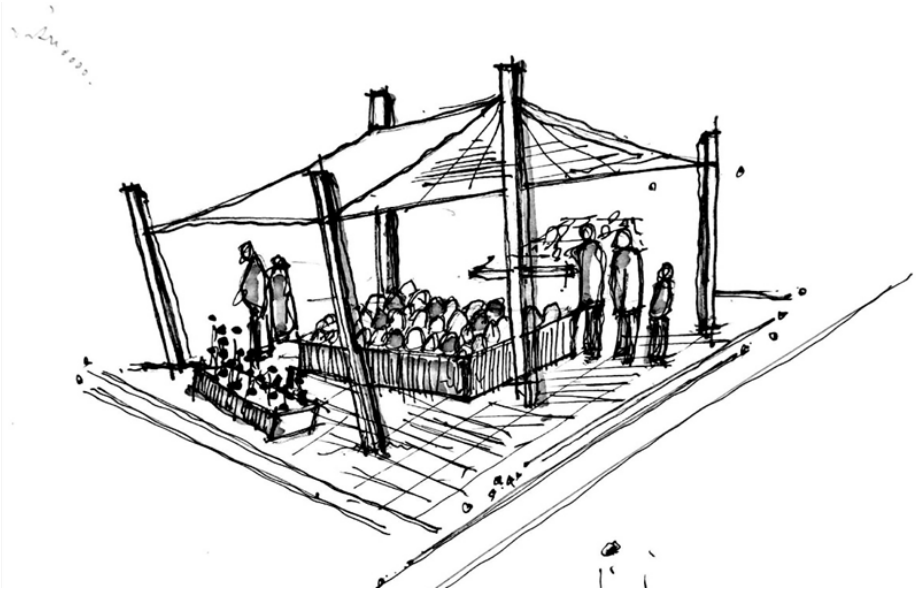


Figure 18. Activity and behavior in the interstitial spaces of the weekly kelachay bazaar (Authors)

7. The Role of Intermediate Space Architecture in Shaping User Behavior in Kelachay Weekly Bazaar

In Kelachay Weekly Bazaar, the existing intermediate spaces—namely the passageways, the gaps between stalls, semi-open areas, and pause points—naturally generate specific behavioral patterns among people. This effect arises entirely from the current architecture of the bazaar, rather than from an idealized design.

Table 13. The influence of the architecture of interstitial spaces on shaping user behavior in the Kelachay Weekly bazaar (Authors)

Exact Location	Impact of Intermediate Spaces	Behavior
Fish stall row in the market: Users were gently guided toward adjacent booths while main paths remained open.	Narrow paths, nodes, and alternating openings guide people's movement and reduce crowding.	Movement
Next to vegetable and fruit stalls: Women pause to select products and interact with each other and vendors.	Pause spaces and intermediate nodes encourage people to stop, converse, and increase social interactions.	Interaction
Mid-market passages with colorful fruits and vendors' bargaining sounds made paths attractive and shopping easy and enjoyable.	Light, sound, color of pathways, and easy access to stalls shape sensory experience and environmental perception, making shopping pleasant.	Perception / Positive shopping experience
Path intersections and pause nodes: Women passed through with more confidence and were actively present in the space.	Open views, path lighting, and appropriate movement nodes enhance users' sense of security and confidence.	Security

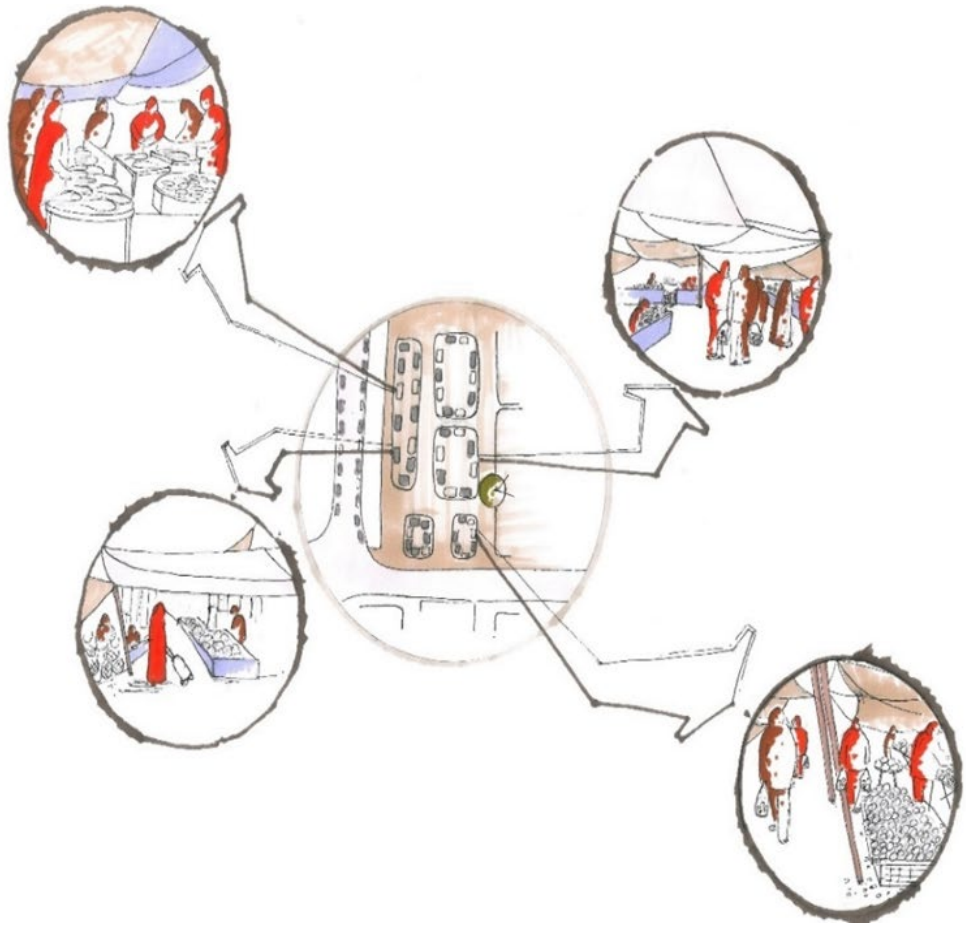


Figure 19: The architectural role of interstitial spaces in shaping user behavior in the Kelachay weekly bazaar(Authors)

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CLIMATE ANXIETY AS A DRIVER: EXPLORING THE RELATIONSHIP BETWEEN ENVIRONMENTAL CONCERN AND GENERATION Z BASED ECO-TOURISM

Sunita Sarker[72]

Abstract
This study investigates the climate anxiety as a motivational driver as well as examining its role in shaping the relationship between environmental concern and the eco-tourism preferences of Generation Z. As the demographic most acutely aware of the climate crisis, Gen Z's psychological responses to environmental degradation are hypothesized to transcend passive worry and actively influence travel behavior. The research analyzes how subjective climate anxiety mediates the relationship between general environment concerned and specific demands for authentic low-impact tourism. Findings indicate that for Gen Z, climate anxiety is a potential catalyst, transforming concern into a non-negotiable the study concludes that for the travel industry recognizing climate anxiety not as a barrier but as a central driver of demand is crucial for engaging this key demographic. It gives that future tourism marketing and development must address these profound psychological drivers to achieve resonance and legitimacy with generation Z.
Keywords: Climate Anxiety, Eco-tourism, Generation Z, Environmental Concern, Behavioral Adaptation

Introduction

The accelerating climate crisis represents not only and existential threat to global ecosystem but also a profound psychological burden particularly for younger generations, among these generation Z those born from the mid-1990 to the early 2010 has come of age amidst escalating scientific warnings and visible environmental degradation. This context has fostered a unique psyche where deep seated environmental concerned is increasingly intertwined with climate anxiety a chronic fear of ecological doom. This psychological response transcends passive worry potentially manifesting as a powerful driver of behavior and consumption choices now where is this potential shift more significant than in the tourism sector, major contributed to global carbon emissions as generation Z emergence as a critical consumer demographic understanding the interpret between their environmental concern .Climate anxiety and travel preferences becomes imperative this study posits that anxiety acts not as a paralyzing barrier but as a catalytic motivational force. It investigates how this specific anxiety mediates the relationship between general environmental values and the active pursuit of authentic low impact eco-tourism experiences. The research explores the hypothesis that climate anxiety transforms abstract concern into nonnegotiable demand shaping a travel ethos prioritizing sustainability authenticity and minimal environmental footprint. Consequently, the traditional tourism paradigm must evolve recognizing climate anxiety as a central driver of demand rather than dismissing it is crucial for the industry's future this paper is used that engaging generation Z effectively requires tourism marketing and development strategies to authentically address these profound psychological drivers there by achieving resonance and legitimizing their offerings for a generation for whom ecological integrity is a Paramount consideration.

Literature Review

The literature establishes Gen Z's strong environmental concern as a key driver of suitable travel intentions. Studies employee theories like TPB and NEP finding dad values ascribed responsibility and significantly predict growth in Environmental behavior willingness to pay and low carbon choices. Notably research highlights the moderating role of green consumption values and the power of emotional often implicit responses over rational statements. Generational lens is consistently applied through finding reveal intra generation complexity under scoring the need of all targeted strategies. [1-10]

Research Methodology

The study qualitatively explores climate anxiety as a motivator for eco-tourism among generation Z. Through semi structured interviews and thematic analysis, it examines how environmental concerned translates into specific travel intentions and behaviors.

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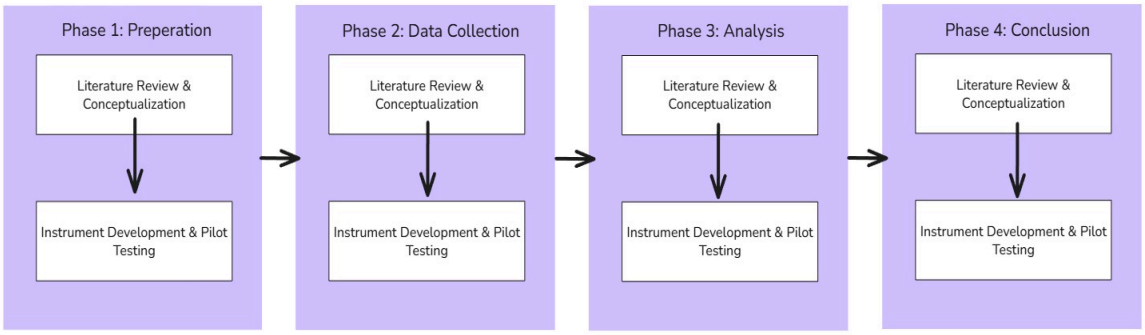


Fig. 1: Flow of Methodology

This diagram (Fig. 1) outlines a standard quantitative research methodology in 4 phases Preparation (literature review, conceptual model, survey design), Data Collection (Sampling and administering surveys), Analysis (statistical testing of the model and hypothesis) and conclusion (interpreting results and discussing implications). The phases progress sequentially to test the proposed relationships.

Result and Discussion



Fig. 2: Demographic Analysis

This graph (Fig. 2) summarizes respondents demographics most participants Are Young adults (mean age ~ 21) with nearly equal male and female presentation. 10 sample in dominated by undergraduate and most respondents travel 225 times annually indicating a young moderately mobile population.

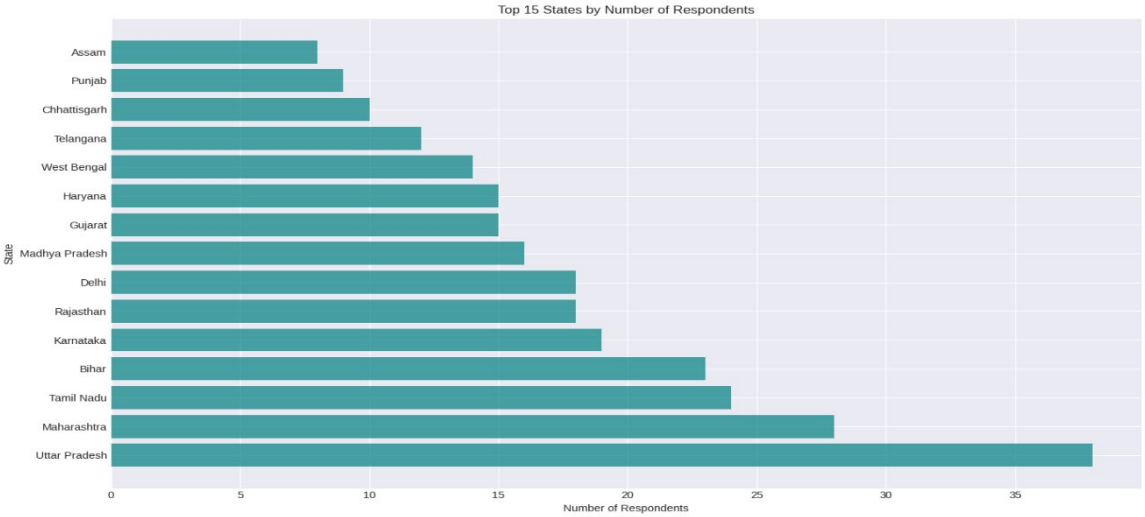


Fig. 3: Top 15 numbers of Respondents

The chart (Fig. 3) shows that geographical distribution of small lands across Indian states. Uttar Pradesh, Maharashtra and Tamil Nadu reviewed the highest responses while not eastern and smaller States so lower participation Hindi getting regional concentration in more populous States.

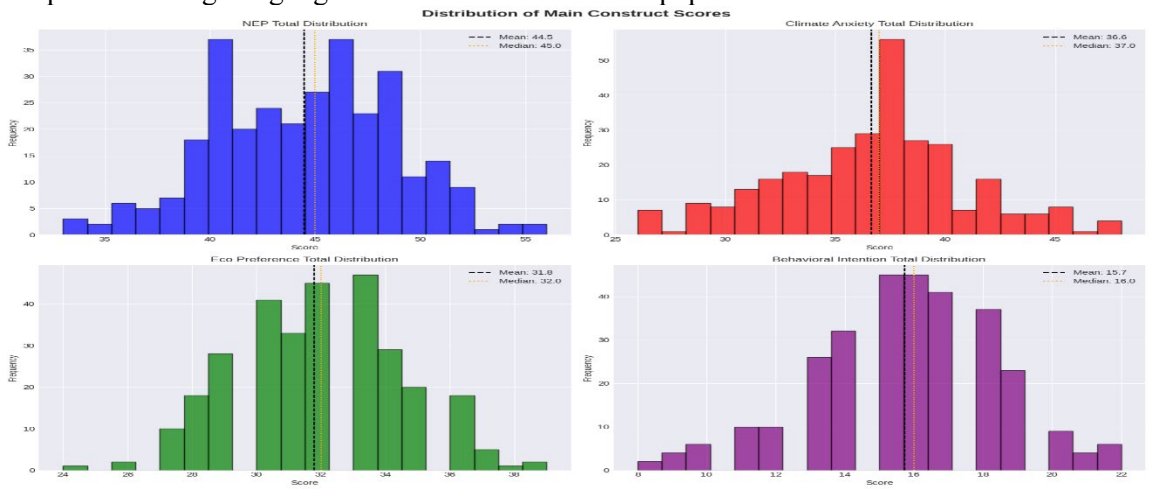


Fig. 4: Distribution of Main Construct Scores

The chart (Fig. 4) shows that geographical distribution of small lands across Indian states. Uttar Pradesh, Maharashtra and Tamil Nadu reviewed the highest responses while not eastern and smaller States so lower participation Hindi getting regional concentration in more populous States.

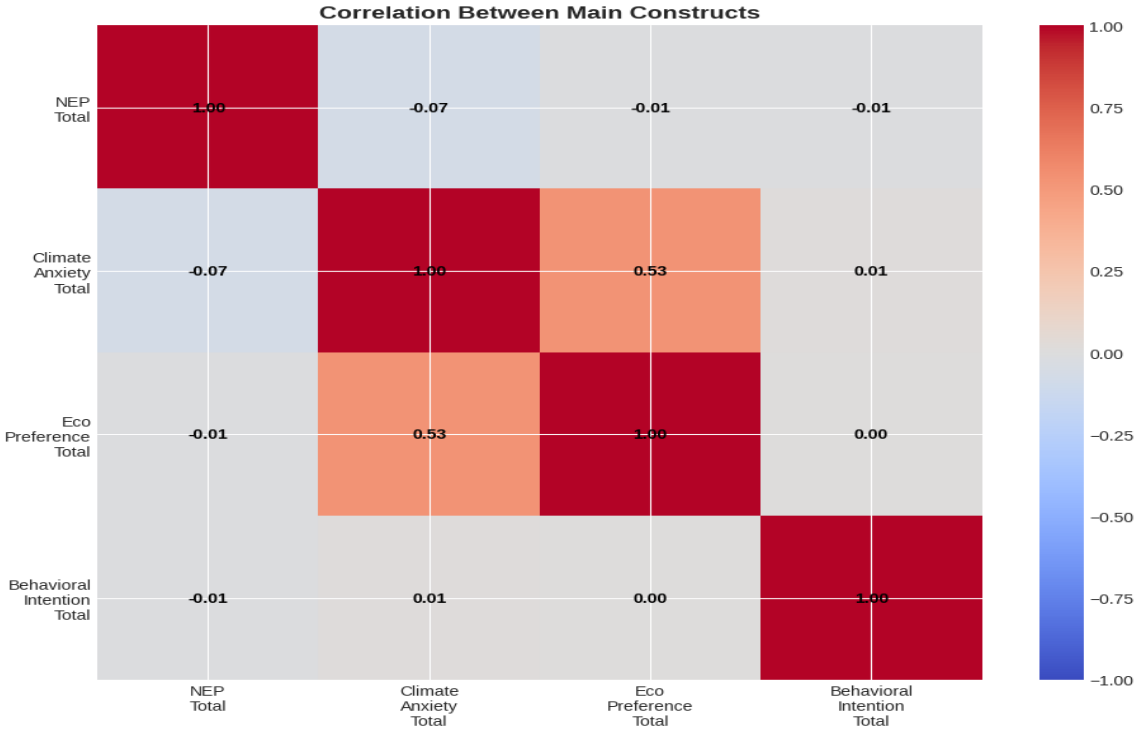


Fig. 5: Correlation matrix

This heatmap (Fig. 5) displays Pearson correlation ecoefficiency between key environmental constructs. the most significant finding is a moderate positive correlation (0.53) between climate anxiety and eco preferences. Other variables such as any total and behavior intention so near Zero correlations indicating little to no linear relationship between them.

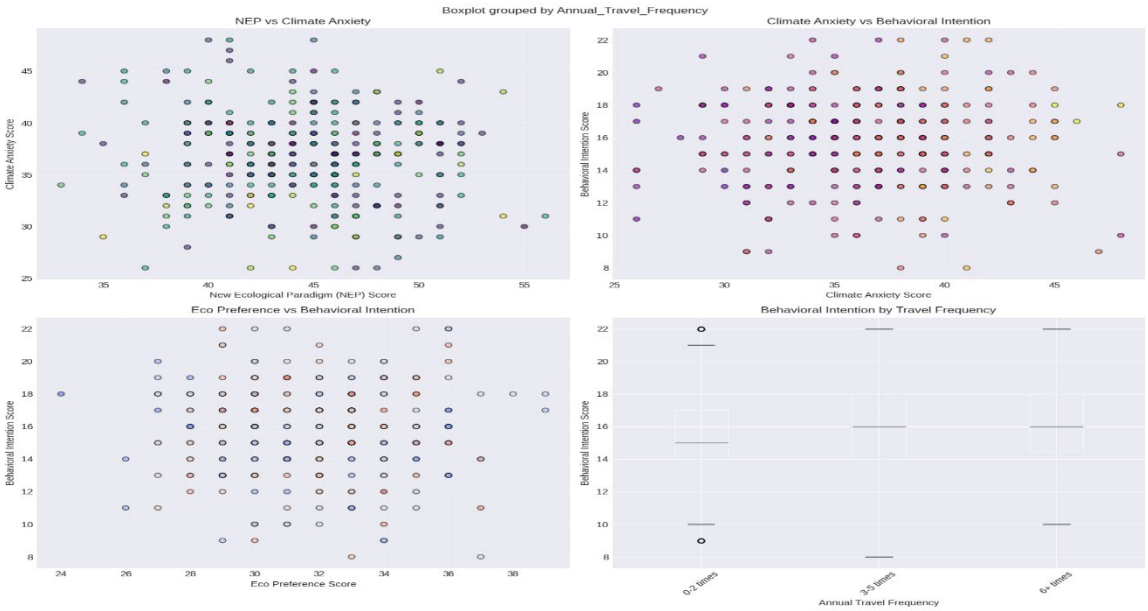


Fig. 6: Annual Travel Frequency

This scatterplots and box plots (Fig. 6) illustrate relationship between in NEP, climate anxiety, Eco preferences, behavioral intention and travel frequency association appear on week to moderate while higher travel frequences shows likely higher behavior intention indicating behavior where is modestly with experience.

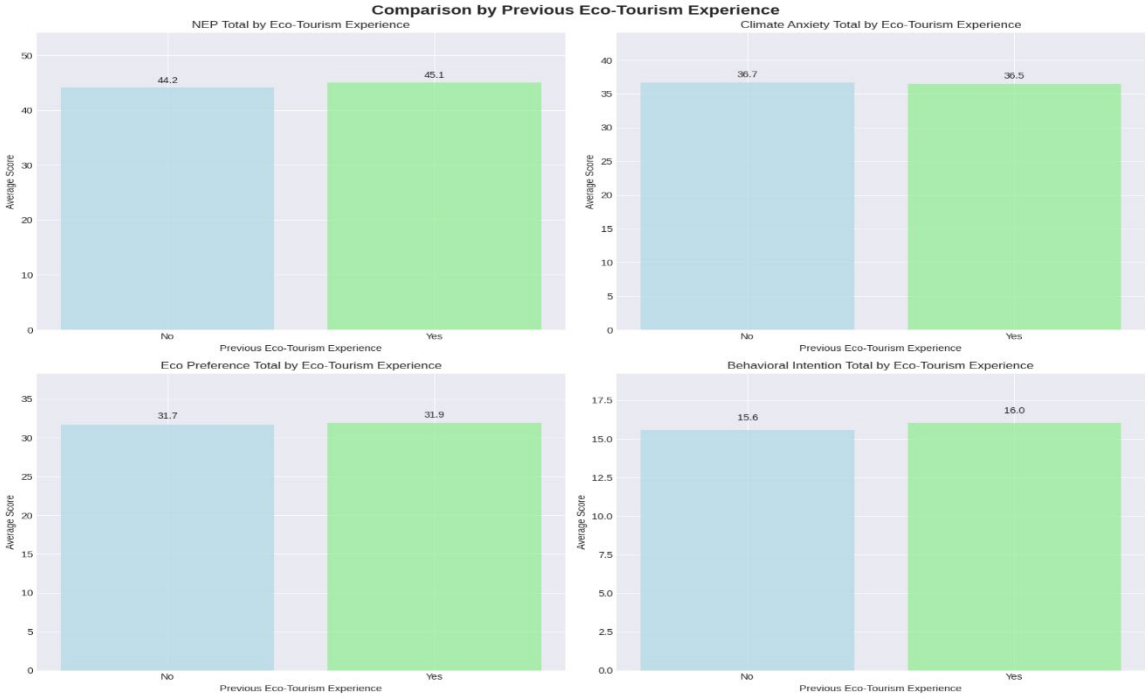


Fig. 7: Comparison by Eco-Tourism Experiences

Respondents with prior Eco tourism experience show (Fig. 7) marginally higher NEP, Eco preference and behavioral intention scores than those without experience. climate anxiety levels remain similar suggesting experience influences bro environmental attitude more than emotional concern.

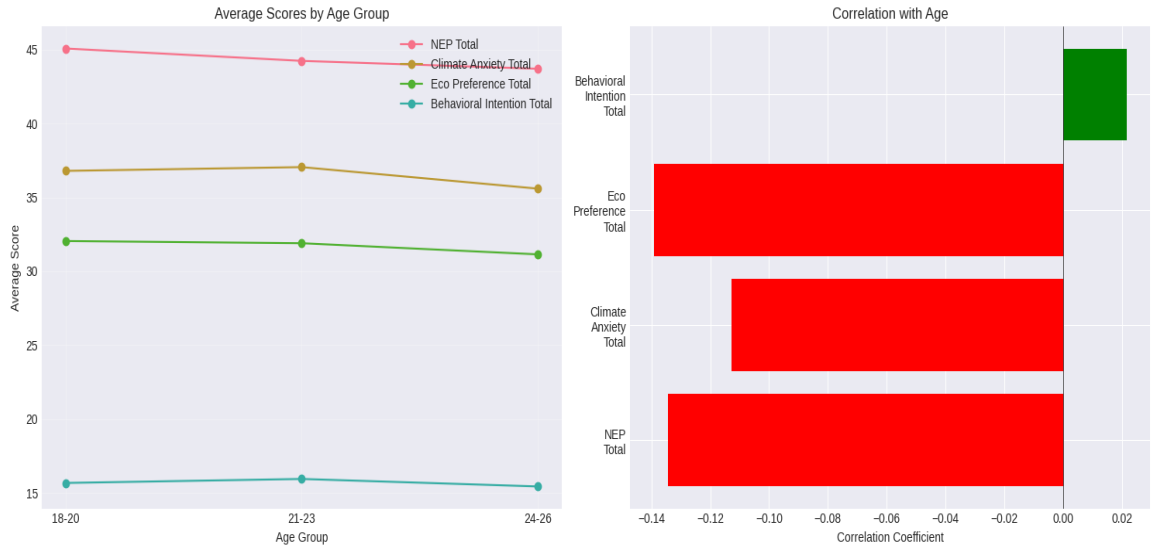


Fig. 8: AVG. scores by age group

Line graphs show (Fig. 8) slight decline in NEP, Eco preference and behavioral intention with increasing age. Correlation analysis indicates weak negative co-ordinations between age and most constructs suggesting is has minimal influence on environmental attitude in this sample.

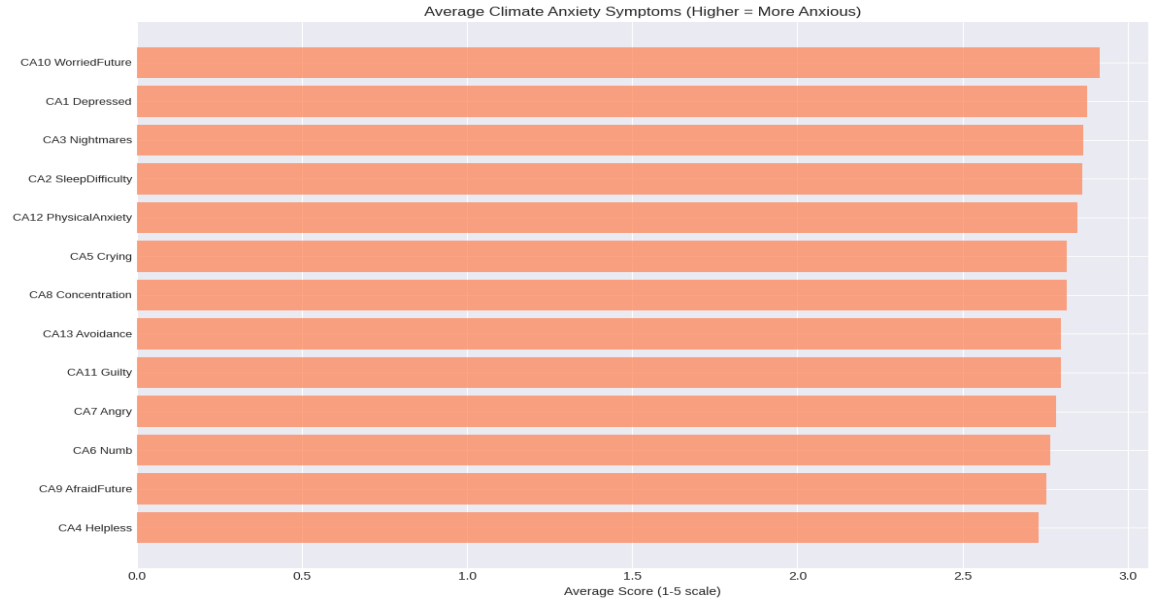


Fig. 9: AVG. Climate Anxity Symptoms

The bar chart (Fig. 9) presence average scores for climate anxiety symptoms. Worry about the future sleep difficulty and depressive feelings rank highest indicating moderate psychological concerned related to climate change among responding through symptom levels remain relatively uniform.

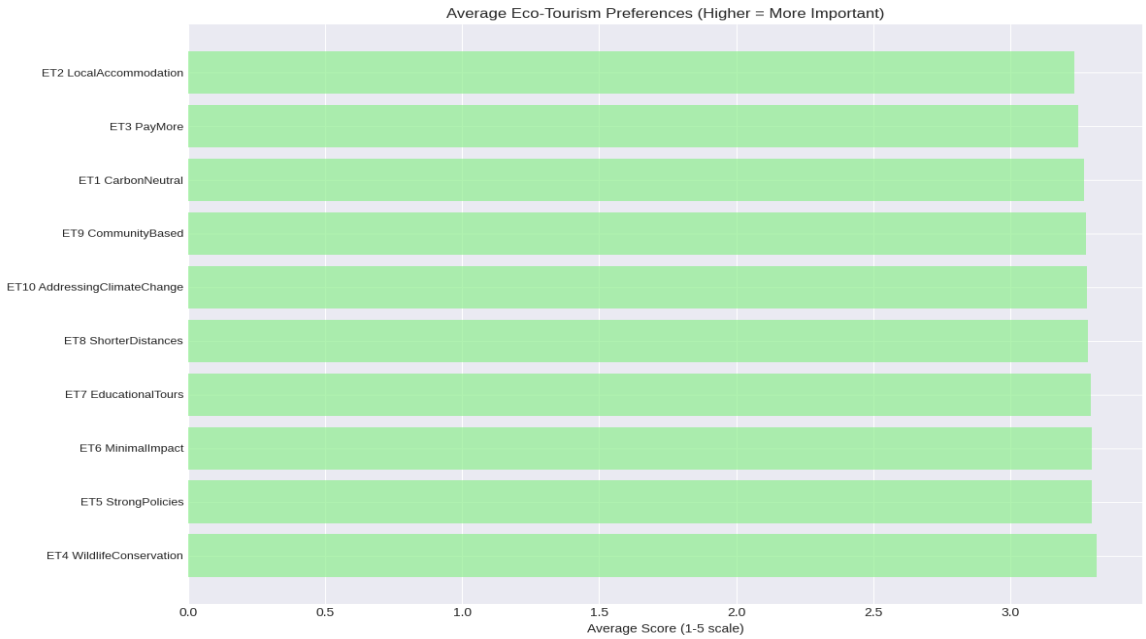


Fig. 10: AVG. Eco-Tourism Preferences

The chart (Fig. 10) highlights strong importance across all eco-tourism preference items. wildlife conservation, strong environmental policies, minimal impact tourism and community-based Travels core highly reflecting consistent support for sustainable and responsible tourism practices.

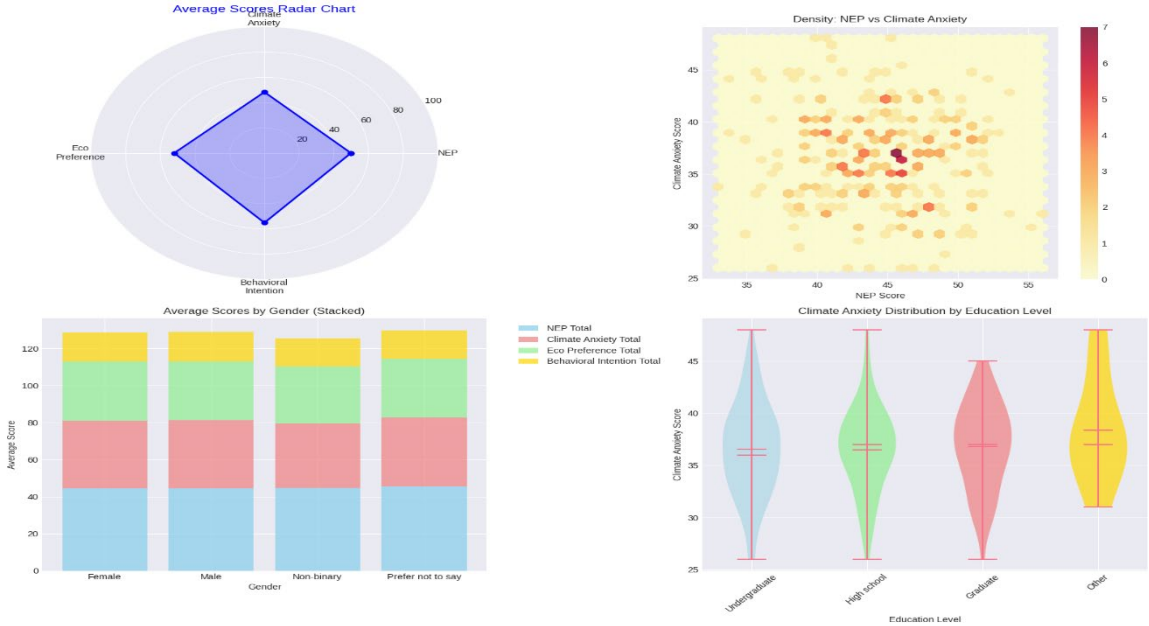


Fig. 11: AVG. scores

The first graph shows (Fig. 11) a heat map where climate anxiety and Eco preference have a moderate positive correlation of 0.53. the second image indicate that environmental scores are relatively consistent across Gender and educational levels with a radar chart showing (Fig. 11) balance ever is course across all four constructs.

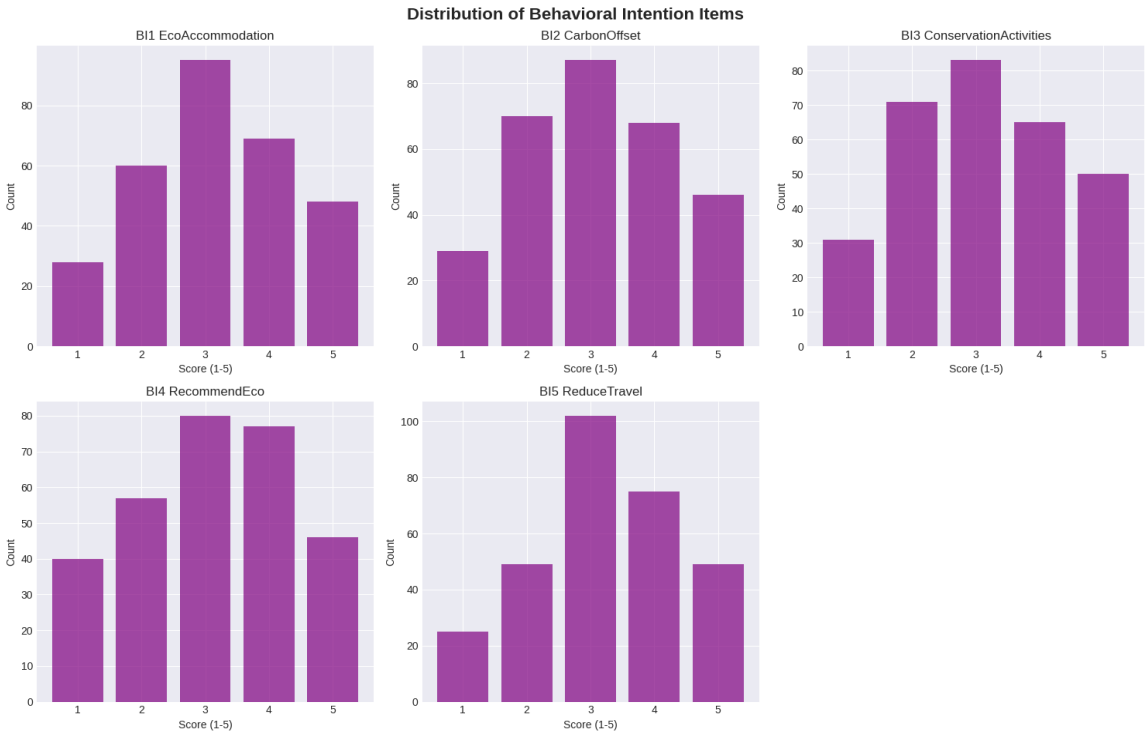


Fig. 12: Distribution of Behavioral Intention Items

This set of bar charts (Fig. 12) displays responses for five specific behavioral intentions. most items follow in normal distribution centered at a score of 3 indicating a moderate level of commitment towards sustainable travel behaviors among the surveyed participants.

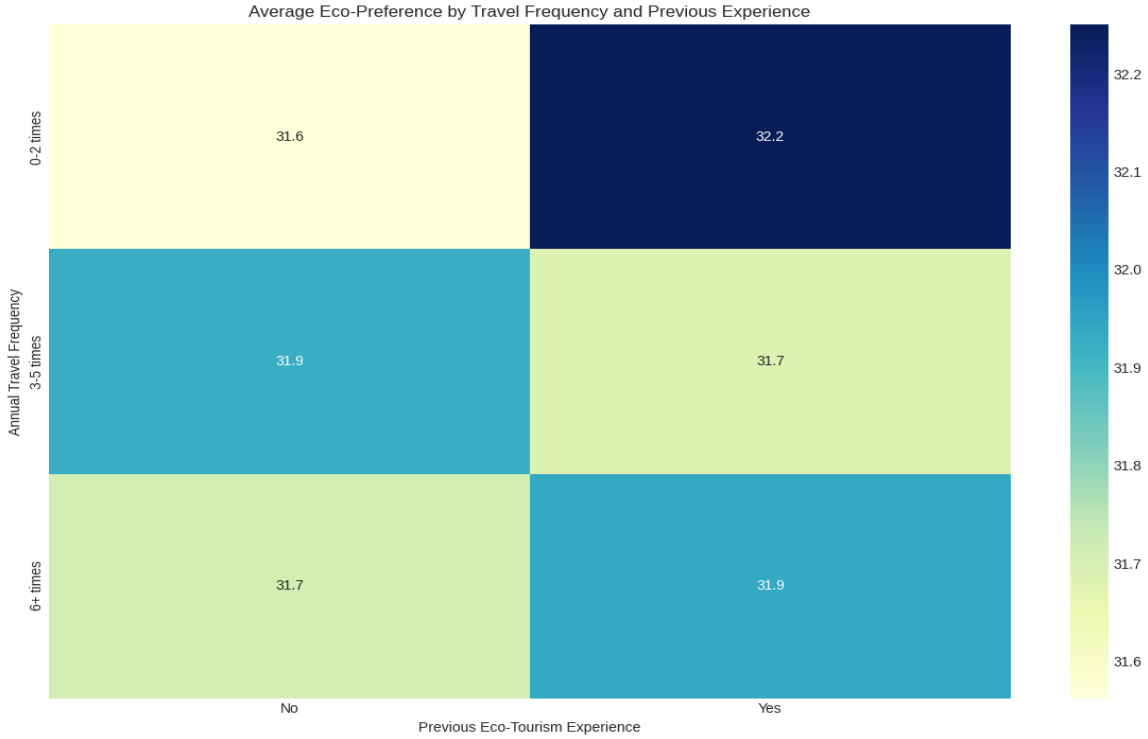


Fig. 13: AVG. Eco-preference by Travel Frequency

This heatmap (Fig. 13) illustrate how travel frequency and previous experience is influence Eco preference. interestingly the highest preference scores (32.2) come from in frequent travelers (0-2 times Per year) with previous Eco tourism experience suggesting that past exposure positively impacts sustainable attitudes for casual travelers.

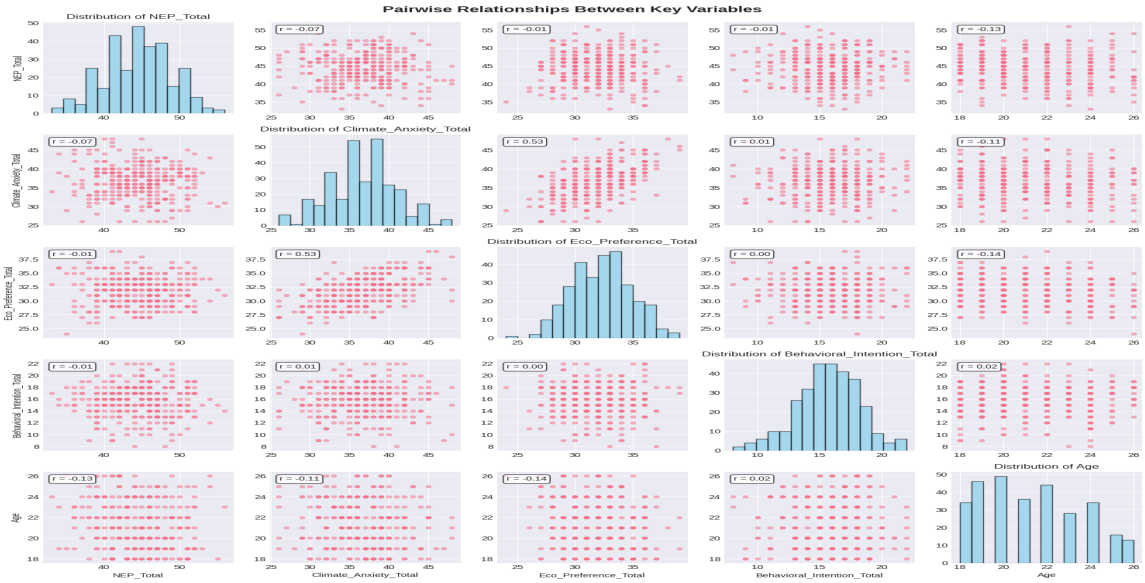


Fig. 14: Pairwise Relationships

This scatterplot (Fig. 14) Matrix explodes correlations between key variables like NEP, climate anxiety and age not able is strong positive correlation (r=0.53) exist between climate anxiety and Eco-preference suggesting that higher environmental concerned is linked to a preference for sustainable travel options.

Conclusion

This study concludes that Gen Z travelers strongly align with Sustainable Tourism models that emphasize environmental protection, community benefit sharing, and transparent governance. Integrating authentic cultural and nature-based experiences with credible sustainability credentials and digital impact communication can enhance engagement. However, translating values into consistent behavior requires robust governance frameworks, effective digital tools and participatory opportunities that empower young travelers as active contributors to Sustainable Tourism Development Relies largely on secondary sources and self-reported data which may not reflect actual travel behavior. Focus on Gen Z limits generalizability to other tourist segments. Variations in governance, culture, and destination context are not fully addressed. Rapid changes in digital tools and sustainability standards may affect relevance over time. Empirical testing of how governance mechanisms influence Gen Z's sustainable travel decisions. longitudinal studies to examine the gap between stated values and actual behavior over time. comparative analysis of Gen Z tourism patterns across developed and emerging destinations. Evaluation of digital transparency tools in shaping trust and engagement. Assessment of participatory and advocacy-based tourism models on sustainability outcomes.

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EMBODIED EXPERIENCES AND EMOTIONAL REGULATION IN NATURE-BASED SCHOOLS: AN ANTHROPOLOGICAL PERSPECTIVE ON CHILDREN'S SOCIAL BEHAVIOR*

Seyed Kasra Mirpadyab[73*] , Sayyedeh Hadiseh Seyed Shafavi Moghadam[74]

Abstract
Human behavior is shaped by continuous emotional and social responses, influenced by spatial perception and interaction with the surrounding environment. Architecture, as the primary organizer of space, plays a key role in guiding these responses and supporting emotional regulation, particularly in educational settings where students experience rapid developmental changes. This study examines the impact of nature-based architectural interventions on emotional balance and risky social behaviors among elementary school students. Two case studies with similar climatic conditions but differing levels of natural integration—Maktabkhane Dr. Mosaheb in Abbasabad and Shadmehr Elementary School in Chaboksar—were selected. Using a qualitative phenomenological methodology, field observation, spatial analysis, and behavioral mapping were combined to explore how nature-oriented design elements influence children's spatial perception, emotional experiences, and social interactions. The core research question investigates how natural design components contribute to emotional regulation and shape behavioral tendencies in daily school environments. Findings indicate that natural features enhance positive spatial perception, reduce negative emotions such as anxiety and withdrawal, foster a stronger sense of belonging, and promote cooperative and creative behaviors. Nature-based architectural configurations also decrease tendencies toward risky or disruptive behaviors by offering calming, engaging, and psychologically supportive spaces. Overall, the results highlight the importance of integrating natural elements into school design. Nature-oriented interventions support healthier emotional climates, improved social functioning, and enriched learning experiences, emphasizing the need to prioritize psychological well-being and social development in future educational environments
Keywords: Nature-Based Architecture; Spatial Perception; Emotional Regulation; Risky Social Behavior; Educational Environments

Introduction:

The educational environment, as the setting where much of a child's personality, behavior, and emotions are shaped, plays a vital role in the psychological and social well-being of the next generation (Hajati et al., 2022). In recent decades, increasing levels of stress, aggression, and reduced concentration among elementary school children have prompted designers and researchers to rethink conventional school architecture models (Ulrich, 1991; Kaplan & Kaplan, 1989). Studies show that environments designed in harmony with children's psychological and social needs can reduce negative emotions and enhance positive social behaviors (Kellert, 2018). The presence of nature in educational spaces—whether through natural landscape design, daylight, native materials, or visual connections to green areas—not only enhances the aesthetic quality of the environment but also has a direct impact on children's cognitive and emotional performance (Kellert, 2018). Environmental psychology theories also indicate that experiencing nature restores attention and reduces psychological stress (Kaplan, 1995). Domestic studies, such as Mohammadi's (2019) research on green schools in Tehran, have shown that children's direct contact with natural elements increases their sense of belonging, behavioral regulation, and emotional calm.

In this regard, the concept of the "nature school" in Iran has recently attracted the attention of architects as an example of human-centered and nature-oriented design (Abassi, 2021). The quality of school architecture and its outdoor environment has a fundamental impact on children's behavior, emotions, and social interactions (Benfield et al., 2015). Numerous studies show that access to nature or natural elements in the learning environment can reduce psychological stress, negative emotions, and tension (DeLauer, 2022), and that school architecture with nature-oriented characteristics—namely biophilic design—offers significant benefits in

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* This research was conducted by the second author under the guidance of the first author and corresponding author, within the framework of the "Architectural Works Critique" course at the Master's level in 1404 (2025). Part of the findings from this study have previously been published in the book **"Architectural Anthropology and Behavior: An Embodied Reading of Everyday Life and Behavior in Architectural Spaces**

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terms of well-being, emotional regulation, and learning outcomes (Duffy, 2024). From the perspective of behavioral settings, school architecture can create conditions in which group social interactions are strengthened and risky behaviors are diminished; circulation paths, open and semi-open spaces, courtyards with natural elements, and views toward greenery are examples of such spaces. Students' spatial perception influences their emotions, motivation, sense of belonging, and feeling of control (Vella-Brodrick et al., 2022). The problem addressed in this study is how the integration of nature into school architecture can function as an effective factor in regulating emotion and reducing risky social behaviors among children. At the same time, examining this phenomenon from the perspectives of phenomenology and the anthropology of space provides a deeper understanding of children's embodied experience of the educational environment.

The importance of this research lies in the fact that its findings can inform the design of future-oriented schools that, by enhancing children's mental health and social interactions, provide a positive and supportive environment. The main aim of this study is to analyze the role of nature interventions in school architecture in shaping the emotions and social behavior of elementary school students.This study is grounded in Attention Restoration Theory, which proposes that exposure to nature can restore attentional capacity (Kaplan & Kaplan, 1989; Kaplan, 1995), and draws on recent evidence that biophilic design in school environments is associated with improved mental health and reduced stress (Kellert, 2018; Alvarsson et al., 2022).

Accordingly, the main research question is: "How can nature interventions in school architecture function as an effective factor in regulating emotion and reducing risky social behaviors among students?" The research hypothesis is that integrating nature into school architecture increases positive spatial perception, decreases negative emotions, and consequently reduces risky social behaviors. The statistical population of this study consists of students of Shadmehr Elementary School (95 boys) and children of Maktabkhaneh Dr. Mosahab (60 mixed-gender children), whose behavioral and perceptual patterns in open, semi-open, and enclosed spaces were observed and analyzed.

Research Literature and Theoretical Framework

According to previous studies, social risk behavior refers to those individual or group actions and interactions that increase the likelihood of physical, psychological, or social harm, including behaviors such as aggression, conflict, rule-breaking, vandalism, or social disorder (Jessor, 2019).

Architecture can be defined as the art and science of designing, constructing, and organizing human spaces in such a way that their form, structure, and spatial quality support human experience, interaction, and psychological well-being (Li & Wang, 2024). In this context, nature intervention can be described as any spatial strategy or design action that intentionally incorporates natural elements—such as plants, daylight, green areas, water, or natural materials—into built environments to promote mental health, cognitive functioning, and prosocial behavior (Zhang, Chen, & Sun, 2025). Spatial perception refers to an individual's sensory and mental experience of the surrounding environment, including feelings of belonging, control, safety, comfort, and overall environmental quality, shaped by spatial layout, circulation paths, views, and connections to nature and other environmental features (Smith & Brown, 2024).

Theoretical perspectives relevant to this study include:Phenomenology of space: In phenomenological thought, space is not merely a material container but a lived and meaningful experience (Merleau-Ponty, 1945). Phenomenological architects such as Norberg-Schulz (1979) understand space as the ground for the emergence of "sense of place" and emotional attachment to the environment. From this viewpoint, natural elements such as light, air, water, soil textures, and vegetation become tools for creating lived experiences of calm and belonging.

Anthropology of architecture: Architectural anthropology holds that space reflects and shapes culture, behavior, and social structure (Rapoport, 1982). In educational environments, children give meaning to space through their collective behaviors and movement patterns. Integrating nature into school architecture can channel these cultural and behavioral interactions in constructive ways (Ingold, 2011).

Spatial perception and embodied experience: Spatial perception is an embodied process, meaning that understanding the environment emerges through the senses, movement, and physical presence (Pallasmaa, 2005). In school settings, multisensory encounters with natural elements—such as touching soil, hearing the wind, or experiencing changing light—activate embodied and multisensory perception and contribute to emotional soothing and regulation (Jamālpour, 2021).

Table 1. Previous studies and findings related to the present research (compiled by the author)

Article Title	Author(s) / Publication Year	Research Method	Main Result
Live green, think green: Sustainable school architecture and children's environmental attitudes and behaviors	Tucker & Izadpanahi (2017)	Survey: 275 children (10-12 years old)	Children in sustainable schools exhibited more positive environmental attitudes and behaviors
Approaching Biophilia in Designing Children's Educational Environment	Habib, Mansour & Khodier (2022)	Theoretical-analytical review	Examined biophilic design dimensions and proposed patterns for children's mental health .
Biophilic Design Effects on Kindergarten Interior: Nature Integration Enhance Learning Environment	Al-Radaideh et al. (2024)	Descriptive survey: 30 kindergartens	Integrating nature into interior design improved children's comfort, focus, and emotional stability
Designing Learning Environments Based on Naturalistic Intelligence	Tabesh, Mohammad (2018)	Analytical-descriptive	Views of nature and presence of plants activated students' naturalistic intelligence more actively
Impact of Integrating Environmental Knowledge Programs with School Physical Education on Students' Environmental Attitudes	Aboud, Aqil et al. (2022)	Experimental-empirical	Environmental education enhanced students' environmental attitudes

Research Method

Research Type

The research is qualitative-phenomenological in structure, adopting an architectural anthropology approach with an emphasis on the embodied experience of space. The author aims to discover and analyze how humans relate to space through embodied behavior and perception in architectural environments, specifically within educational settings. To this end, two schools—" Maktabkhaneh Dr. Mosaheb" and "Shadmehr Elementary School in Chaboksar (Gilandeh)"—were selected for study because both contain nature-inspired elements (such as green spaces, gardens, open and semi-open areas). These schools provide a suitable context for examining the impact of nature's presence on children's behavior and emotions.

Research questions

What recurring behavioral patterns can be observed in students' interactions with different school spaces?
How do school spaces influence students' experiences of reflection, calmness, and social interaction?
Which architectural cues, patterns, and spatial elements are capable of shaping or modifying students' behaviors?
Hypothesis 1. The presence of nature-based elements in school spaces leads to recurring behavioral patterns such as group gathering around natural features, interactive play, freer movement, and longer-lasting presence of students in open areas
Hypothesis 2. Spaces with high aesthetic quality—characterized by natural light, green views, natural materials, and human scale—enhance students' sense of calm, interest, cognitive engagement, social interaction, and inner reflection.
Hypothesis 3. Architectural elements such as semi-open spaces, organic circulation routes, shared and collaborative areas, opportunities for choice, freedom of movement, and natural cues can guide children's behavior toward healthier interaction, reduced tension, and increased creativity.

Aim of the study

The main aim of this study is to examine students' spatial perception and behavior in relation to natural elements in school environments and to identify recurring behavioral patterns in educational settings. The

applied objective of the research is to propose design strategies for improving educational spaces in order to strengthen emotional regulation and reduce behavioral tensions among students.

Population and case studies

The population of this study consists of elementary school students who are educated in environments with nature-based design features. Two case studies were selected in particular: (a) "Maktabkhaneh Dr. Mosahab" in the Langa region, and (b) "Shadmehr Elementary School" in Chaboksar (Gilandeh). These schools were chosen because they integrate natural elements such as plants, green areas, open and semi-open spaces, and nature-oriented circulation paths, providing an appropriate context for examining how architectural environments and the presence of nature influence children's emotions, spatial perception, and social behavior (DeLauer, 2022). The age group of 7–12 years in elementary school was selected because this period is a highly sensitive stage for the formation of social and emotional behaviors, during which the design of the educational environment can have a significant impact (Ulrich, 1991; Benfield et al., 2015).

Instruments and Data Collection Methods

To achieve the aims of the study, the following qualitative tools and techniques were employed:

Field Observation: Systematic on-site observation of students' behaviors and interactions across various school spaces.

Behavioral Mapping: Recording the location and type of behaviors on spatial plans to identify recurrent behavioral patterns in relation to specific environmental features.

Visual Analysis (Photography): Photographing key spaces and activities and analyzing visual data to interpret spatial qualities and children's engagement with natural elements.

Semi-Structured Interviews: Conducting semi-structured interviews with students—and, where relevant, teachers—to explore their perceptions and emotional experiences of the school environment.

Perception Diary: Using short perception diaries in which students describe or illustrate how they feel and behave in different spaces, particularly in relation to natural elements.

Case study

Maktabkhaneh Dr. Mosaheb, Langa (Abbasabad–Tonekabon)

General description of the setting: Maktabkhaneh Dr. Mosaheb is one of the notable examples of informal, nature-based education in northern Iran, located in the village of Langa in Abbasabad County (Mazandaran Province). In recent years, this learning environment has been established by a group of teachers and researchers in education and architecture with the aim of bringing nature back into the learning process and strengthening children's social skills. The complex consists of a simple wooden building with a pitched roof and conical classroom units inspired by the architecture of Nader Khalili. It includes an open yard, educational gardens, and communal interaction spaces embedded in the village landscape, where there is no clear boundary between the classroom and the outdoors.

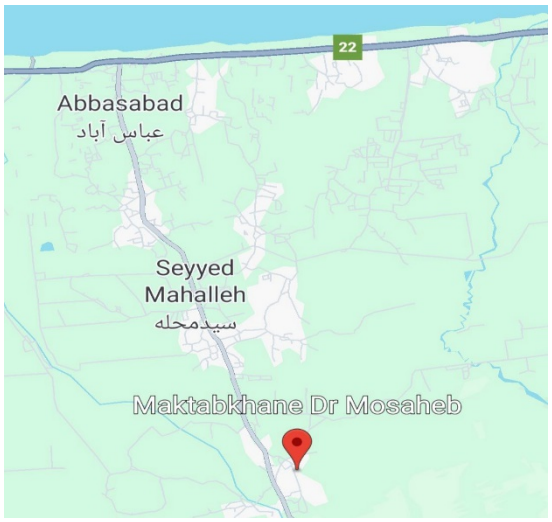


Figure 1. Location of Maktabkhaneh Dr. Mosahab

In the design of the Maktabkhaneh, the principles of "open space" and "nature penetrating architecture" are clearly evident. The classrooms are semi-open and built with local materials. Around the learning spaces, there

are fruit trees, an unpaved play yard, and hand-made paths that allow children to move freely. This spatial structure enables children to engage directly with natural elements such as soil, water, light, and plants during the learning process—an experience that has largely disappeared in conventional schools (Mazloumi, 2020).

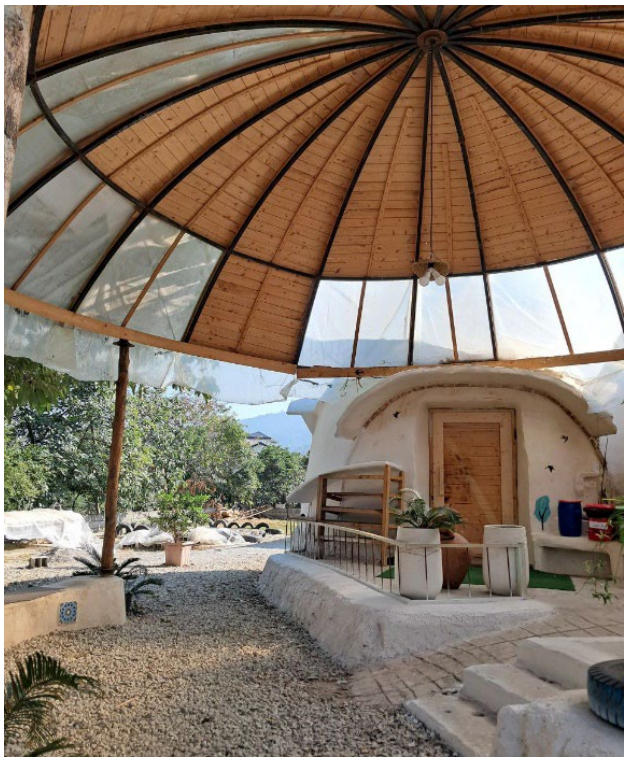


Figure 2. Dr. Mosahab Maktabkhaneh (photo by the author)

Educational Philosophy and Aims: The educational philosophy of the Maktabkhaneh is rooted in contemporary pedagogical approaches such as experiential learning and nature-based learning. Rather than relying on formal, textbook-driven, grade-based instruction, activities are structured around observation, dialogue, group collaboration, and embodied experience. As the head of the center explains, the primary aim is for "children to once again see touching soil and listening to birds as part of their learning process." This orientation aligns with phenomenological and anthropological perspectives on space, wherein spatial understanding emerges not through instruction but through lived, situated experience (Merleau-Ponty, 1945).



Figure 3. Classroom of Dr. Mosahab Maktabkhaneh (photograph by the author)

Observation of Behavioral Patterns:Based on field observations and interviews with teachers, several recurring behavioral patterns were identified among the children. One of the most prominent patterns was an increase in social interaction, with children demonstrating higher levels of cooperation and engagement during group play activities.Furthermore, a noticeable decrease in tension and aggressive behavior was observed; thanks to the freedom of movement and continuous contact with nature, risky behaviors appeared less frequently. Children also showed higher levels of concentration and calm, demonstrating better focus during creative activities in the open, green environment. Many students described the setting as their "second home," indicating the emergence of a strong sense of place and spatial belonging.These findings are consistent with international research. For example, Li and Sullivan (2016) showed that the presence of green space in and around schools directly contributes to improved student behavior, while Kaplan (1995) emphasized that nature supports emotional restoration and mental focus.



Figure 4. Courtyard of Dr. Mosahab Maktabkhaneh (photograph by the author)

Architectural analysis from a phenomenological and spatial perception perspective: In Maktabkhaneh Dr. Mosaheb, space is perceived in an explicitly embodied way. The earthen floor, semi-open walls, natural material textures, and ambient sounds all stimulate multiple senses and deepen the inner perception of space. This quality aligns with Pallasmaa's view (2005) that educational environments gain meaning only when touch, smell, and hearing are also engaged, not just vision. In this setting, the child's embodied experience of the environment supports an internalization of calm, creativity, and respect for nature.



Figure 5. Exterior view of a classroom at Maktabkhaneh (photograph by the author)

Shadmehr Boys' Elementary School, Chaboksar

General description of the setting: Shadmehr Boys' Elementary School is a public school located in the Chaboksar area of Rudsar County (Gilan Province). The school lies in the coastal–foothill zone of Gilandeh, and its student population is composed mainly of children from local families. A humid climate, dense vegetation, and proximity to natural landscapes are key characteristics of the school's geographical context. The school building is situated on a relatively large plot and includes several classrooms, an open yard, a simple sports area, and ancillary service spaces. Despite the rich natural surroundings, the school's architecture follows a standard governmental type and does not actively incorporate natural elements. Nevertheless, the site offers considerable potential for nature-based interventions in the design of its spaces.



Figure 6. Location of Shadmehr Boys' Elementary School (photograph by the author)

Spatial Structure and Relationship to Nature: The school building is a single-storey block primarily constructed with cement-based materials and topped with a pitched metal roof. Classrooms feature windows overlooking the courtyard, yet direct views of the surrounding natural landscape have not been intentionally incorporated into the design. The courtyard contains only a few large pine trees, and the surface is mostly open and asphalted. Despite the limited natural elements, they serve as informal gathering spots for students.Observations indicate that during breaks and recess, children often lean against the trees or sit nearby, using the shaded areas as places for interaction and conversation. These spontaneous behaviors highlight the children's desire for contact with natural elements and demonstrate the importance of even modest greenery in supporting social engagement within the school environment.



Figure 7. Shadmehr Boys' Elementary School (photograph by the author)

Educational Philosophy and Aims: Shadmehr School follows the formal curriculum set by the Ministry of Education, yet in recent years, some teachers have creatively used the outdoor areas for non-classroom learning, small scientific excursions, and artistic activities. These activities aim to strengthen students' social skills, foster a sense of belonging, and help reduce anxiety. Observations suggest that children who spend time outdoors often show calmer behavior, better focus, and more cooperative interactions. From the perspective of environmental psychology (Ulrich, 1984; Kaplan, 1995), regular contact with natural elements can support emotional restoration, improve concentration, and reduce aggressive tendencies.



Figure 8. Courtyard of Shadmehr Boys' Elementary School (photograph by the author)

Observation of Behavioral Patterns and Phenomenological Analysis: During field visits and brief interviews with teachers, several recurring behavioral patterns were observed among students. In open spaces such as the courtyard or near the few trees, students appeared calmer and more cooperative. Group tensions decreased, and during play, verbal conflicts and aggressive behaviors were less frequent, while interactions became more collaborative.

From a phenomenological perspective on space (Norberg-Schulz, 1980; Pallasmaa, 2005), educational environments gain meaning when they allow for embodied and multisensory experiences. At Shadmehr School, despite the physical limitations of the setting, students engage directly with natural elements: the texture of the yard's soil, the sound of rain hitting the metal roof, the smell of wet earth, and the changing patterns of sunlight all contribute to their lived experience. However, the dominance of hard surfaces and cold materials limits the development of a deeper sense of belonging. Introducing more natural elements—such as additional vegetation, unpaved paths, or wooden seating—could enhance spatial perception and gradually transform the environment from a "formal classroom" into a "place of lived experience." This approach reflects what Pallasmaa (2005) terms "sensory and experiential architecture," in which space engages both body and mind simultaneously

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Figure 8. Classroom of Shadmehr Boys' Elementary School (photograph by the author)

Findings

The findings of this study indicate that the presence of natural elements and embodied design in school architecture plays a significant role in improving emotional regulation, reducing risky behaviors, and strengthening students' social interactions. Direct contact with nature, the use of open and semi-open spaces, and the dynamic organization of the environment enhance spatial perception and support the emergence of healthier behavioral patterns within the school setting.

To clarify these results, tables summarizing the key behavioral findings, perceptual findings, and overarching research themes are presented, enabling a more precise analysis of how specific architectural features relate to students' behavioral and emotional responses.

Table 2. Behavioral Findings – Maktabkhaneh Dr. Mosaheb (photograph/observations by the author)

Space type	Behavior type	Category	Environmental element	Design effectiveness	Behavioral analysis	Number & frequency	Observation time
Open natural space	Free play, movement, cross-age interaction	Creative play / social interaction	Soil, plants, sunlight, soft ground	Highly effective	Lack of compulsion → reduced aggression	~35 children	Entire observation period
Conical classrooms	Free seating, dialogue, participation	Interactive learning	Natural materials	Effective	Positive spatial perception → better concentration	15–20 students	Class time
Educational garden	Working with plants, sand play	Experiential learning	Soil, plants, natural textures	Highly effective	Increased responsibility and creativity	~10 students	20–30 minutes
Earthen pathways	Walking, free roaming	Calm behavior	Organic pathway	Effective	Freedom of movement → reduced	~20 students	Multiple intervals

Space type	Behavior type	Category	Environmental element	Design effectiveness	Behavioral analysis	Number & frequency	Observation time
					oppositional behavior		
Garden and trees / natural equipment	Climbing, exploration, testing limits	Controlled risky play	Wood, elevated elements	Effective (with supervision)	Increased self-confidence without injury	6–8 students	15 minutes

Table 3. Behavioral Mapping – Maktabkhaneh Dr. Mosahab (observations by the author)

Space	Space type	Number of students	Behavior type	Duration of presence (minutes)	Interaction with architecture	Emotional indicators
North courtyard	Open	15	Group play	30	Running along the earthen path	Joy, excitement
Semi-open classroom	Semi-open	13	Drawing	60	Sitting on the floor	Calmness, concentration
Educational garden	Open	11	Sand play	20	Bending down, touching soil	Creativity, curiosity
Circulation path	Open	9	Free running	10	Moving along the earthen path	Excitement, vitality
Conical classroom	Indoor	7	Listening to the teacher and discussion	60	Sitting on chairs	Attention and group interaction

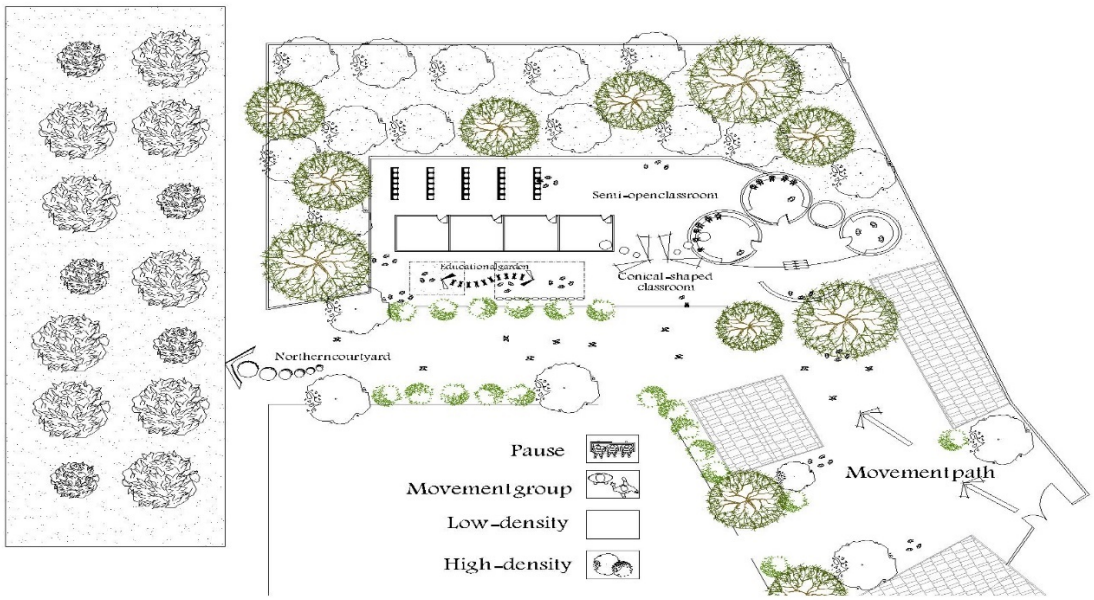


Figure 9: Behavioral mapping – Maktabkhaneh Dr. Mosahab (observations by the author)
Table 4. Behavioral Findings- Shadmehr Boys' Elementary School, Chaboksar (observations by the author)

Space type	Behavior type	Category	Key environmental element	Design effectiveness	Behavioral analysis	Number & frequency	Observation time
Yard – lawn and garden	Sitting, talking, walking	Social interaction	Natural grass, metal benches	Effective (creates a place for pausing and interaction)	Greenery supported calm, friendly group interaction.	About 18–20 students (5th–6th grade)	15-minute recess
Yard – asphalt area	Running, chasing games	Vigorous play	Hard asphalt surface	Relatively ineffective (lacking safety and variety)	High energy but increased risk of falls.	30–35 students (1st–3rd grade)	15 minutes
Classroom	Sitting, writing, listening	Controlled behavior	Large but closed window, limited daylight and ventilation	Ineffective (poor ventilation and restricted movement)	Heat and limited space caused restlessness.	Whole class (25–30 students)	Entire class period
Playless open area	Asking for sports equipment	Behavioral need	Empty paved / unused space	Ineffective	Clear student demand for play facilities.	Group interview with 12 students	After observation
Under canopy	Friendly gathering	Social interaction	Shade, natural breeze	Effective	Semi-open shade promoted calm socializing.	8 students	15 minutes

Table 5. Behavioral Mapping – Shadmehr Boys' Elementary School, Chaboksar (observations by the author)

Space	Space type	Number of students	Behavior type	Duration of presence (minutes)	Interaction with architecture	Emotional indicators
Main courtyard	Open	10	Play and chasing games	12	Running on the asphalt surface	Excitement and high energy
Under the tree	Semi-open	8	Leaning against the tree and talking	8	Touching leaves and branches	Calmness and stillness
Classroom	Indoor	10–20	Listening to the teacher and doing exercises	45	Sitting on benches	Attention and orderly sitting
Shaded bench	Semi-open	10	Discussion and conversation	12	Sitting on the bench	Group interaction
Small garden	Semi-open	12	Walking and talking	8	Touching plants	Calmness and vitality

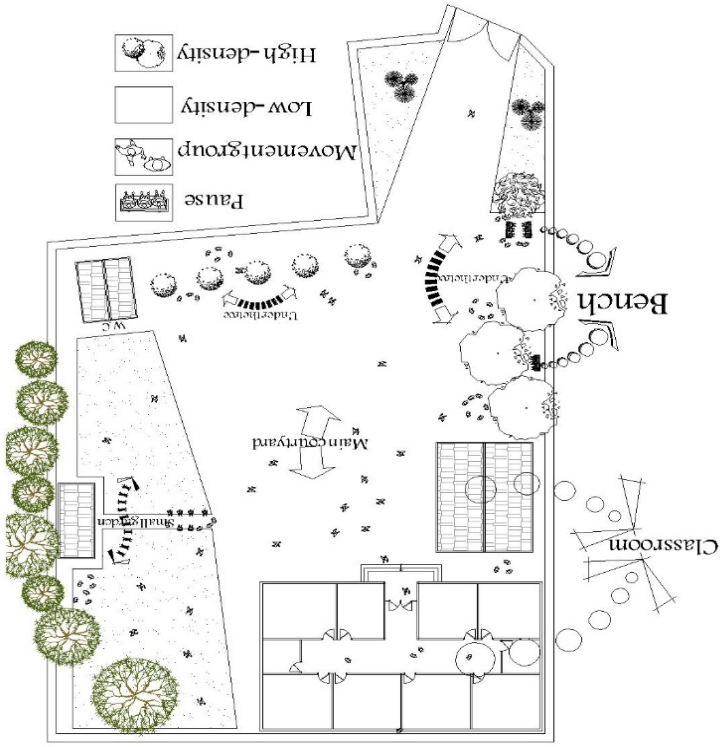


Figure 10: Behavioral mapping of Shahid Shadmehr Elementary School (prepared by the author)

5.2. Perceptual Findings

Table 6. Perceptual Findings – Maktabkhaneh Dr. Mosahab (Author)

Space type	Number observed (out of 60)	Main time of observation	Embodied experience	Key perceptual element	Analytical note – architectural characteristics
Classrooms with local materials	48	Educational workshops	Bodily calm, free breathing	Airflow, natural materials	Wood, natural light, and open ventilation reduced bodily tension.
Gardens and green areas	42	Before and after play	Pausing and watching	Vegetation texture, green color	Plants acted as perceptual focal points, fostering calm and sustained attention.
Semi-open platforms	37	Group activities	Spontaneous group interaction	Soft boundaries, circular layout	Ring-shaped, semi-open spaces encouraged cooperation and dialogue.
Wooden platforms	28	Resting	Sitting on the floor/platform	Low height, bodily flexibility	Lack of formal furniture reduced hierarchy and increased psychological safety.
Garden and trees	22	Play	Climbing and exploration	Height, controlled challenge	Vertical exploration enhanced depth perception and self-confidence.

Table 7. Perceptual Findings – Shadmehr Elementary School, Chaboksar (Author)

Embodied experience	Space type	Key perceptual element	Number observed (out of 95)	Main observation period	Analytical note – architectural feature
Running and frolicking	Asphalt courtyard	Hard, low-quality surface	20	Recess	Lack of soft ground and natural elements → short-term arousal and higher risky behavior.

Embodied experience	Space type	Key perceptual element	Number observed (out of 95)	Main observation period	Analytical note – architectural feature
Friendly gathering	Under canopy	Shade, comfortable thermal conditions	40	15-minute recess	Semi-open, shaded space supports a sense of safety and facilitates conversation.
Avoidance of exposed areas	Open space without greenery	Visual emptiness, direct sun	60	Midday	Absence of shade and vegetation → children avoid the area and rarely pause there.
Use of limited benches	Yard edge	Seating element	25	After play	Shortage of seating → crowding, competition, and reduced positive interaction.

5–3. Themes

Table 8. Extracted Themes from Observations and Interviews at Maktabkhaneh Dr. Mosahhab (author)

Theme	Brief description	Impact on students' experience (60 girls and boys)	Design implication for future-oriented schools
Environmental calm	A strong presence of nature (trees, gardens, green paths, animal sounds) created a calm atmosphere.	More stillness and balanced behavior, fewer conflicts, greater tendency to sit and stay in natural areas. greenschoolyards+1	Preserve vegetation, design shaded pathways, and integrate architecture with the local natural landscape.
Emotion regulation	Multisensory diversity of nature supported lower arousal and more emotional balance.	Fewer risky behaviors and more behavioral stability among both girls and boys. pmc.ncbi.nlm.nih+1	Design climate-responsive open spaces, use natural sounds, and create semi-open zones for psychological "breathing space."
Group interaction	Open and semi-open organic spaces, earthen ground, verandas, and shared areas increased interaction.	More cooperation, shared play, conversation, and interaction across age groups. pmc.ncbi.nlm.nih+1	Strengthen wooden platforms, shared verandas, and circular gathering spaces for group activities.
Play and creativity	Diverse natural settings enabled free and imaginative play.	Exploratory play, building with natural materials, role-playing, and safe running. edutopia+1	Design areas for working with soil, water, and wood, and provide natural exploratory pathways.
Focus and attention	Natural light, open views, and outdoor quiet supported higher concentration.	Increased attention in semi-open classrooms and better focus during activities compared to fully enclosed spaces. pmc.ncbi.nlm.nih+1	Design semi-open classrooms, add large windows facing nature, and use natural colors and local textures.

Table 9. Extracted Themes from Observations and Interviews at Shadmehr Elementary School (author)

Theme	Brief description	Impact on students' experience (95 boys)	Design implication for similar schools
Environmental calm	Limited but existing natural elements (a small garden, green lawn) created calm pause points.	Quiet group gatherings, low-tension conversations, and fewer aimless runs for part of the students.	Expand small green pockets, add natural shade and seating platforms for rest and calm.
Emotion regulation	Lack of sufficient shade and crowding in small classrooms increased negative arousal; brief exposure to greenery helped to moderate emotions.	Need to leave the classroom, turning on fans, restlessness in 6th grade, and repeated requests for more play space.	Design better-ventilated classrooms, provide open areas for emotional release, and add artificial turf for sports activities.

Theme	Brief description	Impact on students' experience (95 boys)	Design implication for similar schools
Group interaction	A metal bench next to the garden functioned as a small social interaction node.	Group sitting, friendly conversation, and formation of positive relationships among older students.	Create group seating areas with circular layouts and integrate natural elements around them.
Play and creativity	Limited play equipment led to movement patterns shaped by lack of space.	Risky running games among younger children; inadequate standard football space for older students.	Add an artificial-turf pitch, safe play routes, and creative zones such as a sand pit or small educational garden.
Focus and attention	Dark, poorly ventilated classrooms reduced concentration; brief exposure to open space improved attention.	Restlessness in 6th grade and reduced focus during long, traditional lessons.	Provide views to greenery from classrooms, add natural potted plants, and use controlled natural light.

Comparative Table 10. Shadmehr Elementary School and Maktabkhaneh Dr. Mosaheb (author)

Comparison axis	Shadmehr Elementary School	Maktabkhaneh Dr. Mosahab	Interpretation of differences and effects
Natural environment and contact with nature	Limited to a small garden and lawn; mainly asphalt courtyard	Extensive natural setting with open green space, educational gardens, earthen ground, trees, and vegetation	The extensive presence of nature at the Maktabkhaneh fosters calm, concentration, and a stronger sense of belonging, whereas spatial limitations at Shadmehr result in weaker effects.
Class structure and architecture	Conventional classrooms, closed windows, high density, limited light and ventilation	Conical, wooden, semi-open classrooms with blurred boundaries between indoors and the yard	Embodied, open architecture at the Maktabkhaneh enhances focus, interaction, and creativity; the conventional layout at Shadmehr restricts movement and limits social interaction.
Teaching approach and teacher–student interaction	Traditional, teacher-centered, note-taking and homework focused	Dialogue-based, teacher as facilitator, activities chosen by students	At the Maktabkhaneh, learning is more meaningful and participatory, supporting emotion regulation and social skills; at Shadmehr, educational pressure and structural constraints reduce this potential.
Student behavior	Limited play and age-segregated groups; calm but somewhat restless in class	Free play, rich group interaction, creative and mixed-age activities	Freedom and strong contact with nature at the Maktabkhaneh increase creativity, cooperation, and empathy; Shadmehr provides fewer opportunities for such interactions.

Summary of Findings

A comparative case study of two schools with contrasting approaches reveals that architectural design and the presence of nature significantly influence students' emotional regulation, social interaction, and creativity. At Shadmehr Elementary School, despite limited greenery and an asphalt courtyard, older students often chose to sit near the lawn or small garden to talk, while younger children primarily engaged in running and simple games. Traditional, teacher-centered classrooms with restricted space and poor ventilation limited movement and interaction, leading to reduced concentration during longer lessons. Minor enhancements, such as the addition of a video projector, bright colors, and potted plants, appeared to boost students' motivation and positive mood, yet their effect was notably smaller compared to the benefits of extensive outdoor nature exposure.In contrast, Maktabkhaneh Dr. Mosaheb, designed with a strong emphasis on nature, semi-open classrooms, and expansive outdoor spaces, offered a highly embodied and multisensory learning experience. Interactions with soil, plants, natural light, and ambient sounds fostered feelings of calm and belonging, while creative activities, play, and participatory learning were accompanied by high engagement levels. The freedom to choose where to sit and what to do, combined with facilitator support and dialogue-based teaching, promoted

better emotional regulation, enhanced concentration, and stronger group interaction across all age groups. Parents also reported noticeable improvements in their children's calmness and focus.

(Comparison of Research Findings with Reference Theories)
Table 11) Comparison of Research Findings with Theories and Reference Studies (Two Schools) (Author)

Finding	Dr. Mosahab Maktabkhaneh	Shahid Shadmehr Elementary School	Theory / reference study	Type of source	Alignment analysis
Group interaction and cooperation	Very high; group play and empathy across age groups	Moderate; interaction mostly limited to outdoor spaces and recess	Environmental psychology theory (Ulrich, 1984)	Book / article	Natural settings enhance social interaction; effect stronger at the Maktabkhaneh.
Socially risky behaviors	Very low; freedom of movement and embodied experience reduce tension	Low; mostly confined to yard use and contact with natural elements	Attention Restoration Theory (Kaplan & Kaplan, 1989; Kaplan, 1995)	Book / article	Nature exposure reduces stress and risky behavior; impact is deeper in the nature-based school.
Focus and attention	Marked improvement; creative and project-based activities	Partial improvement mainly after recess	Biophilic design studies (Kellert, 2018)	Article / literature review	Biophilic features enhance attention; clearer gains at the Maktabkhaneh.
Sense of place and ownership	Very strong; students describe the space as a "second home"	Limited; yard and classrooms generate only partial attachment	"Sense of place" theory (Norberg-Schulz, 1979)	Book / phenomenological theory	Embodied contact with nature strengthens place attachment; much stronger in the nature-based school.
Embodied and multisensory experience	Highly active; soil, sounds, light, and natural materials	Partial; limited soil contact and natural light	Pallasmaa (2005) – embodied architectural experience	Book / architectural theory	Multisensory space supports calm and learning; Maktabkhaneh is a fuller example.
Creativity and self-chosen activities	High; children choose activities and co-create natural spaces	Moderate; mostly simple games and basic classroom tasks	Li & Sullivan (2016) and related studies	Article	Direct nature contact boosts creativity; effect is higher in the nature-based school.

Conclusion

Nature-based school architecture, by offering freedom of movement, direct sensory contact with natural

elements and semi-open spaces, can substantially enhance students' self-regulation, reduce stress and foster healthier social behavior. Therefore, nature should be viewed not merely as decoration but as a vital educational resource and a central element of school design. This sequence of effects suggests that nature-oriented design serves as an effective intervention for supporting children's mental well-being and should be prioritized in the planning agendas of both architects and educational policymakers.

Table 12) Research Hypotheses (Author)

Hypothesis	Result	Explanation
Nature interventions increase positive spatial perception	Supported	Students at the Maktabkhaneh showed a more positive perception of space, a stronger sense of belonging, and a deeper embodied understanding compared to Shadmehr School.
Nature-oriented architecture helps reduce negative emotions.	Supported	Behavioral data indicated that open spaces, natural light, and natural materials contributed to calmness and reduced tension among students.
Increased positive perception and calmness reduce socially risky behaviors.	Supported	In the nature-based environment, socially risky behaviors were noticeably less frequent, whereas in the school with minimal nature, more intense and sometimes risky physical play was observed.

Table 13) Design Recommendations and Suggestions for Future Research (Author)

Number	Theme	Design recommendation and directions for future research
1	Strengthening connection with nature	Design open and semi-open spaces with native vegetation, and experimentally assess how different types of greenery affect students' social and emotional behavior in future studies.
2	Enhancing social interaction	Create small gathering areas, group seating, and inviting circulation paths; conduct comparative studies on how different furniture layouts influence positive interactions.
3	Improving spatial perception quality	Use visual wayfinding elements, calming colors, and natural light; examine how different lighting schemes and color palettes affect concentration and perceived safety.
4	Reducing risky behaviors	Design easily supervised spaces, eliminate blind spots, and strengthen visual transparency; future research can test links between natural surveillance and reductions in risky behavior.
5	Embodied architecture	Develop spaces that stimulate movement, sensory experience, and physical play; proposed future studies can measure how embodied experiences reduce tension and increase calm.
6	Emotion regulation	Design calming spaces such as garden paths, natural soundscapes, or small water features; future work can compare the effects of different calming environments on emotional behaviors.
7	Spatial flexibility	Create multipurpose areas that can support play, learning, and social interaction; evaluate in future studies how flexible spaces influence students' behavior over time.
8	Technology and smart monitoring	Use behavioral sensors, movement-flow analysis, and smart tools to monitor activity; future research can employ these precise data to model and interpret behavioral patterns.

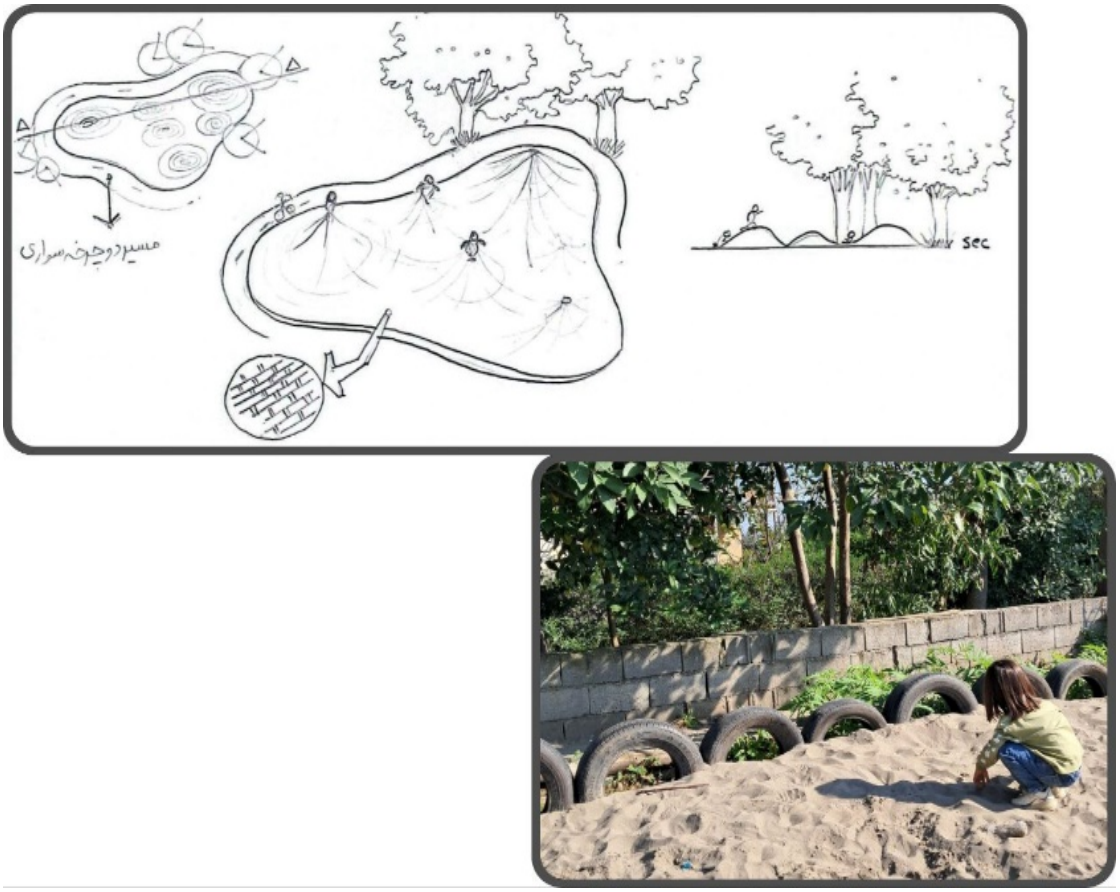


Figure 11: Embodied Architecture Design Recommendations for Maktabkhaneh Dr. Mosaheb (Author)

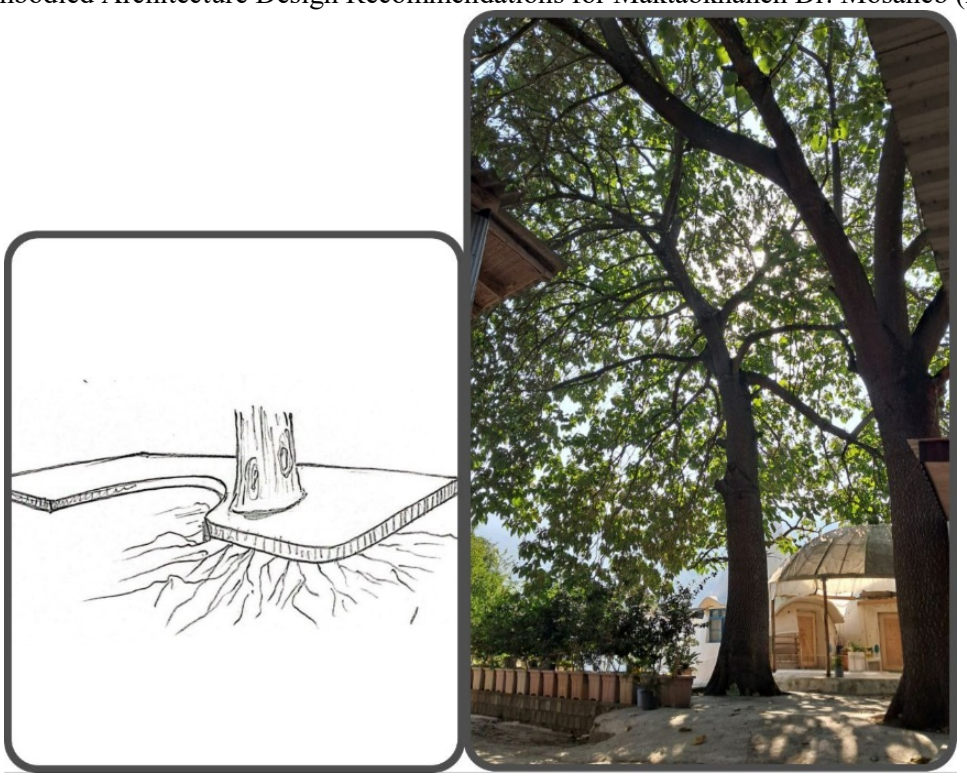


Figure 12: Design Recommendations to Enhance Social Interactions at Maktabkhaneh Dr. Mosahab

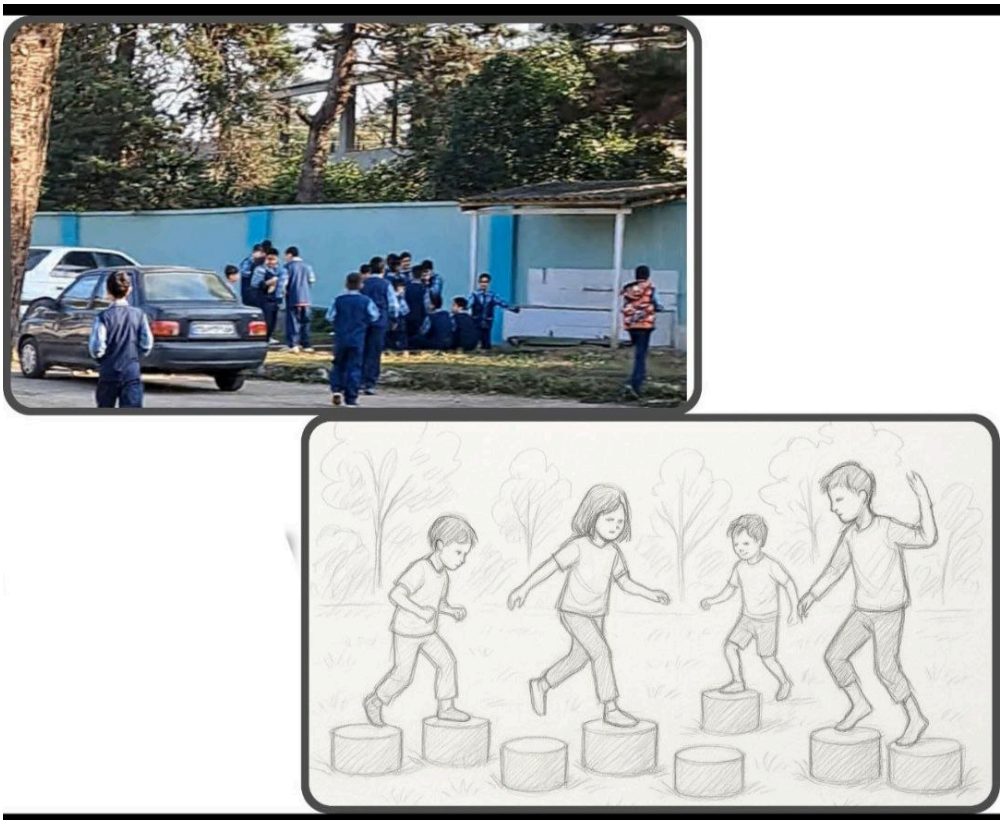


Figure 13: Spatial Design Recommendations for Emotion Regulation at Shadmehr Elementary School



Figure 14: Spatial Flexibility Design Recommendations at Shadmehr Elementary School

The role of the architectural environment on the behavior of elementary school students
The comparison of two educational settings with contrasting approaches demonstrates that school architecture is far more than a neutral backdrop for instruction; it actively shapes students' behavior, emotions, and social

interactions. At Maktabkhaneh Dr. Mosahab, where nature is integrated into the school's physical structure, the architecture played a clear role in regulating, moderating, and guiding student behavior. Open spaces, flexible boundaries, the presence of plants, and natural textures fostered feelings of freedom, safety, and belonging, which in turn reduced risky behaviors, aggression, and anxiety, while encouraging dialogue, creative play, and cooperative group activities.In contrast, Shadmehr School, with its more constrained and less nature-oriented environment, was linked to higher tension, a stronger need for intense physical activity, a desire to escape enclosed spaces, and the formation of small peer groups with limited interaction. Overall, the findings suggest that when architectural spaces support embodied experience, freedom of movement, contact with nature, and perceptual diversity, students' behavior shifts from impulsive emotional reactions to more organized, calm, and prosocial patterns.

Table 14) Impact of Natural Spatial Features on Students' Emotion Regulation and Social Interactions

Environmental / nature feature	Behavioral / psychological effect on students
Wider visual horizons (open views)	Reduced anxiety
Natural light and ambient environmental sounds	Increased calmness
Group and semi-open social spaces	Increased social interaction
Sensory contact with soil, wood, and plants	Reduced risky behaviors and increased creativity

In this study, architecture acted as a behavioral regulator: behavior was shaped not through external control, but through intelligent, nature-based design that responds to children's sensory, emotional, and social needs, guiding their conduct in a natural and lasting way.

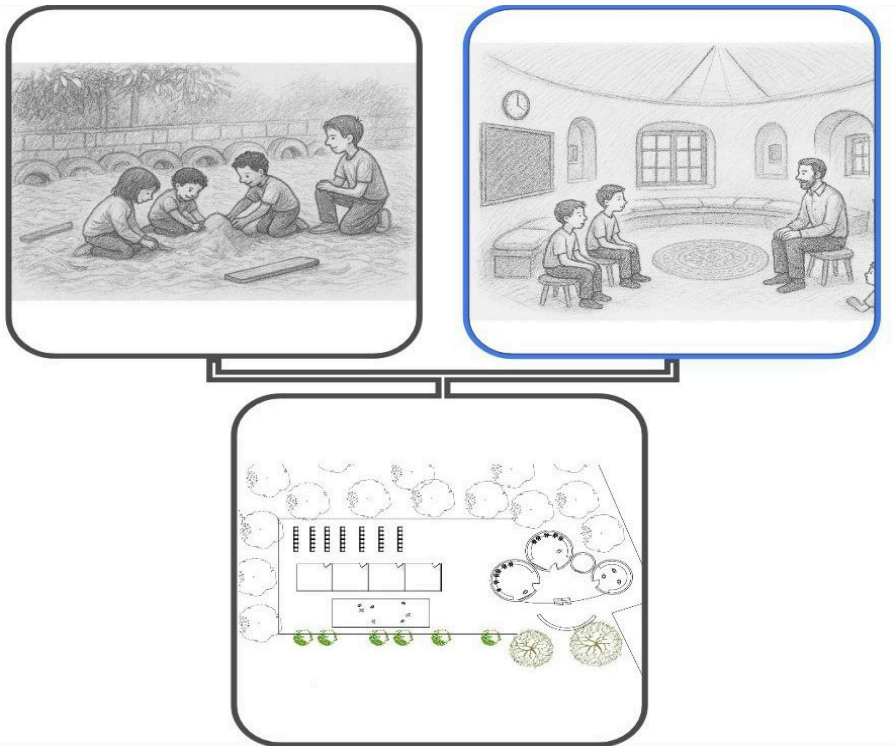


Figure 15: The Role of Architecture in Shaping Student Behavior at Maktabkhaneh Dr. Mosaheb

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IMPROVING TIME SERIES FORECASTING BASED ON BLENDING ENSEMBLE LEARNING FOR EMERGENCY DEPARTMENT ARRIVAL

Abdullah Ammar KARCIOĞLU[75]

Abstract
Time series analysis involves forecasting future data points based on historical data patterns. Within the literature, time series estimation is typically categorized into two main techniques: prediction model selection and prediction model combination. The conventional approach for estimating both seasonal and non-seasonal time series data involves either selecting a single optimal model from a set of candidate models using specific criteria or employing a particular technique. However, this approach may inadvertently disregard the inherent risks associated with the chosen model. By scrutinizing historical data, we gain valuable insights that inform our decision-making processes, guide our business strategies, and provide a deeper understanding of forthcoming trends. Time series analysis of healthcare data is considered as an important study in the field of computer science. The more accurate the future data is predicted, the more vital measures for human health can be taken and the costs in the health sector can be minimized. The purpose of the time series algorithms is to predict data in a certain future time interval based on past data. However, instead of using pure versions of time series algorithms, it is necessary to combine these algorithms with new approaches to improve their performance using well-known algorithms to increase the prediction accuracy. The hospital Emergency Department (ED) arrival dataset in Iowa is chosen as dataset. In this study, the twenty-six time series algorithms and LSTM model have been used. Firstly, the top five algorithms with the best results have been chosen. Then, blending ensemble learning-based time series model is proposed by applying mean, median and voting techniques. As a result, the proposed model achieved 92.88% accuracy for the ED arrival dataset. However, the LSTM model achieved 89.03% accuracy the ED arrival dataset. It has been shown that the proposed model has been achieved better results compared to the LSTM model in healthcare dataset.
Keywords: Time Series Forecasting, Ensemble & Deep Learning, Emergency Department Arrival

1. Introduction

The high number of patients in the Emergency Department (ED) causes many problems such as delay in treatment, disruption of medical equipment supplies, and medical errors [1-3]. In 1987, crowded EDs and their adverse effects on the management of hospital resources were first discussed at a conference in New York City [4]. A general definition has not been made for crowded EDs. The American College of Emergency Physicians explained this expression in a conference as "difficulty demands of the ED and the hospital as a whole" [5]. This definition shows that there is an important link between the demand for emergency services and effective service delivery in the ED [6]. By generating future predictions for these time-dependent datasets, the primary objectives include enabling efficient allocation of economic resources, facilitating decision-making processes, implementing measures within healthcare services, and enhancing the overall management of hospital emergency services [7].

Time series analysis involves forecasting future data points based on historical data patterns. Within the literature, time series estimation is typically categorized into two main techniques: prediction model selection and prediction model combination [8]. The conventional approach for estimating both seasonal and non-seasonal time series data involves either selecting a single optimal model from a set of candidate models using specific criteria or employing a particular technique. However, this approach may inadvertently disregard the inherent risks associated with the chosen model. By scrutinizing historical data, we gain valuable insights that inform our decision-making processes, guide our business strategies, and provide a deeper understanding of forthcoming trends [8].

There may be differences between the predictions of time series algorithms and the predictions of machine learning algorithms. Their performance can be examined as a result of experimental studies. While many machine learning algorithms can be used in time series analysis, they are not the only option for time series problems and do not always produce effective results. Unlike machine learning algorithms, the time series algorithm can make predictions and analysis beyond existing data. Consequently, in this research study, the focus is on prediction using time series algorithms rather than relying on machine learning or deep learning algorithms for prediction. This approach aims to conduct time series forecasting on healthcare data by utilizing

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a variety of time series forecasting algorithms, which offers independence from specific datasets and demands fewer hardware resources and costs.
While time series forecasting is a versatile and widely applicable technique, it does come with its set of limitations. Given that forecasting is an amalgamation of data analysis approaches rather than a rigidly defined method, analysts and data scientists should be mindful of the constraints inherent to forecasting models as well as the characteristics of the data itself. Ensemble learning is recognized as a highly promising strategy, and it has found significant success in both research and industry settings, owing to the diverse array of individual models at its disposal. This learning paradigm revolves around the concept of training numerous low-accuracy models and subsequently amalgamating their predictions to generate a high-accuracy supermodel. Instead of striving to develop a single super-accurate model, ensemble learning capitalizes on the collective strength of these weaker models. In conclusion, ensemble classifiers are frequently capable of producing models characterized by exceptional accuracy [9].
Ensemble learning helps as a valuable tool for enhancing the results of prediction models by harnessing the power of multiple models, thereby augmenting predictive performance beyond what a single model can achieve. We can list our contributions in this study as follows;
Blending ensemble learning based time series forecasting for different healthcare datasets is proposed.
92.88% accuracy value has been obtained in the ED arrival dataset.
It has been observed that the proposed model achieves better results compared to the LSTM deep learning architecture.
Instead of using artificial intelligence models that require high hardware costs, a time series model with low hardware and time efficient manner is proposed.

2. Methodology

In Section 2, the dataset, time series algorithms, ensemble learning techniques, and the proposed model in this study are explained in detail.
Conclusion section should state clearly the main conclusions of the research and give a clear explanation of their importance and relevance. Summary illustrations may be included.

2.1. Tables and Figures

The hospital ED arrival dataset in Iowa was used in this study. As shown in Fig. 1, the dataset consists of the number of hospital ED arrivals recorded hourly between January 2014-August 2017 [7]. This dataset allows for evaluating the effectiveness and accuracy of the proposed model in forecasting ED arrival numbers at different time intervals.

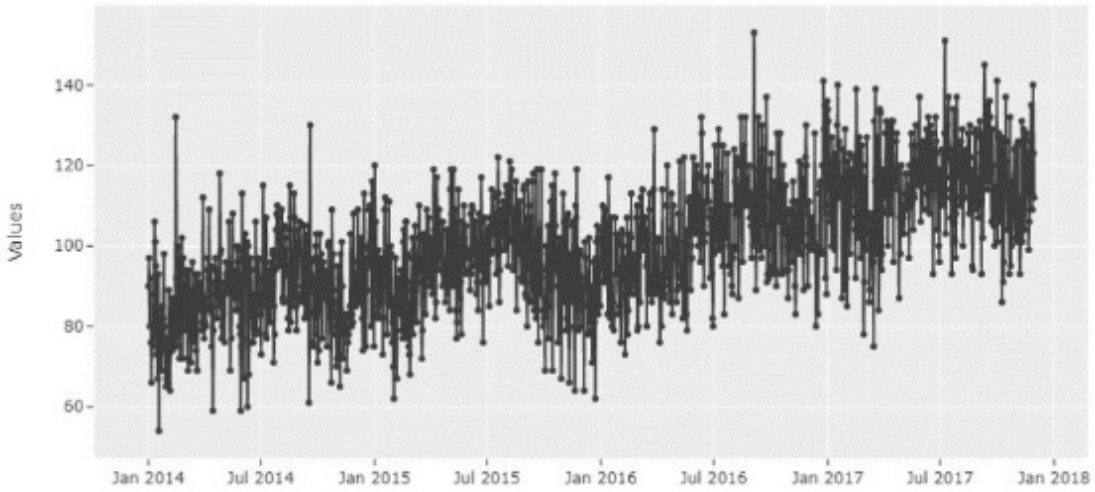


Figure 1. The hourly number of hospital ED arrivals in Iowa.

2.2. Time Series Algorithms Used

In this study, the number of ED arrivals in the next 30 days in Iowa was forecasted. Time series analyses were performed by applying twenty-six different time series algorithms to the dataset for prediction. The time series algorithms and abbreviations used in this study are shown in Table 1.
Table 1. The time series algorithms and abbreviations used in this study.

No	Abbreviation	Algorithm	No	Abbreviation	Algorithm
1	theta	Theta Forecaster	14	ada_cds_dt	AdaBoost
2	exp_smooth	Exponential Smoothing	15	gbr_cds_dt	Gradient Boosting
3	Ets	ETS	16	polytrend	Polynomial Trend
4	auto_arima	Auto ARIMA	17	knn_cds_dt	K Neighbors
5	llar_cds_dt	Lasso Least Angular Regressor	18	rf_cds_dt	Random Forest
6	lasso_cds_dt	Lasso	19	et_cds_dt	Extra Trees
7	huber_cds_dt	Huber	20	lightgbm_cds_dt	Light Gradient Boosting
8	ridge_cds_dt	Ridge	21	snaive	Seasonal Naive
9	br_cds_dt	Bayesian Ridge	22	arima	ARIMA
10	lar_cds_dt	Least Angular Regressor	23	dt_cds_dt	Decision Tree
11	en_cds_dt	Elastic Net	24	naive	Naive Forecaster
12	lr_cds_dt	Linear	25	grand_means	Grand Means Forecaster
13	omp_cds_dt	Orthogonal Matching Pursuit	26	par_cds_dt	Passive Aggressive

2.3. Blending Ensemble Learning Techniques

In this study, the number of ED arrivals in the next 30 days in Iowa was forecasted. Time series analyses were performed by applying twenty-six different time series algorithms to the dataset for prediction. The time series algorithms and abbreviations used in this study are shown in Table 1.

In this study, mean, median, and voting blending methods were applied to enhance the accuracy of results obtained from time series algorithms. Blending is a powerful ensemble learning technique that leverages a machine learning model to combine predictions generated by multiple models. Unlike k-fold cross-validation, blending adopts a "one-holdout set" approach, where a small portion of the training data (validation) is used to generate predictions, which are then "stacked" to construct the training data for the meta-model. Additionally, predictions from the test data form the test set for the meta-model. PyCaret library in Python was used for time series analysis implementation. Model blending techniques facilitated ensemble learning by combining multiple models to improve predictive accuracy. This allowed us to capitalize on the strengths of various models and enhance overall performance.

Mean ensemble calculates the average of all model forecasts for the final prediction. Median ensemble computes the median value of all model forecasts. Voting ensemble combines individual forecasts while considering user-assigned weights, offering flexibility. By using these ensemble methods, we aimed to improve the reliability and accuracy of predictive models.

The *mean* ensemble method produces estimates for each data point by averaging all the predicted values, returning the mean as the result. This method is commonly used in both prediction and classification problems, and its calculation is given in Eq. 1.

The *median* represents the middle value within a dataset, which means that 50% of the data points possess values equal to or smaller than the median, while the other 50% have values equal to or greater than the median. The 'median' is computed as shown in Eq. 2 for odd numbers of data points and in Eq. 3 for even numbers of data points.

The *voting* ensemble method aggregates predictions from multiple models using a voting mechanism to enhance prediction accuracy and prevent overfitting. In this approach, the predictions of each model are combined, and the class with the most votes is chosen as the final prediction—a strategy known as "hard voting." The ensemble utilizes normalized weights for each algorithm are given in Eq. 4 and 5.

$$\mathbf{H(x)} = \frac{\mathbf{1}}{\mathbf{T}}\sum_{\mathbf{i=1}}^{\mathbf{T}} \mathbf{h_i(x)} \quad (1)$$

$$\mathbf{Median_{odd}} = \left(\frac{\mathbf{n+1}}{\mathbf{2}}\right)^{\mathbf{th}}\mathbf{term} \quad (2)$$

$$\mathbf{Median_{even}} = \frac{\left(\frac{\mathbf{n}}{\mathbf{2}}\right)^{\mathbf{th}}\mathbf{term}+\left(\frac{\mathbf{n}}{\mathbf{2}}+\mathbf{1}\right)^{\mathbf{th}}\mathbf{term}}{\mathbf{2}} \quad (3)$$

$$\mathbf{algoWeight_i} = \mathbf{1} - \left(\frac{\mathbf{algo_mape_i}}{\sum_{\mathbf{i=1}}^{\mathbf{5}}\mathbf{algo_mape_i}}\right) \quad (4)$$

$$\mathbf{metric} = \mathbf{1} - \mathbf{algoWeight_i}, \mathbf{w_i} = \frac{\mathbf{1}}{\sum_{\mathbf{i=1}}^{\mathbf{5}}\mathbf{metric}} \quad (5)$$

2.4. Performance Evaluation Metrics

Several performance metrics such as MAE, RMSE, MAPE and Accuracy have been performed to prediction models used in this study. MAE calculates the absolute value of the difference between each predicted value and each corresponding actual value and calculates its average, and is given in Eq.6. Lower MAE values indicate better performance, providing a simple assessment of prediction accuracy. As calculated in Eq. 7, RMSE calculates the square root of the mean of the squares of the differences between the predicted value and the corresponding actual value. RMSE penalizes larger errors more significantly, making it susceptible to outliers. As calculated in Eq. 8, MAPE calculates the average of the absolute percentage differences between predicted values and corresponding actual values. Then, it expresses the prediction accuracy as a percentage. As calculated in Eq. 9, accuracy metric gauges the proportion of correctly predicted outcomes to the total number of predictions. It is often used in classification tasks, where higher accuracy values signify better model performance. These evaluation metrics collectively offer a comprehensive view of the performance of the estimation methods, allowing for comparisons and informed decisions regarding their effectiveness. MAE, RMSE, MAPE and Accuracy values are shown respectively as shown below. (where n is equal to the number of observations, y_i is eual to i-th observed value and $\hat{y}_i$ is eual to the i-th estimated value):

$$\mathbf{MAE} = \frac{\mathbf{1}}{\mathbf{n}}\sum_{\mathbf{i=1}}^{\mathbf{n}}|\mathbf{y_i} - \hat{\mathbf{y}}_\mathbf{i}| \quad (6)$$

$$\boldsymbol{RMSE} = \sqrt{\frac{\sum_{\mathbf{n=2}}^{\mathbf{n}}(\mathbf{y_i}-\hat{\mathbf{y}}_\mathbf{i})^2}{\mathbf{n-1}}} \quad (7)$$

$$\boldsymbol{MAPE} = \sum_{\mathbf{i=2}}^{\mathbf{n}}\left|\frac{\mathbf{y_i}-\hat{\mathbf{y}}_\mathbf{i}}{\mathbf{y_i}}\right| \times \frac{\mathbf{100}}{\mathbf{n-1}} \quad (8)$$

$$\boldsymbol{Accuracy} = (\mathbf{1} - \mathbf{MAPE}) \quad (9)$$

2.5. The Proposed Model

In this study, the number of ED arrivals for the next 30 days in a hospital in Iowa was forecasted using blending ensemble learning-based time series algorithms. The general framework of the model proposed in this study is shown in Fig. 2.

First, twenty-six different time series algorithms were performed for the prediction, and the results of each algorithm were examined. The top five time series algorithms were selected according to their MAPE values. By tuning each algorithm, the best parameter values were achieved for improved results. Subsequently, voting, mean, and median blending ensemble learning methods were applied to these top-performing algorithms, and the results were evaluated. Finally, the forecasting results of the three different blending ensemble methods were compared.

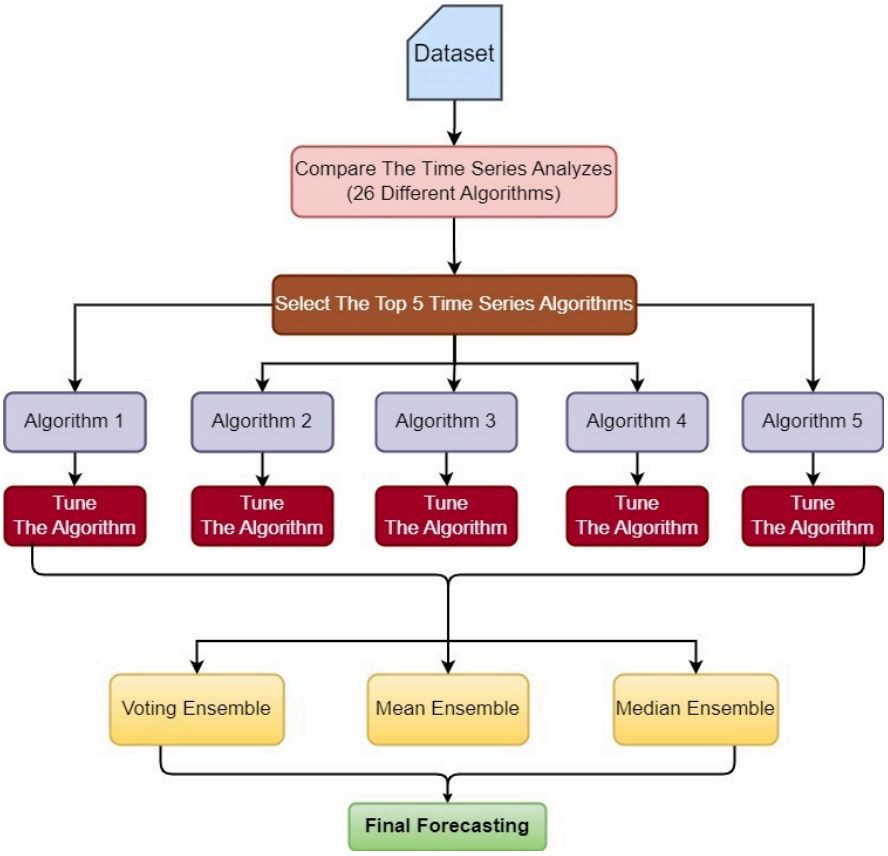


Figure 2. The general flowchart of the proposed model.

Model finalization serves as the concluding step in the experiment. In a typical prediction workflow using PyCaret, the process commences with the setup and selection of a set of candidate models. So, various modeling techniques are applied, including hyperparameter tuning, ensemble methods, and more. This systematic workflow ultimately guides the identification of the best-performing model, which is then utilized for making predictions on new and unseen data. During the "finalize model" step, the selected model is trained on the entire dataset, encompassing both the training and test (or hold-out) samples.

The main objective of this step is to ensure that the model is well-prepared for deployment in a production environment. By training the model on the complete dataset, it becomes better equipped to provide accurate predictions when faced with real-world, unseen data. This comprehensive training process is crucial to maximize the model's performance and reliability in practical use.

Contrary to previous studies in the literature that performed analysis with a small number of time series algorithms, a large number of time series algorithms were used in this study. This approach allows for detailed analyses that facilitate the selection of the most suitable time series algorithm for forecasting, thereby increasing the accuracy by choosing the best-performing algorithms for subsequent steps.

3. Findings

The number of ED arrivals for the next 30 days in a hospital in Iowa was forecasted using blending ensemble learning-based time series algorithms. The general framework of the model proposed in this study is shown in Fig. 2. As detailed in Section 3.1, this study forecasted the number of ED arrivals for next 30 days in a hospital in Iowa. The dataset was examined before being subjected to experimental study. The number of seasonal periods was chosen as 7, and the k-fold validation value as k=5.

3.1. Tables and Figures

Firstly, twenty-six different time series algorithms were applied to the dataset, and the top five algorithms with the best results in terms of the MAPE performance metric were selected. The runtimes of the algorithms are also shown in the following tables (in seconds). The comparison of time series algorithms is presented in Table 2 for the ED arrival dataset. The values that provide the best results in terms of evaluation metrics and the top five algorithms are shown in bold in the tables.

Table 2. Comparison of time series algorithms for the ED arrival dataset.

Algorithm	MAE	RMSE	MAPE	Accuracy (%)
theta	8.95	11.32	0.0802	91,98
exp_smooth	8.94	11.30	0.0803	91,97
ets	8.93	11.30	0.0804	91,96
auto_arima	9.03	11.34	0.0806	91,94
llar_cds_dt	9.27	11.38	0.0806	91,94
lasso_cds_dt	9.28	11.37	0.0807	91,93
huber_cds_dt	9.26	11.37	0.0807	91,93
ridge_cds_dt	9.27	11.37	0.0807	91,93
br_cds_dt	9.28	11.37	0.0807	91,93
lar_cds_dt	9.27	11.37	0.0807	91,93
en_cds_dt	9.28	11.37	0.0807	91,93
lr_cds_dt	9.27	11.37	0.0807	91,93
omp_cds_dt	9.32	11.44	0.0811	91,89
ada_cds_dt	9.19	11.42	0.0823	91,77
gbr_cds_dt	9.48	11.70	0.0844	91,56
polytrend	9.83	12.07	0.0854	91,46
knn_cds_dt	9.72	11.96	0.0866	91,34
rf_cds_dt	9.77	12.15	0.0878	91,22
et_cds_dt	9.99	12.14	0.0893	91,07
lightgbm_cds_dt	10.2	12.66	0.0918	90,82
Snaive	11.12	13.85	0.0964	90,36
Arima	11.16	13.96	0.0970	90,30
dt_cds_dt	14.06	17.05	0.1206	87,94
naive	15.02	17.76	0.1322	86,78
grand_means	18.84	21.44	0.1544	84,56
par_cds_dt	23.51	34.02	0.2047	79,53

3.2. Tune the Chosen Top 5 Algorithms & Results of Blending Ensemble Learning Based Times Series Algorithms

After the top five algorithms were selected according to the MAPE performance metric, each of these algorithms was tuned. After tuning, the performance metrics of the time series algorithm that produced the best result are shown. Additionally, the best parameter values for each of the top five algorithms were obtained following the tuning process.

As shown in Table 3, after tuning, the accuracy value of the Theta Forecaster algorithm increased from 91.98% to 92.04% for the ED arrival dataset. Up to this stage, the ED arrival dataset was estimated using various time series algorithms. Mean, median, and voting ensemble methods were applied to the top five time series algorithms to further increase the accuracy. The best result for each performance metric is shown in bold. As demonstrated in Table 4, after applying blending ensemble learning methods to the top five time series algorithms, an accuracy value of 92.33% was achieved for the ED arrival dataset.

After tuning the time series algorithms, improved results were obtained in the accuracy rates of the algorithms. As shown in Table 3, all performance metrics were improved after applying ensemble learning methods to the tuned time series algorithms. Thus, better results were achieved in all performance metrics with blending ensemble learning-based time series algorithms, demonstrating that the proposed method can be effectively used for time series estimation in healthcare data. The best parameter values of the selected top five time series algorithms are shown in Table 3.

Table 3. Results of applying ensemble learning methods to tuned time series algorithms.

Algorithm	MAE	RMSE	MAPE	Accuracy (%)
Theta Forecaster	8.95	11.32	0.0802	91.98
Tuned Theta Forecaster	10.12	12.35	0.0796	92.04
Top 5 Algorithm with Mean Ensemble	8.89	11.21	0.0767	92.33
Top 5 Algorithm with Median Ensemble	8.91	11.28	0.0777	92.23
Top 5 Algorithm with Voting Ensemble	8.92	11.29	0.0780	92.20

3.3. Tune the Chosen Top 5 Algorithms & Results of Blending Ensemble Learning Based Times Series Algorithms

In this section, the figures are zoomed in for clarity. The best time series forecasting results after tuning the top five selected time series algorithms (Theta Forecaster algorithm for the ED arrival dataset) are shown in Fig. 3-1. As shown in Table 4, the accuracy value of the Theta Forecaster algorithm for the ED arrival dataset is 91.98%.

After tuning, mean, median, and voting ensemble methods were applied to each of the top five selected algorithms. The time series forecasting results after applying the mean ensemble learning method are shown in Fig. 3-2 for the ED arrival dataset. As shown in Table 4, when the mean ensemble learning method was applied, an accuracy value of 92.33% was achieved for the ED arrival dataset. The best result for the ED arrival dataset was achieved using the mean ensemble learning method.

After applying the median ensemble learning method, the time series forecasting results are shown in Fig. 3-3 for the ED arrival dataset. As shown in Table 4, the median ensemble learning method resulted in an accuracy value of 92.23% for the ED arrival dataset. Similarly, after applying the voting ensemble learning method, the time series forecasting results are shown in Fig. 3-4 for the ED arrival dataset. As indicated in Table 4, when the voting ensemble learning method was applied, an accuracy value of 92.20% was achieved for the ED arrival dataset. It was observed that close values are obtained in all blending ensemble learning-based time series forecasting figures. The forecasted values using these methods are presented in the following tables and figures.

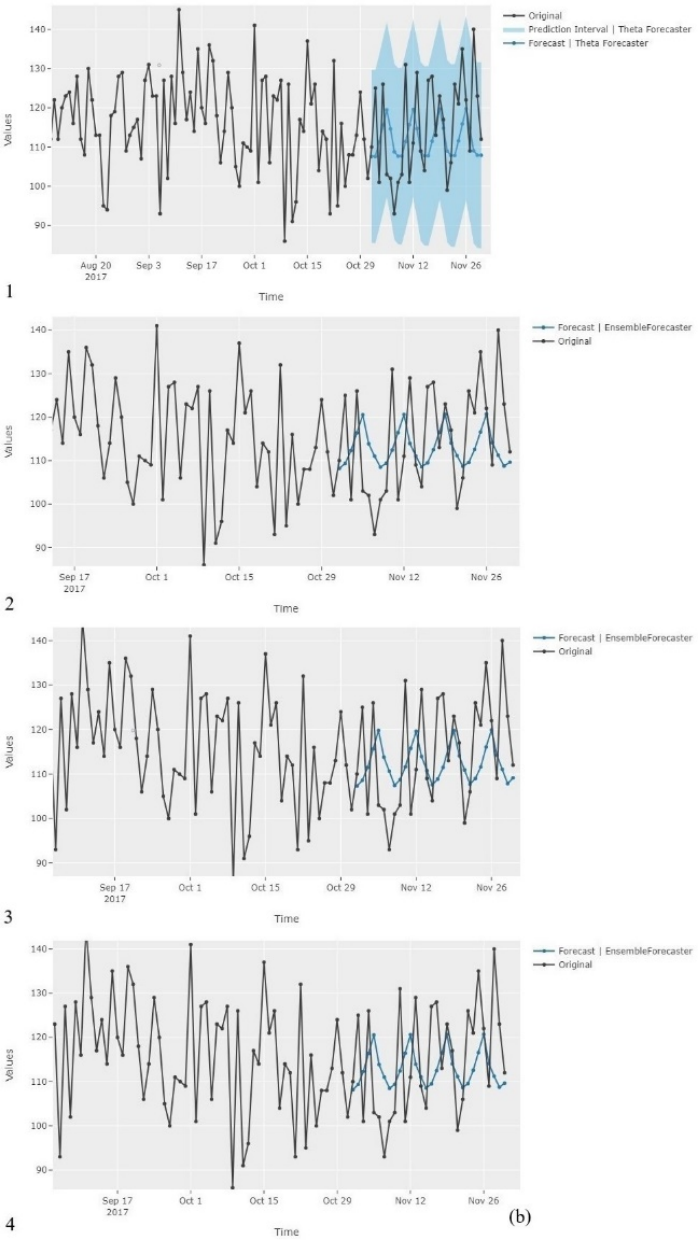


Figure 3. The blending ensemble learning-based time series forecasting for the ED arrival.

In this study, mean, median, and voting ensemble learning methods have been applied to time series algorithms to improve performance. The final estimation of all these ensemble methods constitutes the last step of the experimental studies. As mentioned in Section 2.5, the finalize model recommends the best model for making predictions on new and unseen data. The finalize model fits the model on the entire dataset, including the test/extension sample. The purpose is to train the model on the complete dataset before deployment in production. The final forecasting results for the ED arrival dataset are shown in Fig. 4.

The estimated next 30-days values and actual values of the proposed model for the ED arrival dataset are shown in Table 4. As shown in Table 5, the accuracy value of the proposed model after final forecasting was obtained as 92.88% for the dataset. Higher accuracy rates have been achieved than before by using the final forecasting method. Finally, it has been demonstrated that the proposed model in this study can be effectively used in time series prediction problems for healthcare data.

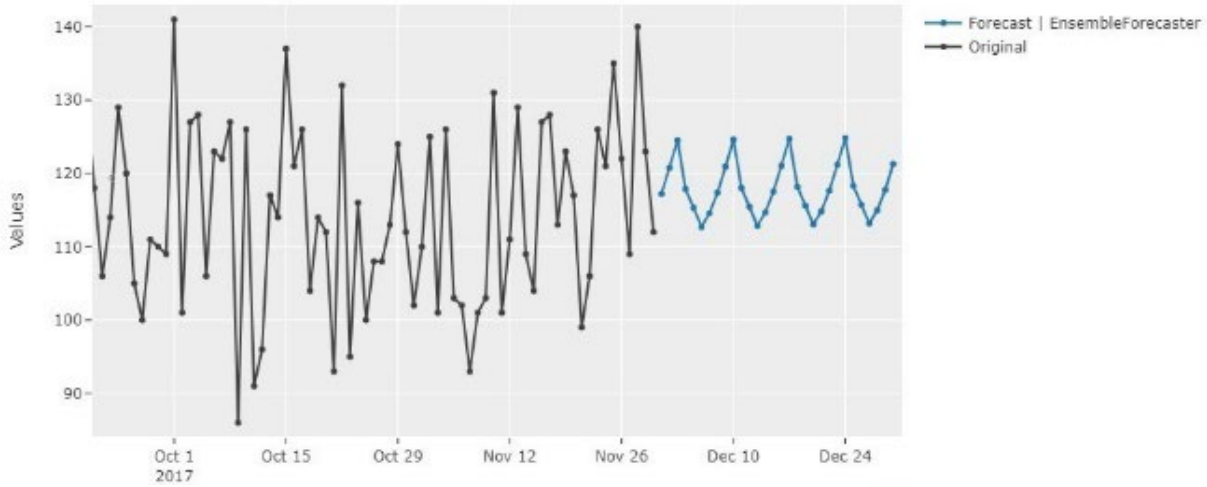


Figure 4. The blending ensemble learning-based time series forecasting for the ED arrival.

Table 4. Results of ensemble learning methods to the tuned time series algorithms.

The # of Next Day	Forecasted Value	Actual Value	Accuracy (%)
1	117	120	97.50
2	111	116	95.69
3	124	135	91.85
4	108	113	95.57
5	86	101	85.15
6	103	108	95.37
7	106	110	96.36
8	117	121	96.69
9	93	107	86.91
10	100	112	89.28
11	88	103	85.43
12	115	117	98.29
13	107	110	97.27
14	114	119	95.79
15	117	125	93.61
16	121	108	87.96
17	124	118	94.91
18	118	108	90.74
19	115	101	86.13
20	113	108	95.37
21	114	102	88.23
22	117	129	90.69
23	121	107	86.91
24	124	119	95.79
25	118	130	90.76
26	115	111	96.39
27	113	106	93.39
28	115	119	96.63
29	117	114	97.36
30	111	105	94.28
The Average Accuracy: 92.88%			

3.4. Results of LSTM

LSTM networks are artificial neural networks developed to address the limitations of traditional RNN networks, such as short-term memory and gradient vanishing. LSTM cells create gates that regulate and control the flow of information, allowing the model to retain relevant data over longer sequences [23]. These gates—

input, output, forget, and cell state—work together to process time-dependent data. The detailed LSTM cell equations are given in Eq. 10–14.

$$i_t = \sigma(W_{xi}x_t + W_{hi}h_{t-1} + W_{ci}c_{t-1} + b_i) \quad (10)$$
$$f_t = \sigma(W_{xf}x_t + W_{hf}h_{t-1} + W_{cf}c_{t-1} + b_f) \quad (11)$$
$$c_t = f_t \odot c_{t-1} + i_t \odot tanh(W_{xc}x_t + W_{hc}h_{t-1} + b_c) \quad (12)$$
$$o_t = \sigma(W_{xo}x_t + W_{ho}h_{t-1} + W_{co}c_t + b_o) \quad (13)$$
$$h_t = o_t \odot tanh(c_t) \quad (14)$$

LSTM architecture, widely used in time series forecasting, was applied to the ED arrival dataset in this study. The layers of the LSTM architecture used is shown in Fig. 5. The results of the next 30-days forecast and actual values for the ED arrival dataset are shown in Fig. 6. By using the LSTM architecture, an accuracy of 89.03% (MAPE: 10.97%) was obtained for the ED arrival dataset.

As a result of the experimental studies, the proposed model achieved a 92.88% accuracy value for the ED arrival dataset, while the LSTM architecture achieved an 89.03% accuracy value. This demonstrates that the proposed model yields better results compared to the LSTM architecture in ED arrival forecasting.

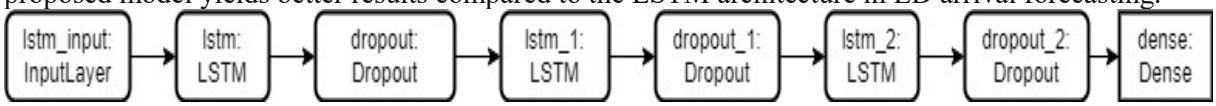


Figure 5. The LSTM model representation.

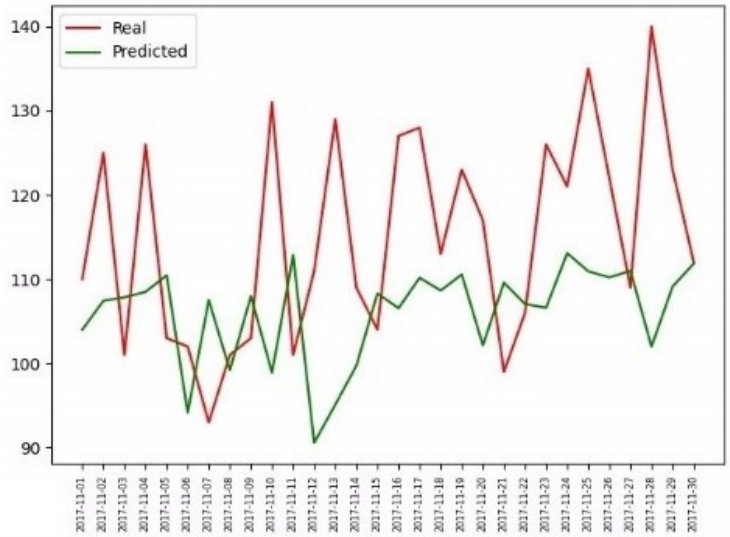


Figure 6. The LSTM model representation.

4. Discussion

Time series estimation is based on estimating the course of the investigated event over time based on previous data. In the literature, time series models and ensemble learning-based models have been used to make predictions in many areas. There are many scientific studies conducted on time series analysis of hospital ED arrival. The remainder of this chapter deals with key studies in the relevant fields.

Numerous studies within the literature have performed to predict the influx of hospital emergency arrivals using time series algorithms. Sudarshan et al. and Whitt and Zhang [10-11] used artificial intelligence techniques to predict ED arrival and occupancy. Jones et al. [12] proposed a multivariate approach to predict the ED volume. Forster et al. [13] investigated the relationship between hospital occupancy rates and length of stay in the ED. Jones et al. [14] estimated the daily number of ED patients in different hospitals using statistical methods. Wiler et al. [15] ED patient numbers and crowding were analyzed using modeling techniques. Carvalho-Silva et al. [16] focused on the number of patients in the ED using the ARIMA model. Matteson et al. [17] proposed an approach that combines integer-valued time series models with a dynamic latent factor structure.

Choudhury [18] used ARIMA, Holt-Winters, TBATS and neural networks to estimate the hourly number of ED patients. Asheim et al. [19] performed real-time prediction of ED patients using prehospital data. Sahu et al. [20] used weather information to predict hospital patient demand using a Hierarchical Bayesian model. Kam et al. [21] used statistical time series algorithms such as SARIMA to estimate the number of patients

arriving at ED in the region. Xu et al. [22] used the number of patients coming to the ED to estimate and focused on the importance of the factors affecting this number.

5. Conclusion and Recommendations

In this study, blending ensemble learning-based time series forecasting was performed to estimate the number of ED arrivals in a hospital in Iowa. First, time series algorithms were applied to the ED arrival dataset in the proposed model. The top five time series algorithms with the best accuracy rates were selected, tuned, and their accuracy rates were improved. Subsequently, mean, median, and voting ensemble learning methods were applied to each of the selected top five algorithms, further increasing the accuracy value of the proposed model. Finally, the final forecasting was made.

Compared to other studies in the literature, high accuracy rates were obtained using the proposed model in this study. The accuracy rate of the proposed model after final forecasting was obtained as 92.88% for the ED arrival dataset. This demonstrates that the proposed model can be effectively used in time series forecasting problems for healthcare data.

It was also observed that the proposed model achieves better results compared to the LSTM deep learning architecture. Instead of using artificial intelligence models that require high hardware costs, the proposed time series model offers low hardware requirements and efficient performance, enabling more effective use of healthcare resources.

In the future, different studies can be carried out by developing various time series models. For example, the proposed model can be applied not only to healthcare datasets but also to other time-series-based datasets. New ML and DL models can be developed to compare the advantages and disadvantages of the proposed approach. Finally, multivariate versions of the proposed model can also be investigated in future research.

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ANALYSIS OF CONTEMPORARY ART AND ITS EFFECTS ON PEOPLE'S LIVES (CASE STUDY OF WOODEN ART PRODUCTIONS IN UNIVERSITIES)

Zeynab Maradian Gojehbaglo[76], Mostafa Rezapour[77]

Abstract
In the field of globalization of contemporary art and the use of new technologies and the changes that have occurred, the existence of novice artists, amateurs, and art graduates defines this field in the contemporary world. In this regard, artists must accept the values of a reversed world when entering the world of contemporary art. In this way, they can offer a newer definition between the values of the aesthetic world of their artworks and products and the needs and tastes of society. This essay attempts to examine contemporary art in the present world with the tastes and needs of people's consumption lives, considering the productions made in universities in the field of wood arts. The purpose of this research is to provide appropriate solutions for artistic productions and people's tastes in choosing and buying these types of goods. The question raised in this research is, how can people's tastes be changed in choosing contemporary artistic products? The method of the present research is descriptive-analytical and the information is collected through library and internet studies. The present research shows that artistic productions have taken steps in society and in the direction of modernity, but they have not found such a definition and place for themselves in the process of people's lives. Because working and training can only be useful for the newer aspects of the design and execution of works and for the artists themselves, but the basis of changes in people's lives in choosing new goods must follow the trend and fundamental structure. Such as advertising in cyberspace and the media, which have the greatest impact on the trend and change of people's thoughts.
Keywords: Contemporary art, artists, wooden art products, people's taste.

Introduction

Contemporary art, as one of the most prominent manifestations of cultural and social changes, has become a global language, relying on innovations and new ideas, and its manifestation has found a place for itself in everyday life. Among the artistic disciplines that have been present in these changes in a special way is wood art, which has also received special attention in Iranian universities. Wood art has found a special place in contemporary art due to its natural characteristics, diversity in processing, and various capabilities in execution techniques. In addition to decorating and beautifying spaces, this art is considered a tool for expressing social and cultural concepts and messages, which for this purpose includes the use of various motifs in its design process, including the use of inscriptional, geometric, plant and vegetable motifs, human and animal motifs, or abstract motifs with a specific content. Also, the execution of the work can be done with techniques such as carving, volume, mosaic, inlay, wood painting, and the like, depending on the type of design and content. This article examines and analyzes wood artworks in Iranian universities, especially Tabriz Islamic Art University, and evaluates its impact on people's lives in various cultural and social dimensions. The research method of this article is based on a qualitative analysis of wood artworks in universities that use modern artistic techniques and processes. The aim of this research is to understand and analyze the trends in the effects of contemporary art techniques and processes on wood art and to provide appropriate solutions to reflect it on the social and cultural life of the people of Iran. Based on selected examples of wood artworks in universities and art workshops in the country, this research attempts to clarify the relationship between contemporary techniques and social and cultural issues. The findings show that this art is not only used in the field of decorating and beautifying spaces, but has increasingly become a tool for expressing individual and collective identities. In this regard, wood artists in Iran have created their works by using local materials and at the same time global techniques, which carry deep and influential cultural messages. These developments in wood art at the university level, especially in art disciplines, are taking shape as a cultural and social phenomenon that will have widespread effects on social and cultural perspectives in Iranian society. Providing advertisements in various media in order to introduce and recognize authentic Iranian-Islamic identities and also helping graduates of art disciplines can further strengthen the trend of using domestic products by supporting Iranian artists in promoting culture in choosing everyday and daily necessities. Also, assessing the needs of artists from domestic markets to meet people's interests and tastes will be another way to apply art in people's lives.

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Methodology
This research uses a qualitative approach and is based on the analysis of the form and content of wooden works of art in Iranian universities. The research method includes library studies and examining samples produced in universities, which in this research will be exclusively specialized in the wood direction at Tabriz Islamic Art University. In this regard, it analyzes the different techniques and methods of producing wooden works and examines how these works affect society and people's lives. Also, using semi-structured interviews with professors and students of this field, the cultural and social dimensions of wood art will be analyzed.

Research Background
Each issue has been studied and researched in different periods according to its importance, which has its own background from different aspects. For this research, research has been conducted from different aspects, including an article titled “Economics of Culture and Art Education”, Samaneh Yaghoubi-Rozgi, 2018, in which the cultural aspects of art in terms of its education and training in various institutions around the main components of cultural industries have been expressed. “A Critical Analysis of the Dominant Trends of the Contemporary Iranian Art Market in the Approach to Cultural Identity”, Fatemeh Pourmand and Effat Sadat Afzal Toosi, 2018, has studied the dominant trends of the contemporary Iranian art market from a socio-political perspective with a cultural identity approach. “Emerging Artists in the Iranian Art Market”, Ansieh Torabi and Mohammad Reza Faridi, 2015, has dealt with emerging artists in contemporary galleries with an analytical approach. "From Art Creation to Art Research" by Mohsen Tabasi, 2012, has studied the necessity and reasons for its improvement, such as the pathology of the subject and its prospects in the future, as well as the development of research beliefs and motivations at the level of the artistic community. "Analysis of the Impact of Public Art on Daily Life and the Act of Creative Consumption of Space Case Study: Tehran City Theater Area, 1401, by Reza Farrokhbakhsh and Maryam Mohammadi, has studied issues such as behaviors and acts of space consumption in daily life and the characteristics of creative consumption and the factors affecting its occurrence and public art. "Pathology of the Economy of Visual Arts and Providing Solutions for Its Improvement: A Case Study of Golestan's Stanan", 1400, by Gholamreza Hassani and Majid Ashrafi, has studied various aspects of art and economics, as well as the characteristics of the economy of visual arts in the general economy and the economy of art, and finally analyzed them statistically. In the article “Investigating the Effects of Globalization on Contemporary Western Art from 1960 to the Present”, 2011, by Amir Rezaei Nabard, he first examined the globalization of culture and then described globalization and contemporary Western art and the audiences and factors of various fields of visual arts. However, this research intends to examine the production of wooden works in Iranian universities, especially Tabriz Islamic Art University (due to its specialization in wood art), considering the need of society in the field of support and innovation in the field of art.

Findings
Globalization and Contemporization of Art The last years of the 20th century to the present day have been considered a process of globalization, and some theorists have linked the beginning of the globalization process to various dates. Some date the beginning of this process to the beginning of human life, others to Islamic civilization and the ancient East, and some to the tradition of modernization and scientific and industrial development, and still others consider globalization to be a recent process. (Rezaei Nabard, 2:2011) However, there are various definitions in this regard, including globalization and contemporaneity as the process of increasing compression of time and space, through which the people of the world are more or less consciously integrated into a single global society. (Golmohammadi, 20:2010) Giddens, one of the theorists of the contemporary era, states the following about globalization and the contemporary world: “Globalization implies that we all increasingly live in a world where our actions have consequences for others and global issues have consequences for us. Today, globalization affects the lives of people in all countries, whether poor or rich, and changes not only global systems but also everyday life.” (Giddens, 2008:109) In the contemporary world and simultaneously with the discussion of globalization, new media began to work. In such a way that a transformation in the form of appearance emerged, which initially began with the use of materials beyond canvas, paint, such as paper and fabric scraps and the creation of collages on different surfaces, and then artists began to completely free themselves from any constraints of painting, sculpture, etc. towards new premises and the creation of the artist, rather than the work of art, became the center and cause more attention than before. Under these conditions, the context of the avant-garde movement, art and artistic expression have both been marginalized, and this is the point of fundamental change that is referred to as the end of art. (Smith,

2008:9) Since the 1960s, new media has been a highly controversial topic in contemporary art, which marked the emergence of new media on October 14, 1966, and this coincided with the fact that Rauschenberg, in collaboration with an electronic engineer named Pill Clover, organized the Nine in the Afternoon; Theater and Engineering series at the 9th Regiment Armory in New York. This program, in turn, led to the establishment of an organization called Experiments in Art and Technology the following year, which Rauschenberg and the technical and engineering collaboration also led. (Golmohammadi, 2011:14) In examining the factors surrounding human life, as well as creativity in social action, as a kind of transfer of sustainable experiences by ordinary people that takes place on a daily basis. On this basis, public art, as a subtle and creative activity, will also be effective in the way choices are made. Establishing contact with a number of audiences to express and convey ideas (like public art) and influence them will lead to an original, useful and creative result for interaction with the environment. (Farah Bakhsh Daqiq and Mohammadi, 106:1401)

1. Different Dimensions of Contemporary Art and Its Effects on Society

In the category of public arts, which has also received special attention in the contemporary world, we can consider performing arts such as music, competitions, performing different programs, three-dimensional visual arts such as sculpture, environmental arts and the like. Contemporary non-visual arts can be considered as forms of public art such as sound or aromatic art (Shahabian and Haghighi, 2014:92) or other categories that have been made in this field are debatable. However, wooden arts in all their execution techniques in the cases of three-dimensional and two-dimensional arts, as well as the discussion of competitions and festivals during the past several years, of course, considering its history, can be discussed and interacted with. In recent years, the emergence of the field of handicrafts in art universities across the country has further emphasized the importance of traditional arts and has contributed greatly to the revival of arts and their academic education. The field of handicrafts is in art universities such as Isfahan, Tehran, Ardabil, Kashan, etc., and at the top of all these universities is the Islamic Art University of Tabriz, which was established as a specialized field independent of the set of handicrafts fields under the title of Islamic arts fields and with a focus on painting, metal, wood, glass and pottery. Today, only the field of painting has been transferred to the Faculty of Visual Arts of this university, and the other 4 fields continue to be strong in the Faculty of Industrial Arts, and all of these fields are specialized. The field of industrial arts with a focus on wood, during the compilation of the course syllabus, the techniques of carpentry, turning, mosaic, inlay, volume, knotting and inlay are discussed. Of course, it should be noted that there are other traditional techniques in this art that are not developed due to their lack of modern use. Including cutting blocks, cutting cloth, carving, sash making and tool making.

2. The trend of developments and productions of wooden arts at the university

The first student admission period for the undergraduate course in Islamic arts with a wood orientation was in 2012 in two groups of boys and girls at the Islamic Art University of Tabriz, which began with academic workshop discussions with the aforementioned techniques. At the beginning of this, traditional and educated masters were invited for this field and its various specialties. But the same field is also held every year at the master's level. (Picture 1) In examining the works produced in this field in the wood workshop of this university, after training during a semester, all the works are exhibited in one day, which was very attractive and in demand in the early days of this field because most of the execution techniques were offered at the academic level. The attractiveness of the work was so high that the students could be commissioned to work from the very beginning of their entry into the university and with their first works, they could enter the job market, albeit at a small level in society, and this was a great encouragement for the new students. But the continuity in the same topics and with the same traditional masters and the process remained at the same level, and this led to repetitive work.

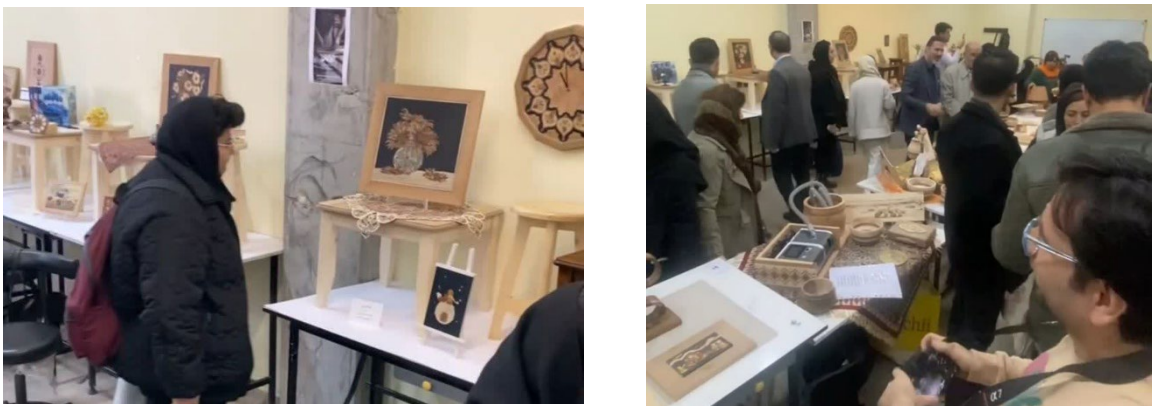


Figure 1: Presentations of the achievements of a semester of undergraduate and graduate students in Islamic Arts with a focus on wood

Of course, it should be noted that the university's support in the form of providing entrepreneurship workshops to students allows them to work on a wider scale. Also, the continuation of students' education at the master's level has led to a small number of graduates being recruited to the university as teaching staff and a few as faculty members. Initially, this increased productivity and improved work presentation, but later, as these professors left the university and were recruited to other universities, this field began to decline, and today, only one faculty member and a few traditional teaching staff are working and studying. However, this situation requires proper and efficient planning so that the process can proceed both in terms of education and in terms of cultivating students interested in working.

3. Contemporary Iranian Wood Art in Universities

The flexibility of each technique, considering its efficiency, requires new and contemporary designs so that they can keep pace with the issues of globalization and contemporaneity, and all of these cases require a needs assessment of people working and students in this field. Because it requires the taste of the people and their support for these graduates and artists in the field of wood. The work that has been done in this university in various fields over the past several years is as follows. Carpentry, knotting, mosaic, volume, turning and layering, inlay, inlay work, examples of these techniques are given in pictures 2 to 11.



Figure 4: An example of production work for the Chinese layer



Figure 3: Example of production work for Lathe



Figure 2: A sample of production works for Drougari







Figure 7: An example of production works for mosaic work



Figure 6: An example of production works for carving



Figure 5: A sample of production works for Inlaye Kari



Figure 10: An example of production work for Chinese knotwork



Figure 9: An example of production works for inlaid mosaic and inlaid lattice



Figure 8: A sample of production works for sculpture and volume



Figure 11: A sample of production works for the paint and finishing workshop

Academic work that for each semester and with each technique, ultimately produces one or two works in terms of learning, and these cases serve as examples of work for that profession and technique. But how much a student can further direct this process towards artistic productions and introduce it into the world and people's lives is an important and challenging discussion. The small number of works and the high cost of the product make people unable to buy it. However, the cost price of each work currently makes the situation unfavorable for artists, given the inflation in society, and in many cases the artist is unable to produce works. This is because presenting works in exhibitions and producing work for it or giving artistic souvenirs in some cases makes the artist's livelihood difficult in many cases because their capital stagnates and thus they have no income, and this concern is one of the important and undeniable issues. The government can solve some of the problems faced by these artists by providing them with special facilities and credits. Many efforts have been made by artists in the contemporary period to establish a method between the modern and the traditional. Among them are modernist artists who have been rethinking the aesthetic aspects of Iranian handicrafts and traditional arts from a modern perspective, such as the Saqqakhaneh. (Pourmand and Afzal Toosi, 2019:35) However, these artists have used different materials and different techniques in the production of their works to convey specific concepts and content. (Kashmir Shekan, 2015:107) In the field of sculpture, Parviz Tanavoli appears in this period with different works that had not been produced before. Because artists only continued their traditional and workshop work routines taken from previous periods. (Pourmand and Afzal Toosi, 2019:35) But Tanavoli was able to introduce the need of contemporary world art in the form of formalist abstract art to contemporary Iranian art, in which a combination of different materials to present a visible work is visible in his works. (Images 13 and 12)



Figure 13: Examples of Parviz Tanavoli's works (https://images.app.goo.gl, 1403/12/13)



Figure 12: No One Sitting on a Chair by Parviz Tanavoli (https://artchart.net, 1403/12/20)

Or other artists took up the formalist side of the work, including Mohammad Ehsaei, Afjeh, Shishe Garan and artists like that. (Images 14, 15 and 16) But all these artists mostly do exhibitions and museum works and do not assess the needs of contemporary society in applying arts in everyday life. In the academic method, they also focus more on techniques and methods of work and the works follow a traditional and almost repetitive routine. But the mission of the artist in the contemporary world includes assessing the needs of people to apply these arts and supporting artists.



Figure 16: A sample of the works of Cyrus the Glassmake



Figure 15: A sample of Nasrollah Afjei's works



Figure 14: A sample of Mohammad Ehsaei's works

Social and cultural impacts of works of education and culture are fundamentally interdependent, and in other cases, education policy and cultural policy can be considered synonymous. Formal and informal educational processes are important in the formation of cultural values, providing new opportunities for cultural experiences and promoting cultural activities. (Yaqubi Zargi and Alaei, 20:2018) In the field of works of art, a distinction can be made between the for-profit and non-profit sectors of this industry, generally where demand is high and widespread. The provision of works of art for profit includes popular entertainment and cultural forms, and in the organization of production, financial incentives prevail over artistic values. On the other hand, the non-profit sector includes more complex art forms. Production activities in these production groupings tend to consider artistic values rather than financial and economic interests. (Ibid., 6) In the discussion of presenting works of art to audiences, one of the most important issues is the attractiveness of the work from an aesthetic point of view. As in the case of aesthetic matters, in the implementation of educational matters in harmony with the social and cultural developments and changes of the contemporary world, it is carried out to the audience, and this will lead to the development of all matters of design, construction and

aesthetics. Media such as the Iranian Broadcasting Corporation, multidimensional and new media are one of the most powerful tools of cultural globalization. Which is a place for advertising in the policy-making of developed countries. (Rezaei Nabard, 13:2011) Today, expressing any issue in artistic forms in expressing the necessities of society and its different layers is undeniable. Various artistic expressions, especially visual expressions, play a very important role in conveying concepts and are effective in communicating with a specific and general audience through text and speech, and this has been proven. (Tabasi, 45:2012) In the different stages of the development process, accumulation is one of the most important stages. The existence of various universities and colleges at the national level will solve the problem of experts, masters and PhDs. (Ibid., 46) However, the duties and responsibilities of managers and officials in the field of art can also be fulfilled by taking the position of art in general and art research in particular seriously and allocating an appropriate share of public and research funds in the field of art. Providing information infrastructure in the media to expand communication with other countries, providing the possibility of presenting the products of the artistic community at national and international levels, paying due and sufficient attention to the issue of education and research (formal and informal) of art, avoiding the phenomenon of commissioned art or commissioned art and propaganda slogan art. (Ibid.) However, artists themselves are also obliged to observe a series of specific principles and conditions towards their officials, which can help improve conditions significantly. Including greater efforts to take charge of professional and trade affairs, through the formation of a trade society, greater efforts to update information and artistic knowledge. Participation in decision-making and development of short-term and long-term plans and programs with specific quantitative and qualitative goals. Participation in decision-making and development of short-term and long-term plans and programs with specific quantitative and qualitative goals. Greater effort in the field of creating works of art. Only if all these issues are resolved and observed will the country's artistic community be able to institutionalize these phenomena and carry out activities in a targeted manner with the aim of promoting them. Students must follow certain paths to enter the art community and become known as artists. Studying in art fields, being with artists, and being in art events are ways to stay in the art field. (Torabi and Moridi, 2019:160) Novice artists or art graduates are trying to realize pure and absolute art. But galleries regulate the relationship between the artist and the audience or the producer and consumer of art, or national and international exhibitions, which are a large arena for visibility and advertising, in which artists and art graduates can also participate in such very important events. But in front of customers, they can also have a special survey in their own field of work to use them in the process of designing and creating their work. But there are two very important issues in this research, one of which is the discussion of the artist's livelihood and the production of his works and their presentation in the field of the individual's work, and on the other hand, the design and implementation of lasting works of art by artists. Each of which has its own specific conditions according to the mission of the artist and society. If under normal circumstances the artist is financially secure, he can take action in creating works at the level of national and international festivals and competitions. However, in many cases it has been observed that artists and especially art graduates need financial support to set up a workshop, whether in terms of production or creation of significant works, and this concern in the contemporary world has led to the works produced by artists entering the market and being offered for sale for the welfare of their lives. Not for the artistic display of the artist.

4. The impact of course syllabus on students' creativity

For several years, the Islamic art major with a wood orientation at Tabriz Islamic Art University and the handicrafts major have been implemented with the same course syllabus, in which each semester students are introduced to two different workshop disciplines. However, no change in the holistic approach to designing and executing works has been considered, and this has led to the work continuing to be done repeatedly in the same type of design and technique. While by examining the course syllabus and the output of the work at the end of each semester and even after a four-year period, they can witness significant changes. Also, employing design professors and, along with them, professors who are skilled in execution can make this issue more and more tangible. In the current world, which is the age of technology and technological progress, skilled professors in this field should be used in 3D design in various software and the use of artificial intelligence alongside it, based on the needs of people in society and the present, so that works of art can be injected into people's lives.

Conclusion and Recommendations

Contemporary art, with its innovative features and the changes it has seen in recent decades, has had a tremendous impact on people's social, cultural and individual lives. In the meantime, wood art, as one of the branches of art with an ancient history, has faced significant changes in the contemporary world and has become a new language of expression. The role of higher education institutions, especially universities, in producing and promoting contemporary art, especially wooden works of art, and their impact on changing the artistic attitude of society is greater. Universities, as scientific and educational institutions, play a significant role in shaping the artistic taste and preferences of society by providing a space for research, thinking and creativity. For this reason, the course syllabus should be revised based on the efficiency ratio, which can be different every year, so that it can be useful in contemporary society. In this regard, the impact of universities on the change in artistic methods and styles, as well as the use of natural materials in wooden works of art, is also effective. Because the impact of wooden art in transmitting cultural and social concepts and its role in spreading new knowledge in social areas will be greater while maintaining Iranian-Islamic authenticity. By emphasizing the use of natural materials such as wood in producing works of art and the connection between contemporary art and public culture through wooden art products, as an expressive medium, it is able to transmit cultural, social and aesthetic concepts and messages to society. These works can represent the characteristics, values and social and cultural norms of society and be influential in interpersonal and social communication. Artists and graduates can also consider this to improve their working conditions by participating in various national and international forums. Also, financial support from the government to provide artists with a living can be a very important and inspiring thing, and an artist with a green mindset will easily follow his path to transmitting very important concepts. Also, media such as the Iranian Broadcasting System and the promotion of Iranian works of art in the background of films or performing arts and scenes can point to the Iranian-Islamic cultural model. Because all of these things can subconsciously influence people's minds and help to support more people by purchasing Iranian and handmade artistic goods.

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AN ASSESSMENT ON FAMILY-FRIENDLY AND SINGLE-FRIENDLY WORK CULTURE IN TOURISM AND HOSPITALITY

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Abstract
Towards the second quarter of the 21st century, organizations have reached a widespread consensus on family-friendly work environments. However, single-friendly or non-parent-friendly initiatives are still on the agenda. The labor inclusion rate of single individuals is rising. Young and single employees are increasingly becoming apparent in the modern workforce, notably in the hospitality and tourism sectors. Furthermore, the number of childless employees has also been increasing. Moreover, it becomes apparent that quiet quitting impacts the tourism and hospitality industry. Given the demographic shifts and negative organizational outcomes, it is high time to leave the notion of *X-friendly* culture. Instead, it is vital to create employee-supportive and inclusive work environments. This is also the core approach in a single-friendly work culture.
The main aim of the study is to evaluate the current status of the family and single-friendly work culture in the tourism and hospitality literature. With using document analysis technique, this study attempts to collect and make a synthesis of the studies on single-friendly and family-friendly workplaces. In order to collect data, the Web of Science (WOS) database was utilized. Collected studies were examined in terms of the used variables, theoretical backgrounds, the findings obtained and major contributions or highlights. The study's findings demonstrate that many studies concentrate on supervisor support in family-friendly work culture. Conservation of resources is highly adopted as a theoretical background and the majority of the studies underline the need for family-friendly supervisor support and policies. However, as a recent concept, single-friendly work culture mainly emphasizes equal opportunity in the workplaces. This study is an attempt to bring a supportive and inclusive work culture into the agenda as the 2030 Sustainable Development Goals approach their conclusion.
Keywords: Family-friendly Work Culture, Single-friendly Work Culture, Tourism, Hospitality

1. Introduction

Organizations have started to dedicate more time and resources to develop family-friendly work environments. The increasing number of work-family studies sheds light on opportunities to gain a deeper understanding on the phenomenon, and organizations, including tourism and hospitality enterprises, have begun to focus on family-supportive workplace practices. Family-friendly work culture is a subfield of work-family literature. Drawing on work-family literature, a family-friendly work culture relies primarily on supportive supervision and policies to balance employees' job and family obligations (Thomas & Ganster, 1995; Allen, 2001). However, today's organizations have tremendously diversified demographics, making family-friendly policies appear inadequate for such a diverse workforce profile. However, single-friendly or non-parent friendly initiatives are still on the agenda. The labor inclusion rate of young, single individuals is rising; they are increasingly becoming a significant demographic in the modern workforce, particularly evident in the hospitality and tourism industries (Goh & Lee, 2018). The number of non-parental individuals has also increased, necessitating the development of employee-friendly workplaces (Andrews, 2024). As a result, there are calls for single-friendly work environments (Casper et al., 2007; Šimunić et al., 2024; Li et al., 2025b). According to studies, single employees are frequently overlooked in supporting organizations; they are likely to take on additional tasks and work longer hours than their counterparts, which can lead to an increase in stress (Casper et al., 2007; Li et al., 2025b). Single-friendly work culture depends on the equality and inclusion (Shi & Shi, 2022), which aims to attract more attention on inclusive non-work supportive workplaces. This is also aligned with the sustainable development goals (SDGs).
The announcement of the SDGs has an emphasis on equality and inclusivity. Gender equality, decent work and economic growth, peace, justice and strong institutions and good health and well-being are the goals, emphasizing equitable treatment and minimizing inequities within organizations (UN, 2016). However, the rise of single-friendly work culture as a concept demonstrates that there are still significant concerns organizations must overcome. Accordingly, this study aims to investigate the current literature on family-friendly and single-friendly work culture in tourism and hospitality. Since the studies are highly fragmented,

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only the studies solely concentrate on family-friendly and single-friendly organizations, including supportive policies and supervision, are taken into consideration.

2. Literature Review

2.1. Family-Friendly Work Culture and Tourism & Hospitality

Family-friendly work culture stands for to the thoughts, expectations, and actions inside organizations that recognize and respond to employees' family and caregiving duties, producing an environment in which employees may successfully balance work and family roles (Allen, 2001). In literature, family-friendly work culture can be categorized as one of the sub-topics of work-family research. A brief scan of research databases reveals that the number of work-family studies has been increasing, indicating that it is still a key topic in the literature. This is also highlighted by Allen and French (2023). The researchers emphasize that the pandemic's devastating impact on the workplace has brought work-family studies to the forefront of trending topics.

Drawing mainly upon spillover (Champoux, 1980; Crouter, 1984; Higgins & Duxbury, 1992), and role theory (Ernst Kossek et al., 1999; Allen, 2001), the early work-family studies concentrated on the relationship between work and family roles. Thus, it can be asserted that the focal point in early work-family studies has necessitated putting more emphasis on the balance between family and work roles of employees (Wayne et al., 2022), ending up with the family-friendly organizations. According to Cook (2009), studies on work-family balance and policy development have helped to establish family-friendly organizations by demonstrating favorable organizational outcomes such as decreased turnover, increased organizational loyalty, and improved performance. Furthermore, to prevent adverse effects of work-family conflict, unions have prioritized family-friendly policies, requiring organizations to implement family-friendly working practices such as flexible hours and increasing management and peer support (Frone, 2003). There are two main elements in family-friendly workplaces: Family-friendly policies and family-friendly supervision (Thomas & Ganster, 1995). In tourism and hospitality literature, family-friendly supervision has become the primary focus in studies (Kong, 2013; Pan, 2018; Li et al., 2025a). Nguyen et al. (2020) emphasize the importance of family-friendly supervision for employee engagement, especially in hospitality enterprises with a dominance of female employees. Fotiadis et al. (2019) also assert that inadequate support in the workplace harms both organizational results and employees' family needs, making it challenging for employees in the hospitality industry to successfully manage their work and life.

2.2. Single-friendly Work Culture and Tourism & Hospitality

The concept, single-friendly work culture has gained popularity in recent years. Since the number of single and non-parent individuals has risen considerably over the past years, the demographic profile has begun to shift (Mustaq, 2024), getting the attention of organizations and as well as academic circles. The number of studies is still limited, yet the necessity to more inclusive work environments is highlighted in certain studies (Casper et al., 2007; Pan & Li, 2022; Li et al., 2025b).

Casper et al. (2007) stressed that family-friendly or family-supportive policies have altered the organizations in a way that single employees or employees free from parental duties are often ignored by the organizations. This is often related to the societal norms. However, the new normal makes it crucial to reconsider the work-family balance, as well as the needs of single and non-parent employees. Two essential tenets of a single-friendly workplace culture are equal treatment and inclusivity (Shi & Shi, 2022). In line with this, one could say that the primary emphasis is on workplace equality, which is consistent with the SDGs. Four out of seventeen SDGs were strongly associated with the support and inclusion of employees, with a focus on various facets of it. However, there is one unifying focus: anti-discrimination and inclusiveness of minorities. Considering the gender inequality, it can be asserted that the equal opportunities for women and eliminating discrimination and harassment at workplaces are stressed (Alarcon & Cole, 2019; Webster & Farmaki, 2025). Furthermore, anti-discrimination policies are emphasized with reducing inequalities. Decent work and economic growth highlight the importance of reducing inequalities and providing equal opportunities for all employees (Baum & Hai, 2019; Santos, 2023).

The workforce in tourism and hospitality has been confronting many obstacles for many years. Baum and Hai (2019) emphasize that low payment, low respect, the high turnover rate, and bad working conditions are persistent in the tourism and hospitality industry. Furthermore, high job-demands and unstable working hours are frequently used to explain the nature of the work in tourism industry (Biedma-Ferrer et al., 2025). While dealing with these problems, non-supportive workplaces and lack of supervisor support have made the situation much worse, necessitating non-discriminatory policies in workplaces. According to Li et al. (2025b), inclusive

work environments seem more attractive for single employees than family-supportive culture since they assume that such environments promise a supportive workplace, declining the probability of discrimination and extra work.

3. Methodology

This study mainly depends on document analysis. In order to collect data, WOS has been chosen since it is widely recognized as one of the most prestigious international databases. Accordingly, for filtering the studies, keywords as "family-friendly" or "family-supportive" or "single-friendly" or "single supportive" with "tourism" or "hospitality" were used. The studies filtered and the studies with "single friendly/ supportive" and "family friendly/ supportive" in their titles were included.

To go deeper, the collected studies were evaluated in terms of the variables investigated in the studies, the theoretical basis, the study findings, and their highlights.

4. Findings

In accordance with the study aim, Table 1 exhibits the examined variables in family-friendly work culture studies in tourism and hospitality.

Table 1: Examined Variables in Family-Friendly Work Culture Studies in Tourism and Hospitality

No	Year	Variables
1*	2010	WFC; FWC; Facilitation (Work-family vs. family-work); Social support (work); Exhaustion; Gender; Age; Education; Tenure ; Marital status
2*	2013	Family supportive supervisor; career competency ; job involvement; job satisfaction
3*	2016	Workload; support (Supervisor & Family & Organization) ; WFC; FWC; job stress
4*	2018	WFC; FWC; job stress; emotional exhaustion; depersonalization ; family-friendly policies; leave intention
5*	2018	Work addiction; supervisor's perception of subordinate's FWC; FSSB; Organizational citizenship behavior; Subordinate's withdrawal behavior
6*	2020	FSSB; turnover intention; organizational trust; job satisfaction
7*	2022	FSSB; intrinsic motivation; thrive at work; work-family enrichment
8*	2022	FSSB; gender; emotional exhaustion; turnover intention
9*	2023	-
10*	2024	FSSB; work-family balance; family centrality; family performance; service performance
11*	2025	FSSB; psychological empowerment; creativity
12*	2025	Accessibility of WFP Organizational support; emotional well-being; physical well-being; satisfaction; gender; family responsibility

(The titles of the studies are represented by the numbers. The full list is provided in Appendix. WFC: Work-family conflict, FWC: Family-work conflict; FSSB: Family supportive supervisor behavior)

Considering Table 1, it can be observed that FSSB is the most studied variable followed by WFC, gender, and FWC in the family-friendly work culture studies. The central variable of FSSB has demonstrated that leadership behaviors serve as an important component in the literature. Furthermore, job stress, emotional exhaustion, turnover intention, and job satisfaction are among the examined variables, indicating that research on family-friendly work culture focuses on the concept's negative personal and organizational impacts.

Table 2 displays adopted theories in family-friendly work culture studies.

Table 2: Theories in Family-Friendly Work Culture Studies in Tourism and Hospitality

No	Adopted Theories
1*	COR
2*	Career Self-Management
3*	COR
4*	COR
5*	Role Identity; SET
6*	SET
7*	Work-home resources model

8*	COR
9*	COR ; SET; Role Theory; Spillover
10*	COR
11*	Person-environment fit
12*	Job Demands- Resources ; SET

(The titles of the studies are represented by the numbers. The full list is provided in Appendix. COR: Conservation of Resource Theory; SET: Social Exchange Theory)

Table 2 shows that COR is the most often used theory, followed by SET. According to COR, balancing work and family life requires an organizational culture that prevents individuals from losing resources while also encouraging resource acquisition. COR offers a valuable framework for explaining the family-friendly work culture (Kalliath et al., 2020). Furthermore, SET provides a theoretical framework for explaining psychological reciprocity with employees via organizational resources such as support, flexibility, and understanding (Bagger & Li, 2014).

In the study, the collected studies are also examined in terms of the study findings and highlights. The results are shown in Table 3.

Table 3: Findings and Highlights in Family-Friendly Work Culture Studies in Tourism and Hospitality

No	Findings & Highlights
1*	The findings revealed that WFC and FWC increased the level of exhaustion. However, social support had a moderating effect. The study emphasizes the importance of creating family-friendly workplaces for frontline employees.
2*	Family-friendly supervision enhanced career competencies, which in turn positively influenced job involvement and satisfaction The study underlines the importance of work-family policies and family-friendly supervision.
3*	The study revealed that work stress caused by a heavy workload and a lack of social support emerges largely as WFC and FWC, and that family supportive control is more successful than general support in reducing these conflicts. The study highlights the importance of providing family supportive supervision rather than general supportive supervision.
4*	The study found that WFC and FWC had a negative impact on job stress, burnout, and intention to quit. The need for family-friendly practices serves as a regulatory mechanism to mitigate the harmful consequences of these conflicts.The study stresses the importance of evaluation of family-friendly policies considering the needs of employees and targeting support to those most in need.
5*	The study findings indicated that the manager's addiction to work often led to more helpful behaviors toward the family. However, that depends on how the management interprets the employee's FWC. FSSB from the management improves the employee's organizational citizenship while minimizing job withdrawal. The study highlights the importance of supervisor support. Supervisors with work addiction are more likely to provide support to employees who they perceive to be in conflict, and that this support encourages employees' positive workplace behaviors.
6*	The findings of the study indicated that FFSB boost employees' organizational trust and job satisfaction, and enhanced attitudes explain why such support decreases the intention to leave in New Zealand's hotel industry. The study highlights the importance of supervisor support. Employee intents to leave are directly decreased when supervisors provide positive support.
7*	The study's findings showed that family-supportive supervisor had a positive link with work-family enrichment, with intrinsic motivation acting as a moderator. The study underlines the importance of building family supportive work environment which may contribute the work-family enrichment.
8*	The findings indicated that FFSB reduced employee emotional fatigue and eventual intentions to leave. The authors also discovered that this relation was more significant among female employees. The study offers valuable insights for managers on displaying family-supportive behaviors, particularly with the goal of improving female employees' work experiences and raising the rate of retention in the workplace.
9*	The findings revealed that work-family support in the hospitality industry lacks integration of theory, pays little attention to childcare regulations, and neglect individual and national differences. The study highlights the need of a strong conceptualization within family-friendly literature. Despite the benefits of work-family support policies, the hospitality industry shows a serious lack of academic interest and knowledge gap on this subject.
10*	The study emphasize that FFSB, by encouraging work-family balance increases both employees' family and work performance, and that this effect is more pronounced in individuals with a high degree of family-centeredness.
11*	The study findings revealed that FFSB had a strong effect on employee empowerment which was also effective on employee creativity. The study highlights the importance of providing FFSB taking the certain needs of employees into consideration.

12*	The study findings demonstrated that satisfaction was strongly correlated with work-family policies and organizational support. The study highlights the importance of accessibility of work-family policies, rather than the mere existence of them at tourism industry. Accessibility to these policies and support are critical for employee well-being.

(The titles of the studies are represented by the numbers. The full list is provided in Appendix WFC: Work-family conflict, FWC: Family-work conflict; FSSB: Family supportive supervisor behavior; COR: Conservation of Resource Theory; SET: Social Exchange Theory)

Table 3 shows the findings and highlighted aspects of the studies. Many studies point out the need of implementing family-friendly practices and regulations in tourism and hospitality enterprises. The direct link between positive outcomes such as job satisfaction, enrichment, decrease in emotional exhaustion and job stress are also emphasized.

In the study, single-friendly work culture studies were also investigated. Table 4 shows the examined variables and adopted theories in the collected studies.

Table 4: Examined Variables and Adopted Theories in Single-Friendly Work Culture Studies in Tourism and Hospitality

No	Year	Variables	Theories
1*	2021	Singles-friendly work culture Organization-based self-esteem Emotional exhaustion Procedural justice Affective commitment Helping behaviors Hostility	SIP
2*	2022	Work-to-personal conflict personal-to-work conflict trait positive affect trait negative affect social inclusion of a singles-friendly culture Job performance Leisure satisfaction Work role identification Gender	SRT SIP
3*	2025	Family friendly culture Inclusive non-work supportive culture Marital status Perceived marital discrimination Probability of working over time Organizational attractiveness	SRT

(The titles of the studies are represented by the numbers. The full list is provided in Appendix. SIP: Social Information Processing Theory, SRT: Social Role Theory)

The number of the collected studies is limited. Considering Table 4, a wide range of variables such as justice, hostility, conflict, and discrimination is examined in these studies. It is early to express a general trend, yet obtained results show that there is a tendency to research on the negative organizational factors. Furthermore, SIP and SRT are used in order to explain the relationships among variables.

In the study, the collected studies are also examined in terms of the study findings and highlights. The results are shown in Table 5.

Table 5: Findings and Highlights in Single-Friendly Work Culture Studies in Tourism and Hospitality

No	Findings & Highlights
1*	The study findings indicated that there were various beneficial impacts of singles- friendly work culture. It might help reducing personal exhaustion through heightened organization-based self-esteem. It could contribute enhancing organizational commitment via improved procedural fairness. It could ensure increasing altruistic behaviors towards colleagues due to diminished hostility. The significance of equal opportunities at workplaces including single employees is highlighted in the study.
2*	The study findings revealed that a social inclusion work culture might contribute better performance and high satisfaction on leisure time by decreasing work-to-personal conflict. The study emphasizes the importance of creating supporting work environment for single, non-parent employees.

3*	The study findings indicated that a family supportive work culture could negatively impact single employees. An inclusive work culture might foster all employees. The study emphasizes the importance of equal supportive and inclusive work culture.

(The titles of the studies are represented by the numbers. The full list is provided in Appendix.)
Considering Table 5, single-friendly work culture studies mainly emphasize creating a supportive work environment for all employees. The studies highlight the need for equal opportunities for single and non-parent employees.

5. Conclusion and Recommendations

The main purpose of the study is to evaluate the current status of the family and single-friendly work culture in the tourism and hospitality literature. By using document analysis technique, studies on family-friendly and single-friendly work culture were collected. Collected studies were examined in terms of the used variables, theoretical backgrounds, findings, and major contributions or highlights. The study's findings demonstrate that the majority of the studies concentrate on supervisor support in family-friendly work culture. COR is highly adopted as a theoretical background and many studies underline the need for family-friendly supervisor support and policies. However, a recent topic, single-friendly work culture, mainly emphasizes equal opportunity in the workplace.

Family- friendly work culture focuses on enhancing the supportive policies and supervision for married and parent employees. However, the availability of family-friendly policies in organizations does not necessarily guarantee their effective implementation (Moore, 2018). It requires an organization with a supportive culture (Syed et al., 2025). Accordingly, it can be asserted that the diverse demographics at workplaces may necessitate reconsideration of the supportive policies in the near future. The number of single employees is increasing. Furthermore, the number of quiet quitters has been escalating, getting attention from both academia and practitioners in tourism and hospitality (Katırcıoğlu, 2024; Prentice et al., 2025). Instead of leaving their jobs, quiet quitters have limited dedication to their jobs. They avoid sharing their ideas and participation projects or teamwork, which can be quite important for overall productivity (Liu-Lastres et al., 2024). No study has been reached investigating the relationship between single-friendly work culture and quiet quitting. However, it is crucial to highlight that developing supportive work environments for single individuals may also have an impact on curbing quiet quitting behavior, as certain research indicate that quiet quitting is a phenomenon that may impact organizations through Gen Z (Xueyun et al., 2023; Öztürk et al., 2023). Furthermore, mutual respect is important in organizations. It is possible to consider each employee's requirements and responsibilities and create a more inviting environment, in other words, equally-friendly workplaces. It is time to revisit the equity theory to reassess the organizational culture.

The study is not free from limitations. The obtained data is limited to the keywords used. Single-friendly or family-friendly work culture studies were highly fragmented. These concepts are also included in work-family, organizational culture, inclusion, diversity management, and gender studies as well. However, this study mainly concentrates on the studies with the mentioned concepts as the focal. Accordingly, future studies may adopt a more holistic approach and make a deeper synthesis by increasing the number of keywords. Furthermore, the scarcity of studies on single-friendly work culture can be evaluated as a research gap. Moreover, the study's findings revealed that the single-friendly work culture focuses primarily on negative organizational aspects. Conducting research on non-supportive and inclusive work environments that result in favorable organizational results can make contribution to the field of research.

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APPENDIX

1. The title of examined studies on family-friendly work culture (Table 1-2-3)

1* The effect of positive and negative work-family interaction on exhaustion. Does work social support make a difference?

2* Relationships among work-family supportive supervisors, career competencies, and job involvement

3* Workload, generic and work-family specific social supports and job stress Mediating role of work-family and family-work conflict

4* Work-family conflict/family-work conflict, job stress, burnout and intention to leave in the hotel industry in Quebec (Canada): moderating role of need for family friendly practices as "resource passageways"

5* Do workaholic hotel supervisors provide family supportive supervision? A role identity perspective

6* Family supportive supervisor behaviours and turnover intentions: testing a multiple mediation model in the New Zealand hospitality industry

7* How Family Supportive Supervisor Behaviors Enhance Employees' Work-Family Enrichment? Thriving at Work as Mediator and Intrinsic Motivation as Moderator

8* Family-supportive supervisor behaviors and employee turnover intention in the foodservice industry: does gender matter?
9* Work-family supportive benefits, programs, and policies and employee well-being: Implications for the hospitality industry
10* How to make the work-family balance a reality among frontline hotel employees? The effect of family supportive supervisor behaviors
11* Empowerment in Hospitality: Does Leader-Follower Congruence in Family-Supportive Supervisor Behaviors Empower Follower Creativity?
12* Work-family policies and perceived organisational support as drivers of well-being and satisfaction among employees in the tourism industry
2. The title of examined studies on single-friendly work culture (Table 4-5)
1* Family supportive and singles friendly: How an equally supportive working environment
Impacts unmarried hotel employees
2* Who cares about single childless employees in the hotel industry? Creating a workplace culture beyond family-friendly
3* Examining the comparative effects of family-friendly work culture and inclusive nonwork-supportive culture on organizational attractiveness for single employees

GREEN HOSPITALS: ''WHO'' PRINCIPLES AND ''3R'' STRATEGIES

Beyza Nur Çalışkan Keleş[79]

Abstract
Hospitals, characterized by high levels of energy and resource consumption, constitute critical building types in terms of sustainability due to their significant environmental impacts. In this context, the green hospital approach has been developed, grounded in principles such as energy and water efficiency, waste management, the use of environmentally friendly materials, and design strategies that are compatible with natural systems. The strategies shaped in line with the seven core principles defined by the World Health Organization (WHO) play a crucial role in ensuring sustainability in healthcare facilities. The green approach in hospitals encompasses solutions that support sustainability in buildings through energy efficiency, nature-compatible design, smart and adaptive systems, effective waste and water management, the use of alternative energy sources, and the preference for natural, recycled, and low-emission materials. Accordingly, this study aims to draw attention to green strategies implemented in healthcare facilities and to discuss the 3R principles adopted within these practices. Within the scope of the study, examples of green hospital applications from various hospitals located in different countries were examined using a qualitative research method, based on the seven fundamental principles identified by the WHO. The findings demonstrate that when the green hospital strategies defined by the World Health Organization are considered together with the 3R principles (Reduce, Reuse, and Recycle), they provide a robust and comprehensive framework for achieving sustainability in healthcare buildings. The results indicate that hospitals are not only facilities for healthcare service delivery but also critical infrastructures whose environmental impacts must be reduced due to their high levels of resource consumption. In the examined cases, practices based on reduction, reuse, and recycling contribute significantly to limiting environmental impacts within the healthcare sector. Consequently, the integrated implementation of WHO principles and the 3R approach is regarded as a fundamental requirement for establishing a sustainable healthcare infrastructure that simultaneously addresses environmental responsibility, economic efficiency, and the quality of healthcare services. The wider adoption of this approach, particularly in developing countries, has the potential to strengthen the role of the healthcare sector in combating climate change.
Keywords: Green Hospital, World Health Organization (WHO), 3R, Reduce, Reuse, Recycle.

1. Introduction

Earth Day ''1970'' transcended social differences by bringing together affluent and disadvantaged groups, urban residents and farmers, employees and employers around a shared environmental awareness, thereby creating a rare atmosphere of political consensus. This broad-based social mobilization paved the way, within the same year, for the establishment of the United States Environmental Protection Agency (EPA) and the enactment of the Clean Air Act, the Clean Water Act, and the Endangered Species Act (URL-1). Concurrently with the establishment of the EPA, the Resource Recovery Act was adopted, aiming to promote practices such as recycling, resource recovery, and the utilization of waste for energy production on a societal scale.

Throughout the 1970s, various legal and institutional arrangements were implemented to support resource conservation and strengthen environmental awareness. These developments facilitated the emergence of the approach later referred to as the "3R" framework (URL-2). Aiming to render waste management more sustainable and to reduce the ecological footprint of human activities, the 3R approach consists of the principles of Reduce, Reuse, and Recycle (Potting et al., 2017). Although these principles have been effectively implemented in many developed countries, comparable levels of success have not yet been achieved in developing countries (Abd Rashid et al., 2015).

Within the scope of the Reduce principle, the primary objective is to minimize the ecological footprint, prevent unnecessary energy consumption, and ensure the most efficient use of available energy (Shuanggui, 2011). Achieving sustainability requires the evaluation and implementation of approaches that minimize environmental impacts across all stages of a building's life cycle. Energy, water, and materials constitute the fundamental input resources of buildings. The conservation of these resources particularly the reduction of non-renewable resource use can primarily be achieved through decisions made during the design phase (Coşgun et al., 2009). During the operational phase, environmental pollution should be mitigated by reducing

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resource consumption and managing waste effectively (Zhong et al., 2021). At the end of a building's service life, the objective should be to transform its constituent resources into components that can be reused in other buildings.

The Reuse principle refers to the direct reuse of building components and materials generated during construction, use, and demolition processes after improvement procedures, or their re-evaluation through transformation requiring minimal energy input (Müderrisoğlu, 2025; Lofçalı & Tunçay, 2025). The Recycle principle, by contrast, encompasses the process of converting recoverable wastes that cannot be reused into secondary raw materials through various physical or chemical processes and reintegrating these materials into the production cycle (Yıldırım & Kantarcı, 2022; Külekçi & Güvendi, 2023).

Globally, increasing importance is being placed on efforts aimed at improving energy efficiency. Within the healthcare sector, hospitals occupy a critical position due to their high levels of energy and water consumption, large volumes of chemical and non-chemical waste, intensive hazardous material outputs, and the diversity of procured materials. Conversely, factors such as the limited availability of natural resources, insufficient areas for waste storage and disposal, inadequate staff training regarding the handling and removal of hazardous substances, and insufficient incentives for renewable energy applications have rendered "green" approaches increasingly significant in hospitals (Erdede & Bektaş, 2014; Azar et al., 2015; Yıldız, 2016; Camgöz et al., 2016).

The green approach in hospitals aims to develop alternatives for resource use, enhance the efficiency and effectiveness of energy, water, and material consumption, prevent all forms of waste, and promote environmentally friendly building designs (Dhillon & Kaur, 2015). The concept of the "green hospital" is used to describe healthcare facilities that meet criteria such as environmentally compatible site selection, the adoption of sustainable and energy-efficient design approaches, the preference for natural and ecological building materials, the minimization of environmental impacts during construction, and the continuation of this environmental sensitivity throughout the service delivery phase (Terekli et al., 2013; Kılıç & Güdük, 2018).

Green hospitals are healthcare facilities that aim to minimize waste generation, encourage the reuse of materials and equipment, support recycling practices, and provide cleaner indoor air quality (Hoşgör, 2014; URL-3; Chias, 2017). The holistic integration of environmental- and health-oriented principles into the planning, design, construction, maintenance, and renovation processes of hospitals offers numerous advantages. Empirical studies indicate that green hospital practices positively affect patients' psychological well-being and contribute to shorter lengths of hospital stay (Baytaş & Aydın, 2022).

The World Health Organization (WHO), in collaboration with Health Care Without Harm (HCWH), has identified seven key elements for climate-friendly hospitals, taking into account their defining characteristics (WHO, 2009:3). These strategies are summarized in Table 1.

Table 1. The strategies defined by the World Health Organization for green hospitals (WHO, 2009:10–21).

Energy Efficiency	To reduce hospitals' energy consumption and operational costs through efficiency and conservation measures.
Green Building Design	To construct hospitals that are adapted to local climatic conditions and optimized to minimize energy and resource demands.
Alternative Energy Generation	To generate or procure clean, renewable energy on-site in order to ensure reliable and resilient operations.
Transportation	To use alternative fuels for hospital vehicle fleets; to encourage walking and cycling to the facility; and to promote the use of public transportation within the community.
Food	To provide sustainably produced, locally sourced food for staff and patients.
Waste	To implement alternatives to waste incineration, such as reduction, reuse, recycling, and composting.
Water	To conserve water resources and eliminate the use of bottled water where safe alternatives are available.

Energy efficiency, nature-compatible design, smart and adaptive systems, effective waste and water management, the use of alternative energy sources, and the preference for natural, recycled, and low-emission materials constitute solutions that support sustainability in buildings. From this perspective, the implementation of green strategies in hospitals is of great importance in terms of sustainability. The aim of this study is to draw attention to green strategies applied in healthcare facilities and to discuss the 3R principles

adopted within these practices. Within the scope of the study, examples of green hospital applications implemented in various hospitals across different countries were examined using a qualitative research method, based on the seven core principles defined by the World Health Organization.

2. Methodology

Qualitative research is defined as a research method in which qualitative data collection techniques such as observation, interviews, and document analysis are employed, and a qualitative process is followed to present perceptions and events in a realistic and holistic manner within their natural context (Yıldırım & Şimşek, 2008:39). The research process begins with the identification of the problem and continues through the definition of concepts and research questions, case selection, data collection, and data analysis stages, and is completed with the interpretation of the findings (Neuman, 2012:23). Accordingly, this study is based on a qualitative research methodology.

Research Model

Various models are employed in qualitative research to examine social phenomena; in this study, the case study method was adopted. A case study is based on the in-depth examination of examples related to a specific time, individual, or cultural context (Ilgar & Ilgar, 2013; Gürbüz & Şahin, 2014:180). Within the scope of the research, the 3R principles were examined through examples of green strategies implemented in hospitals.

Population and Sample

Although many sectors attach importance to green strategies, the population of this study consists of practices implemented within the healthcare sector. Accordingly, hospitals from different parts of the world that have adopted green approach strategies and achieved successful outcomes were selected as the sample.

Data Collection Tools

In qualitative research, the data collection process is conducted through three main methods: observation, interviews, and document analysis (Sönmez & G. Alacapınar, 2011:106). In this study, document analysis was selected as the primary data collection method. Document analysis involves the systematic examination of various sources such as books, documents, reports, photographs, and audio recordings related to the research topic. Data on the green hospital practices included in the sample were obtained from scientific and academic publications as well as digital sources.

Data Analysis

For data analysis, hospital cases were classified based on the seven core principles defined by the World Health Organization for green hospitals. The ways in which the 3R principles (Reduce, Reuse, and Recycle) were implemented in the examined cases were evaluated. Solutions developed to reduce the use of energy, water, and other resources, to promote reuse, to recycle waste, and to prioritize renewable resources were analyzed. The system-level benefits achieved through the adoption of green strategies were demonstrated using quantitative indicators such as energy savings and reductions in resource consumption.

3. Findings

The green hospital approach represents a holistic management framework that aims to minimize environmental impacts during the delivery of healthcare services, ensure the sustainable use of natural resources, and create a healthier physical environment for patients and healthcare staff. This approach encompasses multiple domains, including energy, water, and material use, waste management, building design, and chemical safety. In this context, examples of green hospital practices are presented below within the framework of the strategies defined by the World Health Organization.

Energy Efficiency

Energy efficiency measures represent one of the most accessible and widely adopted first steps that hospitals can take to reduce operational costs and emissions while improving both human and environmental health.

Table 2. Examples of energy efficiency practices in green hospitals

Country	Hospital	Implemented Energy Efficiency Measures	Achieved Outcome

Cuba	Dr. Agosthino Netola Hospital	Implementation of an Integrated Energy Saving and Reduction System; replacement of 171 air-conditioning units and 52 refrigerators with higher-efficiency models; upgrades to the electrical system and boilers; significant reduction in fuel oil consumption	21% reduction in overall energy consumption (WHO, 2009)
Brazil	101 healthcare facilities in the state of São Paulo	Installation of compact fluorescent lamps; improvements to lighting circuits	25% reduction in energy consumption (URL-4)
Poland	Toruń City Hospital	Enhancement of building insulation; installation of modern heating systems; implementation of advanced valves; improved room temperature controls	Approximately 30% energy savings in the renovated building (Jørgensen et al., 2005)
India	Sir Jamshedji Hospital	Systematic shutdown of office equipment; utilization of natural daylight in corridors during daytime; repair of air-conditioning leaks	Total energy savings of 812,000 kWh (LBL)
Australia	Hervey Bay Hospital	Upgrades to lighting and air-conditioning systems; implementation of a computerized Building Management System (BMS) to monitor and control building functions, including air conditioning, medical gases, water heating, and steam generation	20% reduction in energy consumption over a two-year period (McGuire, 2009)

Green Building Design

Environmental sustainability in healthcare facilities can be achieved by integrating green building principles into design, construction, and hospital renovation processes.

Table 3. Examples of green building design practices in green hospitals

Country	Hospital	Implemented Green Building Design Measures	Achieved Outcome
Singapore	Changi General Hospital	Rooftop hydroponic garden for on-site food production and passive cooling; use of natural daylight; automatic doors to optimize cooling efficiency; energy-efficient ceiling fans; motion-sensor lighting; low-flow water fixtures	Significant reduction in energy and water consumption; approximately USD 800,000 annual cost savings (CGH, 2002; Guenther, R., & Vittori, G., 2008)
Italy	Meyer Children's Hospital	Greenhouses and landscaped roofs; skylights and buffer zones; hybrid energy-efficient ventilation system; building energy management system; light tubes for natural daylight distribution	35% reduction in energy consumption for heating and cooling (Jørgensen et al., 2005; Guenther, R., & Vittori, G., 2008)

Alternative Energy Generation

Healthcare facilities can significantly reduce greenhouse gas emissions and energy costs over time by utilising alternative clean and renewable energy sources such as solar and wind power and biofuels.

Table 4. Examples of alternative energy generation practices in green hospitals

Country	Hospital	Implemented Alternative Energy Generation Measures	Achieved Outcome
Rwanda	Five clinics supported by Partners In Health (PIH)	Installation of solar energy systems to supply the majority of electricity needs	Approximately 90% of energy demand met by solar power; addresses limited grid connectivity (only 5% of the population connected) (URL-5)

USA	York Hospital	Reduction of fossil fuel consumption through procurement of 90% of energy from wind, hydroelectric, and biomass-fired boilers	24% reduction in carbon emissions between 2000 and 2006 (URL-6)

Transportation

Globally, transportation represents a significant source of greenhouse gas emissions. The healthcare sector is particularly transportation-intensive, encompassing hospital vehicles, delivery fleets, as well as staff and patient travel.

Table 5. Examples of transportation practices in green hospitals

Country	Hospital	Implemented Transportation Measures	Achieved Outcome
Sweden	AISAB Ambulance Operators, Stockholm	Implementation of "eco-driving" techniques to reduce fuel consumption and vehicle wear; focuses on pre-planning and efficient driving rather than simply driving slower	Up to 10% reduction in fuel consumption over an 18-month trial period (URL-7)

Food

Healthcare institutions can reduce their climate footprint by implementing changes in their operational practices and service offerings, such as producing food on-site, composting food waste, and sourcing local and organic products.

Table 6. Examples of food practices in green hospitals

Country	Hospital	Implemented Food Measures	Achieved Outcome
USA	St. Luke's Hospital	Implementation of a local food sourcing and waste management program; procurement from local farmers to reduce transportation emissions; surplus meals frozen and donated to local food banks; composting of food waste	Approximately 1,000 meals provided annually; 40,000 units of food waste composted each year (HCWH, 2008)

Waste

According to calculations by HCWH, a single medical center in San Francisco, for example, generates an average of 60 tons of waste per day. Disposal of such waste in landfills and incinerators results in the release of substantial amounts of greenhouse gases into the atmosphere. Recycling and composting not only mitigate emissions from waste management facilities but also significantly reduce the demand for primary raw materials.

Table 7. Examples of waste practices in green hospitals

Country	Hospital	Implemented Waste Measures	Achieved Outcome
Sri Lanka	Embassy Health Centre	Collection of waste from nearby landfills and transport to an organic waste digester; production of biogas (methane) to supply energy	Self-sufficient energy supply for the hospital and local community, providing a reliable energy source in areas without continuous grid electricity (Beyond LEED, 2008)

Water

Healthcare facilities consume substantial amounts of water and energy for heating, pumping, and wastewater removal. These facilities can conserve water resources through strategies such as rainwater harvesting, implementation of water-efficient technologies, cultivation of drought-tolerant vegetation, and prompt repair of leaks.

Table 8. Examples of water practices in green hospitals

Country	Hospital	Implemented Water Measures	Achieved Outcome

Australia	Royal Children's Hospital	Implementation of a wastewater treatment plant; recycling of rainwater and wastewater for use in toilet reservoirs, cooling systems, and landscaping; integration with biomass boilers to heat recycled water	Meets 40% of the facility's water heating demand (URL-8)
USA	Norwood Hospital	Improvement of water pumps; replacement of valves in toilets; renovation of air-conditioning systems	29% reduction in water consumption over three years, saving approximately USD 14,000 annually (URL-9)

4. Discussion

The strategic siting of hospitals near public transportation routes, the preference for local and regional construction materials, the incorporation of afforestation on site, as well as the integration of design elements such as daylight utilization, natural ventilation, and green roofs, can contribute to reducing the climate footprint of new healthcare facilities even before they become operational.

Alternative energy sources can be utilized to meet critical energy demands including lighting, heating, hot water production, and water pumping in healthcare facilities in both developed and developing countries. Although initial investment is required, alternative energy systems provide substantial long-term economic savings. Moreover, these systems offer resilience against disruptions compared to fossil fuel-based infrastructure, thereby enhancing healthcare facilities' disaster preparedness.

The transportation-related emissions of healthcare facilities can be mitigated through effective planning and spatial allocation of medical services, the use of high-efficiency or alternative-fuel vehicles, and the promotion of sustainable transport options such as cycling, public transportation, and carpooling among staff and patients. Additionally, procurement from local suppliers or companies employing fuel-efficient logistics further reduces transportation emissions.

Promoting and supporting nutritious, local, and sustainable food systems enables the healthcare sector to reduce its own climate footprint while simultaneously contributing to disease prevention by fostering healthy diets.

In the domain of waste management, practices such as composting and recycling, purchasing policies that reduce packaging, the preference for reusable over single-use products, the use of recycled-content materials, and local treatment and disposal of waste collectively help decrease emissions.

To achieve more advanced environmental protection, hospitals can harvest rainwater for non-potable uses and implement greywater recycling systems. For example, at the Sambhavna Trust Clinic in Bhopal, India, rainwater collected during the monsoon season is stored for use during dry months, while recycled water is applied for irrigation across the hospital grounds.

Access to potable water varies according to geographic location. In areas with adequate drinking water, eliminating the use and sale of bottled water can yield significant environmental benefits. According to a 2007 report by the Pacific Institute, the energy required to produce bottled water in the United States is approximately 2,000 times greater than that for tap water production, equivalent to 32–54 million barrels of petroleum. Meeting global bottled water demand would require roughly three times this energy amount.

In conclusion, the World Health Organization (WHO) considers the integrated implementation of green hospital principles essential for establishing sustainable healthcare infrastructure that simultaneously addresses environmental responsibility, economic savings, and quality of care. Expanding the adoption of this approach, particularly in developing countries, can strengthen the role of the healthcare sector in combating climate change.

5. Conclusion and Recommendations

This study demonstrates that the green hospital strategies defined by the World Health Organization (WHO), when considered in conjunction with the 3R principles (Reduce, Reuse, Recycle), provide a robust and comprehensive framework for achieving sustainability in healthcare facilities. The examined case studies indicate that, despite hospitals being resource-intensive structures, their environmental impacts can be substantially mitigated through appropriate planning, design, and operational decisions.

Under the Reduce principle, energy efficiency measures, passive design strategies, natural lighting and ventilation, the use of high-efficiency equipment, and the limitation of transportation-related emissions are emphasized. The findings show that improvements in lighting, air conditioning, and building management

systems can achieve energy savings of 20–30% in hospitals, aligning directly with WHO's targets for energy-efficient and climate-friendly healthcare facilities. Similarly, water-efficient fixtures and consumption-reducing operational policies contribute to the reduction of both water and energy demand.

The Reuse principle is exemplified through practices such as rainwater harvesting, greywater recycling, the repurposing of non-medical materials and building components, and the composting of food waste. These approaches extend resource life cycles, reduce operational costs, and support WHO's strategies on water management and waste reduction.

The Recycle principle focuses on converting waste that cannot be reused into secondary raw materials or energy sources. The production of biogas from organic waste, the use of recycled-content materials, and on-site waste segregation contribute to greenhouse gas emission reduction. These measures are consistent with WHO's objectives of resource efficiency and minimizing environmental harm.

In conclusion, the integrated application of WHO green hospital principles with the 3R approach is essential for establishing healthcare infrastructure that is environmentally responsible, economically efficient, climate-resilient, and supportive of human health. This comprehensive framework holds particular potential to accelerate the sustainability transformation of the healthcare sector in developing countries.

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PERFORMANCE ENHANCEMENT OF A SET OF HYBRID PARABOLIC TROUGH CONCENTRATORS INTEGRATED WITH SEMI-TRANSPARENT PHOTOVOLTAIC CELLS, TOGETHER WITH A DETAILED STUDY OF THE CHARGING PROCESS OF A RECHARGEABLE BATTERY

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Abstract
The parabolic trough system is a promising and efficient energy conversion technology for covering people's need for clean electricity. In this paper, a set of new hybrid parabolic trough systems integrated with semi-transparent photovoltaic cells and thermoelectric generators are studied. To study the performance of our hybrid systems, a set of new numerical model are presented. The major results show that the maximum power reached 1327.2 W, while the maximum thermal efficiency is 52.16%.
Keywords: Semi-transparent photovoltaic cell, Parabolic trough concentrator, Thermoelectric generator, Thermal efficiency, State of charge, PMMA concentrator.

1. Introduction

The high production of electrical and thermal energy using fossil fuels results in toxic emissions into the atmosphere, causing serious ecological damage to our habitat and planet [1-3]. The scientific community has therefore come up with other ways of avoiding the use of fossil fuels, such as renewable energies, with a view to meeting people's electricity needs [4,5]. According to the research studies conducted by [6-8], renewable energy based on sun power is one of the most recommended methods around the world as solar energy is more abundant than other renewable energies such as wind power, hydroelectric energy.... These renewable solar systems are capable of generating significant thermal and electrical power, or both, when they are exposed to the sun. These include photovoltaic systems, parabolic trough collectors, tower collectors, Fresnel collectors and parabolic dish. Among them, the parabolic trough concentrator (PTC) is considered the most advanced technology and is therefore widely used around the world. In this respect, Spain, USA, China and Morocco represent the top four countries with the largest concentrated solar power plants in 2022, with annual outputs of 2304 MW, 1480 MW, 596 MW and 540 MW respectively [9]. Apart from its advantages, PTC has a number of shortcomings that reduce its thermal efficiency, resulting in low electricity and thermal energy generation. These challenges, such as heat loss and high energy consumption by the pump, have motivated scientific researchers to come up with new ideas for improving the thermal and electrical performance of PTC systems [10,11]. Consequently, the hybrid parabolic trough concentrator came to the limelight in the scientific community, featuring simultaneous thermal and electrical energy production with improved efficiency compared with conventional concentrators [12-14].

Recently, Mohamad et al studied three hybrid parabolic trough concentrators integrated with a set of monocrystalline photovoltaic cells [15]. These cells are installed directly on the top side of the absorber tube in each hybrid system for direct generation of both electrical and thermal energy. Also, they used organic rankine cycle (ORC) to convert thermal energy into electrical power for increasing energy efficiency of the hybrid parabolic trough concentrator. Their main findings demonstrated that the thermal and electrical performance of PTC-PV, PTC-ORC and PTC-PV-ORC is significantly improved as compared with those of conventional PTC. Thus, the maximum overall efficiencies of PTC-PV-ORC, PTC-PV, Conventional PTC, PTC-ORC are 52.29 %, 50.22 %, 43.17% and 33.82 %, respectively. In addition, the electrical efficiencies of conventional PTC, PTC-ORC, PTC-PV and PTCPV-ORC systems stand at 0%, 4.10%, 8.15% and 11.41% respectively. Similarly, a new hybrid parabolic trough concentrator equipped with photovoltaic cells is developed by Yan et al [16]. This new system is mainly proposed to improve the thermal/electrical performance of the PTC, using a new rotation technique of the absorber tube to further optimize the efficiency of the system. They also installed a metal foam inside the fluid channel of the receiver tube for the same purpose. Their 3D-dimensional study proved that for air gap thickness, glass thickness, nanoparticle mass

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fraction and PV cell efficiency of 10 mm, 2 mm, 6% and 21%, the maximum overall efficiency of the PTC/PV system is about 71.1%. However, by using the absorber tube rotation technique, this maximum efficiency is further improved to 82.5%. Habchi et al. [16] proposed a new technique for designing a novel hybrid parabolic trough concentrator that primarily combines the conventional PTC with tubular thermoelectric generators (TTEG). Their main findings revealed that the overall efficiency of the SPTC/Therminol VP1 system reached 70.550%, yielding approximately 585 W of additional electrical power. Meanwhile, the SPTC/Water system achieved an efficiency of 76.913% and generated 97.032 W of additional electrical power, respectively.
The integration concepts described above offer valuable insights into enhancing the performance of parabolic trough concentrators by mitigating heat loss through the Seebeck and/or photoelectric effects. However, the advancements in thermal/electrical performance achieved through these combined techniques remain limited. As a result, there is a quest for a new scientific innovation capable of minimizing heat loss to a greater extent. In response to this need, our proposed scientific innovation entails the intelligent integration of a series of semi-transparent PV cells (TSPV) positioned between the glass cover and the absorber tube. These systems are denoted as follows: PTC/TSPV/Bi2Te3, PTC/TSPV/PbTe, PTC/TSPV/PMMA/Bi2Te3, and PTC/TSPV/PMMA/PbTe. These thermoelectric generators are situated on the lower surface of the absorber tube, with direct contact between the lower surface of the TEG and the heat transfer fluid. The novel geometry of these newly proposed systems provides the foundation for developing a new mathematical model. As a result, a set of six 0-D mathematical models is introduced to examine the performance of each hybrid system. The discretization of a mathematical model of each hybrid system is carried out using the finite element method. Subsequently, the resulting equations are solved using the iterative Newton-Raphson technique. This approach enables the accurate analysis of the thermal and electrical performance of each hybrid system, allowing for detailed insights into their behavior and potential optimizations.

2. Methodology

In the present work, a set of new hybrid parabolic trough concentrators both with and without TEG are investigated, while the electrical performance of a rechargeable battery of different capacity in these hybrid systems is studied. The physical configuration of the first hybrid parabolic concentrator (PTC/TSPV) is described in Figure 1, which comprises a cross-sectional view of the hybrid collector. The PTC/TSPV system consists of a parabolic trough mirror, hybrid collector, and storage tank, which is equipped with a heat exchanger. This new system also comprises seven main components: a pump, a rechargeable battery, a DC/AC converter, a flowmeter, an external water source and two intermediate electrical boxes. The hybrid collector includes a heat transfer fluid (Therminol VP1) with excellent high-temperature characteristics, an absorber tube, an evacuated space, semi-transparent tubular photovoltaic cells (TSPV) and a glass cover. As shown in Table 1 and Figure 1a, a set of TSPVs are characterized by both a high transmission coefficient (60%) and a low thickness (1 mm), for which reason they are attached directly to the backside of the glass cover to protect them from any damage. What's more, the position of the TSPV in the hybrid collector allows a significant portion of the sun's radiation to penetrate both the cover and the TSPV towards the absorber tube. The selected semi-transparent PV cells are manufactured by the solar construction company. The total length of the mirror, glass cover, TSPV and absorber tube is 7.8 m, while the width and focal distance of the mirror are 5 m and 1.84 m, respectively. The storage tank is made of galvanized iron material, with an insulating layer covering it to minimize heat exchange between this tank and the external environment. The total volume of the storage tank is 1200 litre. To generate electrical power by means of water vapor, a heat exchanger is installed inside the storage tank in order to evaporate the cold water stored inside this tank. An external water source is mainly used to fill the storage tank during the working day. Meanwhile, synthetic oil (Therminol VP1) is circulated from the heat exchanger through the hybrid collector to the storage tank using a low-consumption pump with a constant mass flow rate of 0.02 kg/sec, as shown in Fig.1. The said pump is operated by electrical energy stored in a rechargeable battery by means of two intermediate electrical boxes. The selected battery has a capacity of 10 Ah and a voltage of 12 V. It is directly connected to the tubular semi-transparent photovoltaic cells via the first intermediate electrical box. Each electrical box is clearly presented in Fig. 1b.

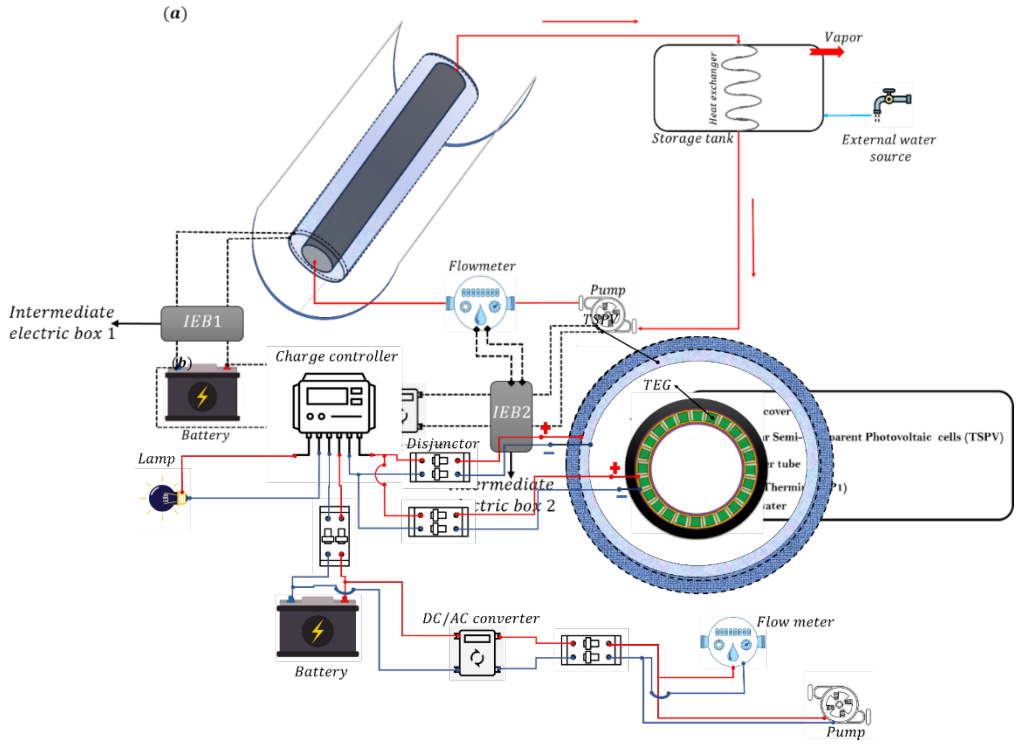


Fig.1 Schematic representation of: (a) the hybrid systems and of the electrical installation of pump (b).

The inclusion of a thermoelectric generator at the inner side of the absorber tube in PTC/TSPV and PTC/TSPV/PMMA systems certainly changes the thermal equation of these systems, especially for the components in contact with TEG. Thus, the thermal equation of the PTC/TSPV and PTC/TSPV/PMMA systems with TEG are as follows:

Starting with the thermal/electrical equations of the PTC/TSPV/Bi2Te3 and PTC/TSPV/PbTe systems:

Glass cover

$$\rho_g C_{p,g} V_g \frac{dT_g}{dt} = \phi^{abs}{}_g - \Phi_{conv,g-am} - \Phi_{rad,g-sky} - \Phi_{cond,g} \quad (1)$$

TSPV (Tubular semi-transparent PVs cells)

$$\rho_{PV} C_{p,PV} V_{PV} \frac{dT_{TSPV}}{dt} = \phi^{abs}{}_{TSPV} + \Phi_{cond,g} - \Phi_{cond,TSPV} + \Phi_{conv,ab-TSPV} + \Phi_{rad,ab-TSPV} - P_{TSPV} \quad (2)$$

The complementary equations for the power output and efficiency of TSPV in the PTC/TSPV/PMMA/Bi2Te3 and PTC/TSPV/PMMA/PbTe systems are detailed in the system of equations for PTC/TSPV and PTC/TSPV/PMMA prior to the installation of the TEG.

Absorber tube

$$\rho_{ab} C_{p,ab} V_{ab} \frac{dT_{ab}}{dt} = \phi^{abs}{}_{ab} - \Phi_{conv,ab-TSPV} - \Phi_{rad,ab-TSPV} - \Phi_{cond,ab-HSTEG} \quad (3)$$

At this stage, the governing equations of thermoelectric generators are included using Eq.1, allowing us to calculate the temperature of the hot/cold side at each instant:

Hot side of TEG (Bi2Te3 or PbTe)

$$\rho_{TEG} C_{p,TEG} V_{TEG} \frac{dT_{HSTEG}}{dt} = \Phi_{cond,ab-HSTEG} - \Phi_{cond,HSTEG-CSTEG} - P_{TEG} \quad (4)$$

Cold side of TEG (Bi2Te3 or PbTe)

$$\rho_{TEG} C_{p,TEG} V_{TEG} \frac{dT_{CSTEG}}{dt} = \Phi_{cond,HSTEG-CSTEG} - \Phi_{conv,CSTEG-fluid} \quad (5)$$

The electrical power of a thermoelectric generator is written as follows:

$$P_{TSPV} = \eta_{TEG} \frac{A^{TEG}(1+\bar{\bar{Z}})k_{TEG}(T_{HSTEG}-T_{CSTEG})}{e_{TEG}} \quad (6)$$

Where, the electrical expression of TEG that appears in the power output equation is given as follows:

$$\eta_{TEG} = \frac{T_{HSTEG}-T_{CSTEG}}{T_{HSTEG}} \left[\frac{\sqrt{1+\bar{\bar{Z}}}-1}{\sqrt{1+\bar{\bar{Z}}}+\frac{T_{CSTEG}}{T_{HSTEG}}} \right] \quad (7)$$

Fluid (Therminol VP1)

$$\rho_{fluid} C_{fluid} V_{fluid} \frac{dT_{fluid}}{dt} = \Phi_{conv,CSTEG-fluid} - \Phi_{u,fluid} \quad (8)$$

Storage tank

$$\rho_{St} C_{St} V_{St} \frac{dT_{St}}{dt} = \Phi_{u,fluid-St} - \Phi_{conv,st-am} - \Phi_{rad,st-sky} \quad (9)$$

The absence of experimental tools to carry out a physical study leads us to use numerical simulation. The latter is a most useful tool where it is equivalent to the accuracy of the experimental approach. In addition, the strength of numerical simulation is embodied in the ability to solve non-linear systems of equations. Accordingly, the numerical simulation of the thermal/electrical models of the PTC/TSPV and PTC/TSPV/PMMA systems before and after the use of TEG is applied in this section. In the first place, our numerical model is based on the finite difference method, which is a simple and more convergent method [40]. This technique is essentially used to discretize the temporal/spatial operators using the following approximate discrete schemes:

$$\frac{dT_i}{dx} = \frac{T^t_{i,j} - T^t_{i,j-1}}{\Delta x} \quad (10)$$

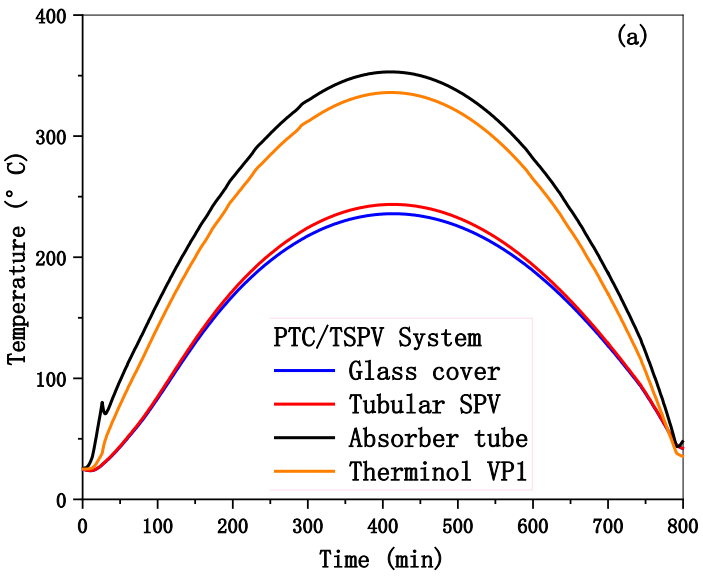
$$\frac{dT_i}{dt} = \frac{T^{t+\Delta t}_{i,j} - T^t_{i,j}}{\Delta t} \quad (11)$$

Where, i is the individual component of the hybrid system, Δx and Δt are respectively the space and time steps. The two terms j [1:120] and t [0:800 min] are iteration counter and time.

3. Findings

Thermal performance of hybrid systems

Figs.2 present the temperature of each component in the hybrid system as a function of time. From Figure 2a, it is evident that the temperature of each component in the PTC/TSPV system rises as time progresses from 0 minutes to 400 minutes. This increase can be attributed to the rise in solar irradiation during this time period. Additionally, it is observable that the temperature of the absorber tube reaches 353.07°C, while that of the Therminol VP1, TSPV, and glass cover is respectively 336.04°C, 243.61°C, and 235.93°C. As expected, the hot-side temperature of the TEG closely tracked the absorber tube temperature due to their direct contact, as demonstrated in Fig. 2b. Conversely, the bottom-side temperature of the TEG is lower than the top-side temperature due to the relatively low thermal conductivity of the thermoelectric materials (Bi2Te3 and PbTe). Consequently, in the case of Bi2Te3, the maximum temperature of the hot and cold sides of the TEG is 476.61°C and 441.84°C, respectively, resulting in $\Delta Tmax$ = 34.77°C. Correspondingly, for the PbTe thermoelectric material, these values are 469.5°C and 444.98°C, with $\Delta Tmax$ = 24.52°C.



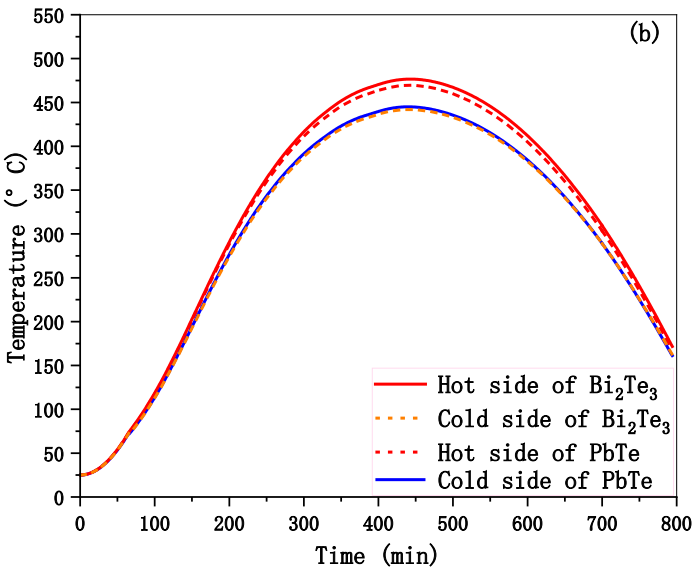
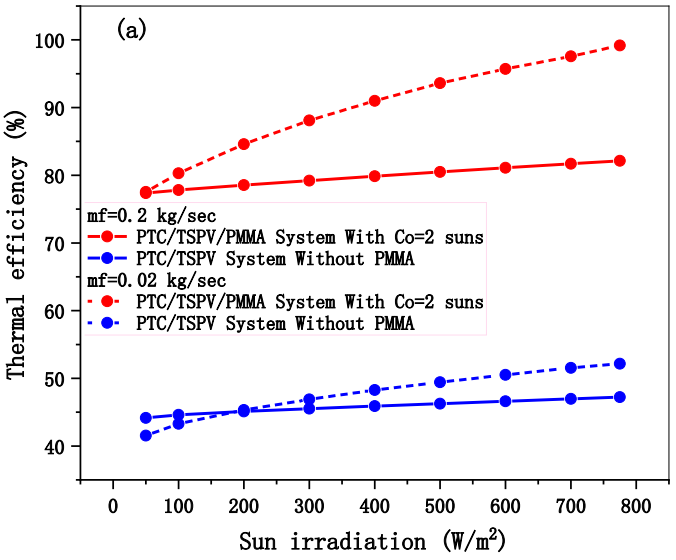


Fig.2 Daily temperature of each of the hybrid collector components in the PTC/TSPV (a) and those of thermoelectric generator sides (b).

Thermal efficiency of hybrid systems

Figure 3a illustrates that the thermal efficiency of the PTC/TSPV system, prior to integrating TEG, increases from 41.547% to 52.164% for a mass flow rate of 0.02 kg/sec, as solar irradiation rises within the specified range. This increase is attributed to the augmented useful energy conveyed by the heat transfer fluid, corresponding to the heightened solar irradiation, as elucidated by Eq. 12 [17]. Contrary to expectations, the thermal efficiency of the PTC/TSPV system diminishes as the mass flow rate escalates from 0.02 kg/sec to 0.2 kg/sec. This phenomenon arises due to the excessively high fluid flow rate of 0.2 kg/sec, preventing adequate heating of the fluid within the solar collector, thereby diminishing the system's thermal efficiency. Likewise, the thermal efficiency of the PTC/TSPV/PMMA system, excluding TEG, experiences a notable surge from 77.539% to 99.172% with the elevation of solar irradiation from 50 W/m² to 775 W/m², under Co=2 suns and mf=0.02 kg/sec conditions. This escalation is attributed to the PMMA concentrator, which amplifies the solar flux transmitted across the TSPV, thereby substantially enhancing both the fluid temperature and the useful flux.



$$\eta_{PTC} = \frac{\dot{m}_f C_f (T_f{}^{out} - T_f{}^{in})}{C_o A^r G_d} \qquad (12)$$

Fig.3 Effect of solar irradiation on thermal efficiency of PTC/TSPV and PTC/TSPV/PMMA systems without TEG (a) and after the installation of TEG.

3.3 State of charge of the battery

The state of charge of the PTC/TSPV/PMMA/Bi2Te3 and PTC/TSPV/PMMA/PbTe systems (Red lines) increases from 0% to 53.016% and from 0% to 46.359%, respectively, while that of the PTC/TSPV/PMMA system increases from 0% to 44.583%, as demonstrated in Figs. 4a and 4b. These results demonstrate that integrating TEG into PTC/TSPV and PTC/TSPV/PMMA systems can enhance the battery's electrical

performance. Also, the state of charge of the battery in our hybrid systems does not reach 100% (Full Charge). This is attributed to the non-constant nature of the charging current.

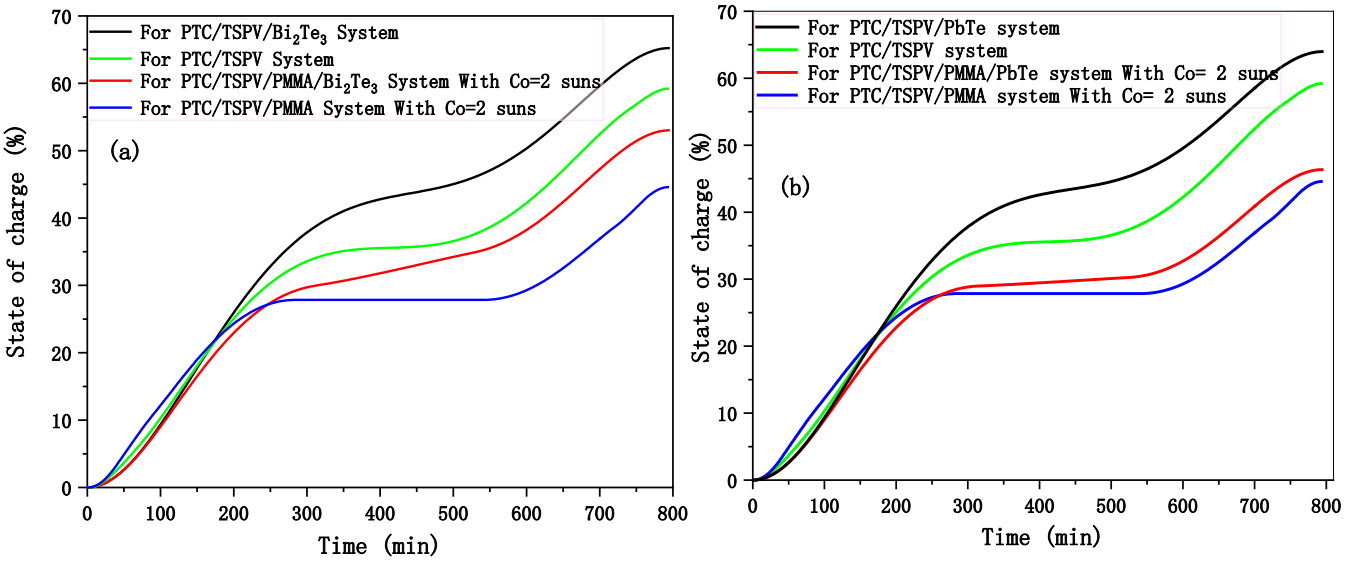


Fig.4 Daily variation of SOC of same battery connected to PTC/TSPV/bi2Te3 (a) and PTC/TSPV/PbTe (b) with and without PMMA concentrator.

4. Conclusion and Recommendations

In this work, a set of new numerical models is proposed for the first time to study the thermal and electrical performance of PTC/TSPV and PTC/TSPV/PMMA systems. These new systems are equipped as never before with semi-transparent photovoltaic cells and PMMA concentrator to generate both thermal and electrical energy. The main new conclusions can be summarized as follows:

The maximum additional electrical power of the PTC/TSPV system is 1327.238 W, while its maximum thermal efficiency reaches 52.164% for solar radiation of 775 W/m2 and 0.02 kg/sec. When the TEG is installed in the PTC/TSPV system, the maximum thermal efficiency becomes 51.81% and 52.235% in the case of Bi2Te3 and PbTe (without the use of a PMMA concentrator).

The maximum thermal efficiency of the PTC/TSPV/PMMA, PTC/TSPV/PMMA/Bi2Te3, PTC/TSPV/PMMA/PbTe systems up to 99.172%, 72.874% and 74.177% for solar radiation of 775 W/m2, Co=2 suns and 0.02 kg/sec, respectively.

In future research, we will study a new control technique to achieve stabilized electrical performance of rechargeable batteries with different capacities, as well as to control the thermal/electrical performance of PV cells in the parabolic trough concentrator throughout the day.

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METHODOLOGICAL INNOVATIONS IN PARTICIPATORY MAPPING FOR COMMUNITY-BASED DISASTER RISK ASSESSMENT: A CASE STUDY IN COASTAL REGION IN TURKEY

Anang Widhi Nirwansyah[85]

Abstract
Coastal regions in Turkey are increasingly threatened by climate-induced hazards such as sea-level rise, coastal erosion, and flooding, yet a significant gap remains between technical scientific data and local, on-the-ground knowledge. This research proposal outlines a methodological framework for community-based disaster risk assessment, focusing on the ecologically sensitive and agricultural regions of the Çukurova Delta and Yumurtalık in Adana Province. Adopting a Participatory Action Research (PAR) approach, the study aims to co-produce high-quality disaster risk maps by integrating indigenous spatial knowledge with modern geospatial technologies. The proposed methodology involves a phased process of spatial literacy training, collaborative fieldwork utilizing GPS and mobile data collection, and the synthesis of community insights with open-source GIS datasets. By employing a hybrid analytical framework that draws upon both socio-economic and coastal vulnerability indices, the project seeks to validate risk models through direct community engagement. The expected outcomes include the development of accurate, locally validated risk maps and a refined participatory protocol that strengthens community resilience and offers a scalable model for disaster risk reduction in Turkish coastal environments.
Keywords: Participatory Mapping, Disaster Risk Assessment, Participatory Action Research (PAR), Coastal Vulnerability, Geographic Information Systems (GIS)

1. Introduction

Coastal regions in Turkey are becoming increasingly vulnerable to the impacts of climate change, such as sea level rise, coastal erosion, and flooding (Aykut & Tezcan, 2024; Ciritci & Türk, 2019; Koç et al., 2020). These risks are intensified by high population density, expanding land use, and the presence of sensitive ecological areas (Koç & Thieken, 2018; Velioglu Sogut, 2025). Robust disaster risk management strategies are urgently needed in these settings, ones that can bridge the gap between scientific data and local, on-the-ground knowledge.

Participatory mapping has emerged as a powerful methodological tool for disaster risk management, allowing local communities to share their indigenous spatial knowledge and collectively assess vulnerabilities. Building upon the frameworks established by (Nirwansyah et al., 2024) and the vulnerability assessment approaches of Aykut & Tezcan (2024), this research proposal seeks to develop and refine participatory mapping techniques specifically tailored for vulnerable coastal regions in Turkey. The project aims to systematically engage community members in spatial literacy training, collaborative map-making, and risk assessment processes, thereby enabling joint production of high-quality, community-validated disaster risk maps. By integrating traditional practices with modern geospatial technologies (such as GPS, open-source GIS, and remote sensing data), the study will address how participatory methodology can be adapted and operationalized in Turkish socio-environmental contexts.

Earlier studies emphasize that participatory mapping not only improves hazard awareness but also strengthens communication among communities, scientists, and decision-makers (Canevari-Luzardo et al., 2017; de Andrade & Szlafsztein, 2015; Tiepolo et al., 2021). Local validation of risk maps and joint vulnerability assessment are found to foster greater trust and uptake in disaster planning (de Andrade & Szlafsztein, 2015; Hendricks et al., 2022). However, methodological questions persist around optimizing technical processes—from grassroots training and GPS-enabled fieldwork to integrating community data within GIS platforms (Eitzel et al., 2018; Nirwansyah et al., 2023). Moreover, there is a need to evaluate the quality, accuracy, and practical impacts of the collaboratively generated maps themselves (Thapa et al., 2019). Building on these insights, this research proposal aims to advance participatory mapping methods for disaster risk assessment in Turkish coastal communities. The study will address two central research questions (RQ):

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How can the technical process of participatory mapping—including training, data collection, GPS integration, and GIS analysis—be developed and optimized to effectively engage community members in Turkish coastal settings?
What are the qualitative and quantitative outcomes of collaboratively generated disaster risk maps, and how do these maps inform local understanding of vulnerability as well as future disaster risk reduction strategies?

2. Methodology
This study employs a Participatory Action Research (PAR) framework within the Çukurova Delta and Yumurtalık region of Turkey, a coastal area highly susceptible to flooding and sea-level rise due to its low-lying topography. Diverse stakeholders, including village leaders and marginalized groups, participate as equal collaborators guided by strict ethical protocols and trust-building activities. The methodological foundation consists of interactive workshops focusing on spatial literacy and collaborative mapping to identify local hazards and evacuation routes. Participants utilize a combination of analog tools and GPS-enabled mobile devices during field surveys and transect walks to ground-truth environmental vulnerabilities. These community-generated insights are integrated into open-source GIS software (QGIS) alongside official geospatial datasets to produce draft disaster risk maps. Refinement occurs through iterative validation workshops using a hybrid analytical framework that incorporates socio-economic and coastal vulnerability indices. Finally, the project's effectiveness is evaluated through mixed-methods analysis, including thematic coding of reflexive learning data and pre- and post-project surveys to assess changes in participant spatial literacy and risk perception.

3. Findings
The primary tangible output of this research will be the production of high-quality, community-validated disaster risk maps in both printed and digital formats. These maps will visualize localized hazards, vulnerability zones, safe locations, and critical infrastructure, such as evacuation routes, by integrating community-sourced data with official geospatial datasets like Sea Level Rise (SLR) projections and Digital Elevation Models (DEM). By utilizing a hybrid analytical framework that combines Socio-Economic and Coastal Vulnerability Indices, the project will generate actionable resources and summary reports for local and regional authorities to enhance disaster preparedness and policy application at both the grassroots and governmental levels.
Beyond technical deliverables, the study expects to significantly strengthen the social and intellectual capital of the Çukurova Delta and Yumurtalık communities through its emphasis on capacity building. Through interactive workshops and collaborative field surveys, participants are expected to demonstrate enhanced "spatial literacy," including improved proficiency in map reading, interpreting aerial photography, and utilizing GPS-enabled technologies for data collection. This participatory process is designed to foster deeper hazard awareness, bridge the communication gap between local residents and scientific experts, and build the necessary trust for the long-term uptake of disaster risk reduction strategies within these vulnerable coastal regions.
Scientifically, the study will provide a refined and optimized methodological protocol for implementing participatory mapping within the specific socio-environmental context of Turkey's coastal regions. By analyzing reflexive learning data, facilitator diaries, and thematic coding of workshop discussions, the research will offer actionable insights into overcoming the inherent technical and social challenges of Participatory Geographic Information Systems (PGIS). This rigorous evaluation will identify the obstacles to inclusive engagement and data accuracy, ensuring that the resulting methodology is robust enough to handle the complexities of local knowledge integration.
Ultimately, these insights will yield a scalable framework and actionable recommendations for adapting participatory mapping models to other vulnerable coastal communities across Turkey. The research aims to deliver a tested model that successfully integrates indigenous spatial knowledge with modern geospatial science, providing a blueprint for community-based disaster risk assessment. These final outputs will not only support local resilience in the Mediterranean but will also serve as a strategic guide for national policymakers seeking to implement inclusive and scientifically grounded disaster management programs in diverse environmental settings.

4. Discussion
The expected outcomes of this research demonstrate the transformative potential of integrating community-sourced spatial data with high-resolution geospatial technology to address coastal vulnerabilities in Turkey.

By producing locally validated risk maps through a hybrid analytical framework, the study effectively bridges the gap between expert-driven scientific models and indigenous on-the-ground knowledge. The anticipated improvements in spatial literacy among residents of the Çukurova Delta and Yumurtalık suggest that Participatory Action Research (PAR) serves not only as a data collection tool but also as a vital capacity-building mechanism for disaster preparedness. Furthermore, the development of a refined methodological protocol addresses existing gaps in PGIS implementation by systematically documenting reflexive learning and overcoming technical and social barriers. Ultimately, these results provide a scalable model that empowers vulnerable communities to become active collaborators in risk management, offering a scientifically robust and socially inclusive pathway for enhancing coastal resilience across the Mediterranean region and beyond.

5. Conclusion and Recommendations

In summary, this research proposal establishes a methodology to bridge the gap between technical geospatial data and indigenous knowledge within Turkey's vulnerable coastal regions. The expected outcome is the development of a community-validated mapping protocol that significantly enhances local spatial literacy and hazard awareness. By integrating local insights with modern GIS technology, the study aims to produce actionable risk maps suitable for both grassroots planning and regional policy application. This collaborative process is expected to build trust among stakeholders and provide a scalable model for disaster risk reduction in diverse environmental settings. Ultimately, the project anticipates delivering a tested framework that empowers coastal communities to actively participate in strengthening their own climate resilience.

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A COMPARATIVE STUDY OF ANIMATION AND IMMERSIVE MEDIA IN HERITAGE STORYTELLING AND DESTINATION BRANDING IN IRAN, TURKEY AND SAUDI ARABIA

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Abstract
Recent advances in animation, projection mapping, and immersive technologies such as virtual reality (VR) have opened new ways to tell heritage stories and shape destination branding. West Asia, with its dense concentration of cultural heritage and ambitious tourism strategies, is an especially revealing context, yet comparative research on how animation and immersive media are used across different countries in the region remains limited. This study addresses this gap by examining how selected animation and immersive media projects in Iran, Turkey, and Saudi Arabia construct the cognitive, affective, and conative dimensions of destination image. The research adopts the cognitive–affective–conative (CAC) destination image framework as its theoretical lens. Methodologically, it employs a qualitative, comparative multiple-case design based on multilingual web-based document analysis. Publicly available project descriptions, promotional videos, virtual tours, policy documents, and news articles in Persian, Turkish, Arabic, and English are examined. Using directed qualitative content analysis, each case is coded in terms of the type of media (e.g., animated film, tourism animation, projection mapping, VR/360° virtual tour), the heritage or identity elements it foregrounds, and its implied cognitive, affective, and conative effects. The findings reveal three distinct national configurations. In Iran, animation and immersive media are primarily used in an educational–heritage configuration aimed at domestic audiences: projects focusing on historic cities, villages, and UNESCO sites build detailed cognitive knowledge of local heritage and evoke nostalgia, warmth, and national pride, while encouraging domestic travel and learning. In Turkey, an experiential–heritage configuration dominates: site-specific projection mapping shows in Cappadocia and Istanbul's cisterns, together with tourism animation campaigns, frame heritage as a multi-sensory spectacle designed to enrich international visitors' experience and redistribute attention beyond sun-and-sea tourism. In Saudi Arabia, a strategic heritage–entertainment–smart configuration emerges: VR heritage platforms, interactive museums, anime-themed districts, and IP-based theme parks jointly construct a dual image of the country as both a technologically advanced guardian of heritage and a global entertainment hub aligned with Vision 2030, directly targeting event-driven travel and extended stays. The study contributes to destination image research by operationalising the CAC framework in the context of animation and immersive media in West Asia and by identifying three comparative configurations of media use and image construction. It also offers practical insights for tourism and heritage policymakers seeking to design media strategies that balance heritage interpretation, emotional engagement, and behavioural impact.
Keywords: West Asia; destination image; animation; immersive media; virtual reality; heritage tourism

1. Introduction

Animation, projection mapping, and immersive media—especially virtual and augmented reality (VR/AR)—are increasingly used to narrate heritage, design tourist experiences, and influence how destinations are imagined before travel. Tourism research shows that destination image shapes choice and is formed through mediated information and traveler characteristics (Baloglu & McCleary, 1999). Destination image is commonly treated as multidimensional—cognitive, affective, and conative—linking communication to behavior (Echtner & Ritchie, 1991, 1993). Place- and destination-branding perspectives add that these images are strategically negotiated through coordinated communication, experience design, and governance rather than merely reflecting "reality" (Anholt, 2010; Kavaratzis, 2004). Within this broader agenda, media-induced tourism research has established that film and related screen media can translate landscapes and cultural symbols into compelling storyworlds that stimulate interest and travel motivations (Beeton, 2005; Hudson & Ritchie, 2006). Immersive media extend screen influence by adding interactivity and a stronger sense of "being there," which can function as a form of experiential preview. Foundational media theory conceptualizes such effects in terms of telepresence (Steuer, 1992), and tourism scholarship argues that VR can serve marketing, education, entertainment, and heritage-preservation purposes (Guttentag, 2010). Empirical evidence further suggests that presence within VR experiences can shift attitudes toward destinations and contribute to visitation

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intentions (Tussyadiah, Wang, Jung, & tom Dieck, 2018). In heritage contexts, virtual-heritage research highlights how digital reconstructions and interactive environments can support interpretation by combining spatial experience, historical information, and affective engagement (Champion, 2021). Together, these strands suggest that animation and immersive media can co-produce knowledge, emotion, and behavioral inclination central to destination branding. West Asia offers a revealing context for testing this proposition because it combines globally significant heritage with fast-changing tourism agendas and strong state involvement in cultural, creative, and visitor economies. Aligned with KEF's interdisciplinary focus linking tourism with architecture and technology (Atatürk University, 2025), comparing Iran, Turkey, and Saudi Arabia—countries with contrasting governance and branding trajectories—clarifies how similar media tools are adapted to heritage narratives and target markets. Saudi Arabia's Vision 2030 and its National Tourism Strategy position tourism as a pillar of economic transformation and destination development (Saudi Tourism Authority, 2025; Ministry of Tourism Saudi Arabia, n.d.), while Turkey's Tourism Strategy (2023) emphasizes competitiveness and diversification, including culture- and heritage-linked tourism (Republic of Türkiye Ministry of Culture and Tourism, 2007). Yet, despite growing global literature on film-induced and VR-enabled tourism, comparative research remains limited on how animation and immersive media are mobilized across different governance contexts in West Asia to build destination brands through heritage storytelling. To address this gap, this study compares selected animation and immersive-media initiatives in Iran, Turkey, and Saudi Arabia and examines how they construct the cognitive, affective, and conative dimensions of destination image. It asks: (1) how these initiatives communicate destination knowledge and authenticity cues, (2) how they orchestrate emotions such as nostalgia, awe, or excitement, and (3) what cross-national patterns of media use and image construction emerge. The remainder of the paper presents the conceptual lens and comparative approach, then discusses country cases and implications for tourism and heritage stakeholders.

2. Theoretical Framework and Literature Review

Destination image research provides a foundational lens for explaining how mediated heritage narratives influence tourism branding and travel-related behavior. Early accounts describe destination image as a mental representation shaped by the interaction of information sources and individual characteristics, and as a key antecedent of destination selection (Baloglu & McCleary, 1999; Gartner, 1993). A widely used refinement conceptualizes destination image as an interrelated set of cognitive, affective, and conative evaluations: what people believe they know about a destination, how they feel about it, and what they are inclined to do (Echtner & Ritchie, 1991, 1993). Empirical syntheses further show that the cognitive component is multidimensional (e.g., attractions, infrastructure, culture), that affective responses can operate as a summary evaluation, and that conative intentions are influenced by both (Beerli & Martín, 2004). Within destination and place branding, these images are not treated as passive reflections but as strategically shaped meaning systems produced through communication, experience design, and governance, where branding aims to align identity claims with stakeholder practices and audience perceptions (Anholt, 2010; Kavaratzis, 2004). Media-induced tourism scholarship offers a direct mechanism for such shaping by demonstrating how screen narratives convert places into storyworlds, provide iconic visual schemas, and circulate emotionally charged associations that can alter awareness and travel motivations (Beeton, 2005; Hudson & Ritchie, 2006). Although the classic literature focuses on film and television, similar mechanisms extend to animation and transmedia cultural content, where stylization, character-based identification, and repeatable iconography can condense complex heritage into accessible narrative cues and, in some contexts, foster contents tourism and animation-driven pilgrimage behaviors (Mori, 2025; Ono et al., 2020). Across media forms, narrative engagement helps explain why affective and conative shifts occur: when audiences become transported into a story, they can adopt story-consistent beliefs and emotions that persist beyond exposure (Green & Brock, 2000). Immersive media extend mediated influence by moving tourism communication toward simulated experience. Virtual reality (VR) is commonly framed as enabling pre-visit exploration, education, accessibility, and marketing, with distinctive value arising from immersion, interactivity, and a heightened sense of presence (Guttentag, 2010; Steuer, 1992). Presence has been theorized as the subjective feeling of being there in a mediated environment, shaped by sensory richness and system responsiveness (Slater & Wilbur, 1997), and tourism studies show that VR experiences can influence destination attitudes and intentions, often through mechanisms such as presence, enjoyment, and vivid mental imagery (Tussyadiah et al., 2018). Systematic reviews document the growth of immersive technologies in tourism research, identify major themes and gaps, and call for stronger theory integration and clearer evidence on behavioral outcomes (Calisto & Sarkar, 2024; Pratisto et al., 2022; Yung & Khoo-Lattimore, 2019). Augmented reality (AR) overlays interpretive content onto physical settings;

reviews highlight clusters around acceptance, heritage interpretation, and experience enhancement, suggesting shifts in both cognitive learning and affective engagement in situ (Liang & Elliot, 2021). Projection mapping, often described as spatial AR, similarly stages heritage as an audiovisual spectacle on physical surfaces, blending monumentality with narrative sequencing; digital heritage studies argue that projection mapping can communicate spatiotemporal transformation and interpretive content by synchronizing imagery, sound, and architecture, thereby producing awe, curiosity, and memorable learning moments (Li & Ito, 2023; Nofal et al., 2018). In parallel, virtual heritage and digital storytelling scholarship explains how immersive interpretation works when heritage is treated as a narrative and experiential problem rather than a catalog of facts. Interpretation traditions stress that effective heritage communication connects information to meaning and feeling (Tilden, 1957), while virtual heritage work shows how reconstructions, interactive environments, and mixed media can externalize historical layers, scale, and intangible practices that are otherwise difficult to convey (Addison, 2000; Champion, 2021; Economou & Pujol, 2011). Recent work on interactive digital storytelling in digital heritage emphasizes the integration of narrative structure with interactive choice and gameplay-like affordances, aiming to deepen engagement and learning (Rizvic et al., 2024), and reviews in cultural and heritage tourism point to the growing role of social platforms in disseminating heritage stories and shaping youth engagement (Kasemsarn & Nickpour, 2025). Synthesizing these strands, the CAC model can be operationalized as an analytical bridge between media affordances, storytelling strategies, and brand-relevant outcomes: cognitive image can be traced in how media represent heritage attributes, landscapes, and visitor logistics and in how they signal credibility through institutional voices and expert framing; affective image can be traced in tonal design choices (music, color, pacing), character empathy, spectacle, and the emotional arc of heritage narration; and conative image can be traced in action scripts embedded in media, such as calls to visit, itineraries, ticketed events, shareable experiences, and implied forms of participation that translate heritage story into travel intention and advocacy (Baloglu & McCleary, 1999; Echtner & Ritchie, 1993). This operationalization enables systematic cross-media comparison by treating each project as a comparative configuration of cues, emotions, and action invitations explicitly grounded in theory.

3. Methodology

This study employs a qualitative, comparative multiple-case design to examine how animation and immersive media are mobilized for heritage storytelling and destination branding across Iran, Turkey, and Saudi Arabia. A multiple-case strategy supports analytic generalization through replication across contrasting contexts (Yin, 2018) and enables cross-case pattern development and theory extension (Eisenhardt, 1989; Stake, 1995). The cases were selected purposively because the three countries combine prominent heritage assets with distinct tourism-governance arrangements and different mixes of heritage interpretation and entertainment-led attraction building. The unit of analysis is the publicly visible "initiative" (e.g., an animated tourism campaign, a site-specific projection mapping show, a VR/360° heritage platform, or an immersive museum experience) positioned as serving tourism promotion, destination branding, or heritage interpretation. Data were gathered via multilingual web-based document analysis, treating online materials as documents that can be systematically located, appraised, and interpreted (Bowen, 2009). The corpus included official project and institutional webpages, destination-marketing materials, press releases, policy/strategy documents, event/program descriptions, and associated audiovisual materials (e.g., trailers and walkthrough clips) in Persian, Turkish, Arabic, and English. Searches combined keywords for media forms (animation, projection mapping, immersive, VR/AR, 360° tour) with destination and heritage terms, followed by snowballing through institutional link networks and referenced sources. Inclusion criteria required public accessibility, clear attribution to a recognizable institution or project actor, and sufficient descriptive detail to infer intended audiences, heritage referents, and experience claims. Analysis used directed qualitative content analysis, in which a priori categories guide initial coding while allowing refinement when data do not fit the initial scheme (Hsieh & Shannon, 2005). A codebook operationalized the cognitive–affective–conative (CAC) destination-image dimensions as code families: cognitive codes captured communicated destination attributes and knowledge (heritage elements, spatial features, suggested activities, accessibility claims, authenticity cues); affective codes captured emotional framing (tone, music/visual rhetoric, awe, nostalgia, excitement); and conative codes captured implied action scripts (calls to visit, itinerary cues, ticketed-event prompts, sharing/participation cues). Coding proceeded through repeated reading/viewing, unitizing content into meaning segments, applying codes, memoing emergent patterns, and revising definitions to improve consistency; an audit trail documented decisions and strengthened analytic transparency (Krippendorff, 2018). Credibility was enhanced through triangulation across document types and sources within each case (Carter et

al., 2014). Because the corpus is multilingual, translation was treated as an analytic step rather than a purely technical conversion: key excerpts were translated into English for coding and reporting, with attention to preserving culture-specific terms and branding rhetoric; ambiguous passages were cross-checked via back-translation and cross-language qualitative research practices (Brislin, 1970; Regmi et al., 2010; Squires, 2009; Temple & Young, 2004). Ethical practice followed established internet-research guidance: only public, non-sensitive materials were analyzed; no personal data were collected; and sources were cited to ensure transparency while minimizing potential harm (Franzke et al., 2020). Limitations include reliance on curated representations and the absence of direct measures of tourist responses; findings therefore address communicative strategies and implied image effects rather than verified behavioral outcomes.

4. Case Study I: Iran

Across Iran's tourism ecosystem, animation and immersive media operate as a portfolio of tools produced by municipalities, heritage bodies, and private VR studios, largely oriented to domestic audiences and cultural learning. A national-scale initiative illustrates this logic: an IRNA interview with the CEO of the VR startup Binesh-e Bod-e Sevvom (republished by Kanoon Farhangi Amoozesh) reports a collaboration with tourism/heritage authorities to model 80 leading attractions in VR in two phases, distributed via the VisitIran and IRANinVR web portals (Kanoon Farhangi Amoozesh, 2019). The interview frames VR as enabling users to "walk" through attractions, access interpretive information, and preview destinations in 360°/3D before travel, while also serving those constrained by cost or distance and providing inbound visitors with pre-trip familiarity (Kanoon Farhangi Amoozesh, 2019). Private platforms translate similar aims into products: Panoman curates 360° virtual tours and markets Iran's "art and architecture," "diverse cuisine," and "warm and hospitable people," while the Iran Tour app combines 360° media, VR, augmented reality, and 3D interactive animation with map-based guidance (Panoman Studio, 2023; Iran Tour, n.d.). At the city level, a clear coupling of animation with site interpretation appears in Yazd, where the Cultural–Social–Sports Organization of Yazd Municipality produced the "Yazdgardi" tourism animation series and a set of virtual tours intended to introduce the city to visitors (CHTN, 2024a). CHTN reports that ten short animations were developed after two years of research, covering emblematic monuments and thematic explainers on vernacular architecture, traditional houses, qanat/water structures, and local sweets and foods (CHTN, 2024a). CHTN adds that the virtual tours were designed for exhibitions and first-time audiences, accessible via a portal, shareable links, and smart glasses, with point-to-point navigation plus special viewpoints such as historical photo overlays and skyline/underground access (CHTN, 2024a). Digital heritage documentation also blends conservation with immersive visitation; a virtual reconstruction and 360° tour of Saryazd Castle (near Yazd) pairs photogrammetric modeling with an online "virtual museum," arguing for access when travel is not possible and for stimulating interest in lesser-known places (Exarc, 2020). Iranian animation has also been mobilized as a culturally resonant storytelling layer: the short animation Masouleh (directed by Bahram Azimi) draws on the iconic stepped-village setting, while provincial campaigns have used child-friendly musical animation to normalize "tourism literacy," such as the Fars unveiling of an eight-minute children's tourism musical titled Fesghaliha-ye Jahangard for ages 5–9 with subtitles for both hearing and hearing-impaired children (Rasekhoon, 2018; CHTN, 2024b). Taken together, these cases indicate, in practice, an educational–heritage configuration in which immersive media primarily builds the cognitive dimension of destination image through granular content—architectural typologies, water engineering, monument lists, and navigable spatial viewpoints—rather than through entertainment-first framing. In cognitive terms, the dominant strategy is informational richness: tours and animations translate heritage into legible "objects" (sites, crafts, foods, water systems) and into explorable "spaces" (streets, courtyards, roofs, underground chambers), so that viewers can form a concrete mental map of what a trip would entail. This is reinforced by the national VR program's emphasis on 360° previews for far-distance destinations, which it presents as helping domestic travelers choose itineraries with greater confidence while also reducing uncertainty for prospective foreign visitors (Kanoon Farhangi Amoozesh, 2019). Affective cues, meanwhile, are frequently carried by stylised graphic design, friendly narration, and the everyday warmth of domestic scenes—sweets being made, family meals, neighborhood alleys—rather than by adrenaline or fantasy aesthetics. Most outputs are produced primarily in Persian and circulate via national platforms, reinforcing a domestic orientation even when "foreign tourists" are referenced (CHTN, 2024a). The VR producer also describes supplying content to hotels and exhibition booths, suggesting that VR often functions as a portable interpretive kiosk rather than a destination-wide attraction (Kanoon Farhangi Amoozesh, 2019). Conatively, the media often points to low-threshold actions: "visit when you can," "learn and share," or "plan your route," and it also expands participation by making

heritage visitable for groups with mobility, budget, or access constraints, which is consistent with how virtual tours have been promoted as a public-access tool in Iranian heritage communication (Exarc, 2020). This orientation aligns closely overall with Iranian destination-marketing research showing that satisfaction with 360°-video-based VR experiences—driven by sense of presence and aesthetic experience—can positively influence destination image and intention to visit (Hadianfar & Darzian Azizi, 2021).

5. Case Study II: Turkey

Turkey's contemporary heritage storytelling and destination branding increasingly rely on immersive, digitally mediated experiences that translate "place" into curated spectacles, while aligning with national ambitions to diversify tourism products and reduce seasonality. In the OECD profile of Turkey's tourism policies, a challenge is conveying an accurate and positive impression to potential visitors, and recommended measures include diversification, improved marketing, and stronger use of digital channels and audio-visual content (OECD, 2018). Against this backdrop, projection mapping and related immersive techniques are deployed not only as entertainment, but as heritage-interpretation devices that restructure what visitors know, feel, and intend to do in situ. In Cappadocia, the Zelve Mapping Light Show positions a rock-cut landscape as an after-dark attraction; tour descriptions present a roughly 30-minute spectacle inside Zelve Open Air Museum where projection techniques "bring the ancient fairy chimneys to life" and narrate Cappadocia's history and culture through light and motion (Expedia, n.d.). This format compresses stratigraphies—geology, monastic settlement, vernacular architecture—into a legible, shareable experience, while also adding a time-specific reason to remain in the destination after sunset, often as part of guided itineraries (Expedia, n.d.). Istanbul offers a more institutionalised model through municipal heritage venues that embed mapping shows into the visitor journey. The Şerefiye (Theodosius) Cistern markets itself as the first Turkish museum—and among the oldest structures globally—to host a 360° projection mapping system, explicitly designed to enhance three-dimensional spatial perception and to "trace the water culture" of Istanbul (Şerefiye Cistern, n.d.). Its programme is described as a multi-part, short-format show that visualises aqueducts and distribution lines, then layers Byzantine and Ottoman memories across the walls with iconographic and tile-art references, produced in cooperation with a private investment partner (Şerefiye Cistern, n.d.). The cognitive work here is concrete—teaching infrastructures and historical periods—while the affective register is cultivated through darkness, echo, and the sensation of history enveloping the body, encouraging visitors to interpret water heritage as a lived environment rather than a static ruin. A complementary framing appears at the Basilica (Yerebatan) Cistern, where the official narrative links extensive restoration to a "new generation" museology identity oriented toward exhibitions and performances. The site states that it reopened on July 22, 2022 after its most extensive restoration under Istanbul Metropolitan Municipality heritage units, and that it now hosts temporary exhibitions, contemporary art performances, and cultural events (Yerebatan Cistern, 2022). Visitor information further indicates long opening hours and a premium-priced evening slot, effectively packaging the monument as a night-time cultural experience and extending the city's cultural timetable beyond daytime sightseeing (Yerebatan Cistern, n.d.). Beyond water heritage, Istanbul's Panorama 1453 History Museum demonstrates how projection mapping can repackage national history as immersive entertainment. The museum frames "The Dream of Sultan Mehmed" as a mapping show that brings May 29, 1453 to life through digital interpretation, promising a three-dimensional museum experience and narrating the city's passage from Constantinople to Istanbul (Panorama 1453 History Museum, n.d.). By presenting conquest history as a timed, sensorial programme, the institution turns learning into spectacle and creates a repeatable, schedule-driven attraction that fits into packaged city itineraries (Panorama 1453 History Museum, n.d.). Animation-led branding reinforces this experiential orientation by compressing national diversity into a globally legible story that can circulate online before travel. In the animated tourism film "Avantgarde Journeys," the production brief aims for a visual language "global and appealing to the international traveller" and sequences heritage and lifestyle themes—art and history, shopping and entertainment, gastronomy, sea tourism, and business life—through recognisable sites and contemporary urban scenes (Koff Animation, n.d.). Such animation functions as a cognitive map of breadth while also producing affective coherence through fluid transitions and upbeat pacing, implicitly inviting multi-stop travel rather than a single-resort holiday (Koff Animation, n.d.). Finally, the International Tourism Cartoon Competition adds a lighter but strategically meaningful layer by institutionalising tourism-themed satire as a recurring cultural output. Its guidelines enable broad participation and publication pathways while explicitly excluding AI-generated works, encouraging a human-authored, self-reflexive visual conversation about tourism and society (International Tourism Cartoon Competition, 2025). Taken together, these Turkish initiatives foreground an experiential–heritage configuration in which

municipalities and private partners stage history and landscape as immersive media events, generating both on-site awe and reasons to visit specific places at specific times (OECD, 2018).

6. Case Study III: Saudi Arabia

Saudi Arabia's destination branding increasingly relies on immersive media and animation-linked experiences to support a state-led repositioning of the Kingdom as both a guardian of heritage and an emerging leisure-and-events hub. Vision 2030 frames tourism and cultural development as pillars of diversification, and the Saudi Tourism Authority explicitly situates tourism "at the heart" of national transformation (Saudi Vision 2030, 2016; Saudi Tourism Authority, n.d.). This repositioning is coupled with governance signals that foreground scale and growth: policy-facing summaries of the national tourism strategy emphasise targets such as raising tourism's GDP contribution above 10%, creating one million additional jobs, and reaching 100 million annual visits by 2030 (Al Riyadh City Portal, 2025). More recent reporting also indicates an even higher ambition of 150 million tourists per year by 2030, reinforcing a strong behavioural (conative) orientation toward converting interest into actual travel and longer stays (Azhari, 2025). Within this context, immersive media operate as a practical branding instrument: they make heritage legible and emotionally resonant at a distance, while simultaneously constructing a modern, high-energy image of the country through spectacle and entertainment formats. One cluster centres on heritage interpretation through virtual access and digitally layered narration. At the museum scale, the National Museum offers an online virtual tour with language selection, signalling an intent to widen access to curated national narratives beyond on-site visitation (National Museum of Saudi Arabia, n.d.). At the global heritage scale, UNESCO's "Dive into Heritage"—funded by Saudi Arabia's Ministry of Culture—positions immersive digital experiences (including VR/AR and other digital formats) as tools to safeguard, promote, and re-activate heritage places for broad publics (UNESCO World Heritage Centre, 2025). In parallel, destination-specific digital gateways (e.g., the Experience AlUla platform) frame the destination through curated stories, itineraries, and planning tools that translate heritage landscapes into consumable visitor narratives (Royal Commission for AlUla, n.d.). Together, these initiatives build a dense cognitive image—sites, histories, landscapes, and interpretive frames—while also engineering affect through awe and reverence produced by panoramic visuals, sequencing, and symbolic storytelling (UNESCO World Heritage Centre, 2025; National Museum of Saudi Arabia, n.d.). Heritage immersion is also produced as embodied edutainment through interactive museum design that blends projection, spatial audio, and responsive interfaces. Industry documentation of Lumotion Studio's "Interactive Museum Al Jouf" (Dumat Al-Jandal) describes projection mapping, 3D mapped walls, interactive tables, sensor-based interaction, and 360-degree video shows that transform interpretation into a multi-sensory environment (Lumotion Studio, n.d.; Inavate, 2025). These installations extend cognitive learning into spatial experience (what happened here, how the place is structured, what it signifies) and cultivate affective responses (wonder, pride, intimacy) through spectacle techniques typically associated with immersive entertainment, thereby narrowing the gap between heritage education and tourist desire. A second cluster foregrounds immersive entertainment and animation cultures to trigger event-driven travel and longer stays. Riyadh Season's Anime Town is promoted as the "largest anime city" within Boulevard World, offering "40" activities and staging recognisable urban iconography (including a Shibuya-like streetscape) as a walk-through environment of lights, signage, and themed performance, effectively importing an anime visual grammar into the destination itself (General Entertainment Authority, 2022). Qiddiya extends this logic from seasonal activation to permanent, IP-driven attraction: the officially announced Dragon Ball theme park is framed as the world's first of its kind, spanning roughly 500,000 square metres with multiple themed zones and rides, and anchored by a landmark "Shenron" structure—an approach that uses globally legible animation IP to generate excitement, novelty, and "must-visit" urgency (Qiddiya Investment Company, 2024). In destination-image terms, these entertainment formats construct cognitive cues about Saudi Arabia as technologically capable and globally connected, while their affective register emphasises high-arousal emotions (excitement, surprise, fantasy) that contrast with the solemnity of heritage-VR narratives; crucially, they also embed explicit conative prompts (attend, participate, plan around the season, stay longer to complete experiences) aligned with the broader growth trajectory described in policy and reporting (Al Riyadh City Portal, 2025; Azhari, 2025). Finally, immersive media are also used to communicate heritage-led development to international tourism gatekeepers, aligning destination branding with investment narratives: Diriyah's external communications around major tourism trade events have described immersive exhibition formats designed to showcase its heritage-led tourism proposition to industry leaders and decision-makers (Diriyah Company, 2025). Overall, the Saudi case demonstrates a strategic coupling of virtual heritage (credibility, depth, and

reverent affect) with large-scale immersive entertainment (spectacle, novelty, and direct behavioural activation), producing a dual destination image that is simultaneously "heritage-authoritative" and "experience-intensive" (Saudi Tourism Authority, n.d.; UNESCO World Heritage Centre, 2025).

7. Comparative Analysis and Discussion

Comparative analysis across Iran, Turkey, and Saudi Arabia suggests that animation and immersive media operate as place-making infrastructures that reorganize how heritage is known, felt, and acted upon, rather than as interchangeable promotional add-ons. In destination-image research, the cognitive–affective–conative (CAC) tradition frames image as a layered system in which mediated communication builds beliefs about place attributes (cognitive), shapes emotional evaluations (affective), and primes behavioral intentions such as trip planning, visiting, or recommending (Gartner, 1993; Baloglu & McCleary, 1999). When these layers are produced through immersive interfaces—VR, projection mapping, and interactive digital heritage—they also interact with "presence" and experiential persuasion, which can intensify learning, emotion, and intention by simulating proximity and embodied encounter (Tussyadiah et al., 2018). Across the three cases, the media form is therefore inseparable from governance, branding priorities, and the imagined publics each country is trying to mobilize (Anholt, 2007; Kavaratzis, 2004). Iran most closely exhibits an educational–heritage configuration oriented primarily toward domestic publics. Immersive outputs are frequently justified as cultural access and learning tools: virtual tourism is framed as a way to "show" heritage broadly and support cultural literacy through VR and similar formats (Kanoon News, 2019). In CAC terms, the cognitive layer tends to be comparatively "thick," foregrounding granular vernacular detail (built form, crafts, everyday cultural practices, and localized heritage cues), while the affective layer leans toward low-arousal emotions such as familiarity, warmth, and nostalgia—emotions that align with family travel, school-age learning, and identity reinforcement. Conatively, the implied action is often domestic mobility (weekend trips, family itineraries, educational visits) rather than event-based international travel, meaning that immersive media functions less as a "global rebrand" and more as internal image consolidation. This configuration also tends to fragment across institutions and projects, which can generate rich local storytelling but makes consistent international amplification more difficult (Kavaratzis, 2004). Turkey, by contrast, is best characterized as an experiential–heritage configuration designed to enrich and differentiate visitor experience through site-specific spectacle. Projection mapping and 360° storytelling in heritage infrastructures turn architecture into a time-based narrative interface, compressing multi-civilizational history into an embodied encounter that is difficult to reproduce through text-only promotion (Cistern of Theodosius, n.d.). In parallel, Cappadocia's mapping shows illustrate how heritage landscapes can be programmed as night-time cultural products that add temporal "reasons to stay," not only "reasons to see" (Cappadocia Travel Pass, n.d.). In CAC terms, the cognitive layer is curated (selective sequences of history, identity, and space), the affective layer emphasizes awe, wonder, and artistic spectacle, and the conative layer is strongly itinerary-shaping: the media experience becomes an attraction in itself (e.g., scheduling evening attendance), helping diversify demand beyond a single tourism formula. This aligns with broader diversification and experience-design logics in tourism policy conversations, where heritage is positioned as a renewable experiential asset rather than a static monument (OECD, 2018). Saudi Arabia's configuration is strategic heritage–entertainment–smart, distinguished by the deliberate coupling of immersive heritage interpretation with large-scale entertainment development under Vision 2030 (Saudi Vision 2030, 2016). On the heritage side, UNESCO's Dive into Heritage—funded by Saudi Arabia's Ministry of Culture—mobilizes digital storytelling and immersive interfaces to expand access to World Heritage and normalize heritage as a digitally consumable experience for global audiences (UNESCO, 2025). On the tourism-growth side, the conative layer is explicitly investment- and target-driven: Saudi statements and coverage point to ambitions such as reaching 150 million tourist visits by 2030, reinforcing an action orientation toward inbound flows, mega-events, and extended stays (Arab News, 2025). Even religious tourism modernization (e.g., large-scale capacity projects tied to a 2030 target for 30 million pilgrims annually) signals how infrastructure, policy, and destination communication are bundled to scale mobility (Reuters, 2025). In CAC terms, Saudi Arabia's cognitive image splits between heritage legitimacy (guardianship, archaeology, UNESCO frames) and techno-modernity (innovation, mega-project confidence), while affect oscillates between reverence/awe (heritage) and high-arousal excitement (entertainment and events). Across the three cases, the CAC comparison clarifies that cognitive image is never neutral information: it is curated identity work. Iran prioritizes detailed vernacular heritage knowledge; Turkey narrativizes layered history into spectacular, site-bound sequences; Saudi Arabia balances heritage guardianship with techno-modernity and entertainment leadership. Affective patterns diverge systematically—belonging and nostalgia (Iran), awe and

spectacle (Turkey), awe plus adrenaline (Saudi Arabia)—suggesting different emotional routes to persuasion (Gartner, 1993; Tussyadiah et al., 2018). These differences matter for destination branding outcomes: Iran's approach strengthens internal coherence and cultural continuity; Turkey's approach amplifies experiential distinctiveness and cultural diversification; Saudi Arabia's approach constructs a new composite brand architecture in which heritage authenticity and entertainment modernity are meant to reinforce rather than contradict each other (Anholt, 2007). The policy implication is that "best practice" is not a single media format but a strategic fit between governance capacity, heritage ethics, target publics, and the desired cognitive–affective–conative pathway from representation to action.

8. Conclusion and Implications

This study set out to explain how animation and immersive media contribute to heritage storytelling and destination branding in Iran, Turkey, and Saudi Arabia by tracing how mediated projects construct the cognitive, affective, and conative (CAC) dimensions of destination image (Baloglu & McCleary, 1999; Echtner & Ritchie, 1993; Gartner, 1993). The comparative reading of initiatives across the three countries indicates that the same media families (animation, projection-based spectacle, VR/360° and interactive heritage interfaces) do not produce uniform branding effects; instead, they assemble into nationally distinctive configurations shaped by governance capacity, tourism strategy, and intended publics—an insight consistent with place-branding arguments that destination meanings are actively produced through coordinated communication and stakeholder practices (Anholt, 2007; Kavaratzis, 2004). Three configurations summarize the main contribution. First, Iran's pattern is best described as an educational–heritage configuration that prioritizes detailed interpretive knowledge and culturally familiar emotional tones, with conative cues oriented mainly toward domestic travel and cultural learning. Second, Turkey exhibits an experiential–heritage configuration that programs heritage sites as time-based, multi-sensory events, strengthening affective intensity (awe, wonder) and shaping itineraries by turning "heritage" into scheduled attractions—an approach aligned with diversification logics in tourism development and marketing (OECD, 2018). Third, Saudi Arabia most clearly demonstrates a strategic heritage–entertainment–smart configuration in which immersive heritage storytelling is coupled with large-scale leisure and event development under a transformation agenda, producing a dual image of heritage authority and contemporary experience leadership (Saudi Vision 2030, 2016). Across all three, the CAC lens helps clarify how cognitive cues (attribute knowledge and authenticity signals), affective cues (emotional framing through narrative and spectacle), and conative cues (implied action scripts such as planning, visiting, attending, and sharing) are bundled rather than operating separately, and why immersive affordances matter: VR and other embodied interfaces can intensify persuasion by increasing presence and experiential vividness, which tourism research associates with attitude and intention shifts (Guttentag, 2010; Tussyadiah et al., 2018). The study contributes theoretically by operationalizing the CAC framework for cross-media, cross-country analysis of heritage storytelling, demonstrating that "destination image" can be read not only from marketing slogans but from design choices embedded in immersive experiences—what is made explorable, what is made emotionally salient, and what actions are made easy or desirable (Echtner & Ritchie, 1993; Gartner, 1993). Methodologically, it also illustrates how a comparative multiple-case approach can support pattern building across heterogeneous initiatives while remaining sensitive to contextual differences (Eisenhardt, 1989; Yin, 2018), and how directed content analysis can translate a theory-driven coding model into a transparent interpretive procedure (Hsieh & Shannon, 2005). Practically, the findings suggest that tourism and heritage policymakers should treat immersive media as strategy, not decoration: effective branding requires explicit alignment between the intended CAC pathway and the governance model that sustains production, distribution, and on-site integration (Anholt, 2007; Kavaratzis, 2004). For Iran, that may mean consolidating fragmented local storytelling into more interoperable, multilingual pipelines that preserve interpretive richness while improving discoverability and international legibility. For Turkey, the implication is to maintain authenticity and conservation ethics while expanding experiential programming that redistributes demand spatially and temporally. For Saudi Arabia, the key challenge is coherence: ensuring that entertainment acceleration complements, rather than dilutes, heritage credibility, and that immersive heritage remains more than a symbolic layer in a high-arousal events economy. Limitations stem from reliance on publicly available, curated representations and the absence of primary visitor-response data; thus, the study identifies intended and implied image effects rather than measuring actual behavioral change. Future research should triangulate these findings with visitor studies (experiments comparing animation/VR exposure, on-site surveys, and longitudinal intention-to-visit tracking), social media

analytics on sharing and sentiment, and comparative policy analysis on how procurement, creative industries, and heritage regulation shape media outputs across West Asia (Tussyadiah et al., 2018; Yin, 2018).

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EXPLORING THE SUBLIME IN DAVOUD EMDADAIN'S WORKS BASED ON IMMANUEL KANT'S THEORY

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Abstract
Davoud Emdadian, a prominent Iranian Romantic painter, creates landscapes dominated by imposing natural forms, monumental trees, and expansive mountainous vistas that evoke perceptual tension and profound contemplation in the viewer. Despite his standing in contemporary Iranian art, the philosophical dimensions of his work particularly its relationship to Immanuel Kant's concept of the Sublime have received limited scholarly attention. Addressing this gap, this study examines how Kant's ideas of the Sublime emphasizing the cognitive and affective tension aroused by encounters with nature's overwhelming magnitude and boundlessness are visually articulated in Emdadian's landscapes. Employing a descriptive analytical method and thematic visual analysis, the research focuses on 5 representative paintings selected from various phases of the artist's career, chosen for their distinctive treatment of scale, atmospheric depth, and spatial composition. The analysis reveals that key visual feature such as misty atmospheres, sweeping valleys, monumental natural elements, and dynamic compositional arrangements generate an experiential tension consistent with the Kantian Sublime. These elements place the viewer in direct confrontation with grandeur, obscurity, and the unpresentable, thereby eliciting contemplative and emotional responses. The study concludes that Emdadian's landscapes do not merely illustrate but actively reinterpret the Sublime theory based on Kant's philosophy within a romantic context. By tracing these philosophical theme in his paintings, this research provides a comprehensive understanding of the intersection of perceptual experience, emotional engagement, and compositional strategy in romantic landscape painting, contributing meaningfully to both Iranian art historical scholarship and philosophical discourse on visual arts.
Keywords: Davoud Emdadian, The Sublime, Immanuel Kant.

Introduction:

The necessity of engaging with the oeuvre of Davoud Emdadian as one of the most significant contemporary painter, together with the scarcity of scholarly resources, the absence of reliable and systematic information on his works, the lack of detailed philosophical analysis (particularly from the perspective of Kant's concept of the sublime), and his relative obscurity in comparison with his German contemporaries has motivated the present research. It is hoped that this study will contribute to the existing body of knowledge and pave the way for further scholarly investigations into Emdadian's work. This research aims to identify manifestations of the sublime and to analyze the visual signs through which it is articulated in the landscape paintings of Davoud Emdadian.Methodology:

The present research has been conducted using a descriptive-analytical method and employing a library-based method for data collection. The study samples and primary data consist of approximately 20 samples from Emdadian's works, of which 4 samples, including "Dramatic Red," and 3 Untitled works by the artist from the years 1977, 2003, and 2002, were selected using non-probability sampling from online sources and a solo exhibition of the artist's works. The targeted study samples were examined and researched in three areas: visual characteristics, conceptual characteristics, and existing characteristics in terms of the presence of the Sublime. This selective sampling from the mentioned works was examined using qualitative analysis. The selection method was as follows: first, a list of Emdadian's works was prepared, and then, among them, works that corresponded to the natural elements exemplified by Kant were selected. In the final step, after reviewing and finding the concept of the Sublime based on theoretical foundations, works in which the context of analysis was more based on the Sublime than others were selected, and the final result was revised with the opinion of experts. The images reviewed were selected through internet searches and from reputable websites and galleries.

Findings:

In Emdadian's works, the horizon line is depicted lower down to showcase a large and infinite overpowering sky, similar to the works of the Romantics, conveying faith and respect for nature. Expansive landscapes

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stretching into the distance, turbulent skies, large trees and forests, towering mountains, and massive rocks are common visual elements painted in Emdadian's works. Humans play a secondary role in his paintings, serving the surrounding nature and acting as its spectators. Emdadian's landscapes are depicted as formidable, vast, and powerful. Absolutely large trees and small humans exemplify mathematical sublimity, while blurred and mysterious backgrounds, along with wrathful skies in his works, are examples of dynamic sublimity. In the following, we will examine the presence of both types of sublimity in Emdadian's works:

Table 1- Investigating the visual characteristics of the presence of the mathematical sublime (Authors).

Name of work / Mathematical sublime	Dramatic Red	Untitled 2003	Untitled 1977	Untitled 2002
monumental trees	□	□	□	□
Presence of small humans	□	□		□

Table 2- Investigating the visual characteristics of the presence of the Dynamic Sublime (Authors).

Name of work / Dynamic Sublime	Dramatic Red	Untitled 2003	Untitled 1977	Untitled 2002
Blurred and mysterious background			□	□
infinite overpowering sky	□	□	□	
Deep valley	□			□
Great Mountain	□	□	□	
Intense Illumination			□	

Table 3- Matching Tables 1 and 2: Examining the visual characteristics of the presence of Mathematical and Dynamic Sublime (Authors)

Name of Work / presence of the Sublime	Dramatic Red	Untitled 2003	Untitled 1977	Untitled 2002
monumental trees	□	□	□	□
Presence of small humans	□	□		□
Blurred and mysterious background			□	□
infinite overpowering sky	□	□	□	
Deep valley	□			□
Great Mountain	□	□	□	
Intense Illumination			□	

Great mountains, infinite overpowering sky, deep valleys, and mysterious backgrounds are examples of the Sublime presence in Emdadian's works. Among Emdadian's works, the Dramatic Red, and the Untitled work of 1977, with the presence of 5 out of 7 visual features listed, have the most signs of the sublime presence, followed by the Untitled work of 2002 and the Untitled work of 2003, by this painter, with the presence of 4 out of 7 features, have the most signs of the Sublime's presence.

Discussion:

According to Kant, the Sublime evokes a negative feeling, arising from a supersensible and formless entity that resists the ordinary purposes of perception. A prime example of this effect is the overwhelming power of nature, which the imagination cannot comprehend as a coherent whole. In the experience of the sublime, reason ultimately transcends the limitations of thought and asserts dominance over the observed phenomena, revealing a rational purpose within itself. Based on careful study and analysis, it can be concluded that Davou Emdadian's works in landscape painting—particularly those depicting vast forests and giant trees, small human figures reflecting mathematical sublimity, turbulent skies, expansive mountains and massive rocks, chaotic foregrounds, mysterious backgrounds, and deep valleys exemplifying dynamic sublimity—most effectively embody the aesthetic of the sublime among the works examined

In Emdadian's works, the Sublime manifests in two distinct forms: the mathematical sublime and the dynamic Sublime. In the foreground, particularly in depictions of giant trees juxtaposed with diminutive human figures, the mathematical sublime is evident. Here, contemplation transcends sensory perception: the trees appear overwhelmingly vast, rendering everything else—including other trees, humans, and even the viewer—comparatively small. Beyond the mathematical sublime, Emdadian's landscapes also evoke the dynamic sublime, primarily in background elements. According to Kant, the dynamic Sublime arises from the inadequacy of our imagination to fully grasp an object as a whole, with no absolute limit to its perception. This form of the sublime is accompanied by feelings of awe and respect, stemming from the recognition of our cognitive limitations. Examples in Emdadian's works include colossal mountains, tempestuous skies, deep valleys, and enigmatic landscapes, all of which evoke the dynamic sublime.

Conclusion and Recommendations:

In Emdadian's works, the horizon is often positioned low to emphasize a vast, seemingly infinite sky, echoing the approach of Romantic painters and conveying reverence for nature. Human figures typically occupy a secondary role, either serving or observing the surrounding environment. Expansive landscapes receding into the distance, turbulent skies, towering trees and dense forests, immense mountains, and massive cliffs are recurring visual elements in his paintings, presenting nature as formidable, vast, and overwhelmingly powerful. Faced with the helpful natures, the audience realizes a powerful, crushing, and beyond the limits of their own thinking presence, which reminds them of their limitations with the threatening feature, and finally, the audience realizes again that this supreme presence depends on the audience to exist, and this overwhelming force of nature cannot eliminate their rational principles. Absolutely large trees, as well as small humans, in the works of his work are examples of the high presence of Kantian mathematical Sublime. Blurred and mysterious backgrounds, as well as infinite overpowering sky, deep valley, great mountains, intense illumination in Emdadian's works, are examples of the dynamic Sublime's presence in this painter's paintings. Among Emdadian's works, "Dramatic Red" and "The Untitled work from 1977", with the presence of 5 out of the 7 visual characteristics enumerated for the presence of the sublime, have the most signs of presence. Following them, "The untitled work from 2002" & "The Untitled work from 2003" of this painter, with the presence of 4 out of the 7 characteristics, have the most signs of the presence of the sublime.

For Kant, the Sublime evokes a complex, often negative, feeling that originates from a supersensible and formless entity, one that resists the ordinary purposes of human perception. Nature, in its overwhelming magnitude and power, serves as the quintessential example of this experience: it presents a totality that the imagination cannot fully grasp. Yet, in confronting such immensity, human reason transcends the limitations of mere sensory perception, asserting a form of cognitive mastery over the observed phenomenon and revealing a rational purpose within itself. Through careful examination, it was determined that Emdadian's landscape paintings most prominently embody these qualities of the sublime. In the foreground, vast forests and monumental trees, juxtaposed with diminutive human figures, exemplify the mathematical Sublime, in which scale and proportion evoke awe and highlight the insufficiency of our senses to fully apprehend the scene. In the background, turbulent skies, enigmatic terrains, deep valleys, and immense mountains and rocks illustrate the dynamic sublime, where the sheer power and unpredictability of nature provoke a mixture of fear, respect, and admiration, emphasizing the limits of human imagination. Across his landscapes, Emdadian consistently portrays nature as vast, formidable, and overwhelming, situating humans as secondary observers who both witness and are humbled by the grandeur surrounding them. Consequently, his works offer a profound engagement with the Kantian sublime, bridging aesthetic perception and philosophical reflection in a manner that resonates with the traditions of Romantic landscape painting while asserting a distinct contemporary vision.

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HUMAN ACTIVITY RECOGNITION BASED ON SMARTPHONE SENSOR DATA USING NEURAL NETWORK: A PERFORMANCE ANALYSIS AND CLASSIFICATION

Rohan Debnath[89], Zunaid Ahammed[90]

Abstract
Human Activity recognition (HAR) Using a smartphone sensor data has become an important research area due to its wide range of applications in healthcare monitoring, Fitness tracking and context aware mobile systems. Modern smartphones are equipped with inertial Sensors such as accelerometers and gyroscope. That continuously capture motion related signals, enabling automatic recognition of human activities. This paper presents a performance analysis and classification study of human activities based on smartphone sensor data using neural network models. The experiments are conducted on the publicly Available UCI Human Activity Recognition data set, which contains labelled sensor read ing corresponding to six common delay activities including walking, seating, standing and lying. A Multilayer perceptron (MLP) The neural network is employed as the primary classification model and its performance is evaluated using standard metrics such as accuracy, precision, recall, and F1 score. Detailed class wise analysis is performed using confusion metrics to examine misclassification patterns among similar activities. In addition, training and valuation learning curves are analyzed to study convergence behavior and generalization capability. The results demonstrate that neural networks are effective in learning discriminative patterns from smartphone sensor data and achieve high classification performance across most activity classes. However, activities with similar motion characteristic exhibit higher confusion, highlighting inherent challenges in sensor-based activity recognition. This study provides valuable insights into model behavior strengths and limitations. And contribution to the development of reliable and efficient HAR systems based on smartphone sensors.
Keywords: Human activity recognition, Smartphone sensors, neural networks, multi-layer perceptron, Sensor data classification, Machine learning.

1. Introduction
İn past years human activity recognition (HAR) has become a significant field in ambiguous computing and with applications spanning healthcare fitness tracking smart environments and assistive technologies. In the current era smartphones equipped with multimodal sensors such as accelerometers and gyroscopes has enabled the collection of rich real time data making (HAR) more accessible and scalable. There are many variabilities in human motion, Sensor noise and similarity among activities so recognizing human activities automatically from sensor data is A challenging pattern Recognition problem.
Traditional Machine learning algorithm like Decision trees and Support Vector machines are widely used in HAR. But the recent growth in Deep learning and neural network fields It now possible to capture the complex temporal and spatial patterns from the sensor data. This study will show a comparative performance analysis between a classical ensemble method (Random Forest) And a neural network model (Multilayer Perception) for HAR using the UCI HAR dataset. The objective is to evaluate their effectiveness identify the strengths and weaknesses and provide insights into model selection for real world HAR applications.

2. Literature Review
The research on smartphone-based Human Activity Recognition (HAR) completely compares the machine and deep learning models. Amongst the sensors accelerometers and gyroscopes are included. In recent researches, it can be seen that models like Deep Neural Network (DNN), Random Forest (RF), Gradient Boost (GB), and Convolutional Neural Network (CNN) sometimes achieves top performance, with some models reported with accuracies above 95%. It can be seen that real-time architecture optimization, user-independent classification, efficient-feature extraction, and sensor fusion helps to boost the accuracy constantly where that the field is continuously evolving by focusing on robust and low latency systems for healthcare and monitoring systems. [1-10]

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3. Methodology

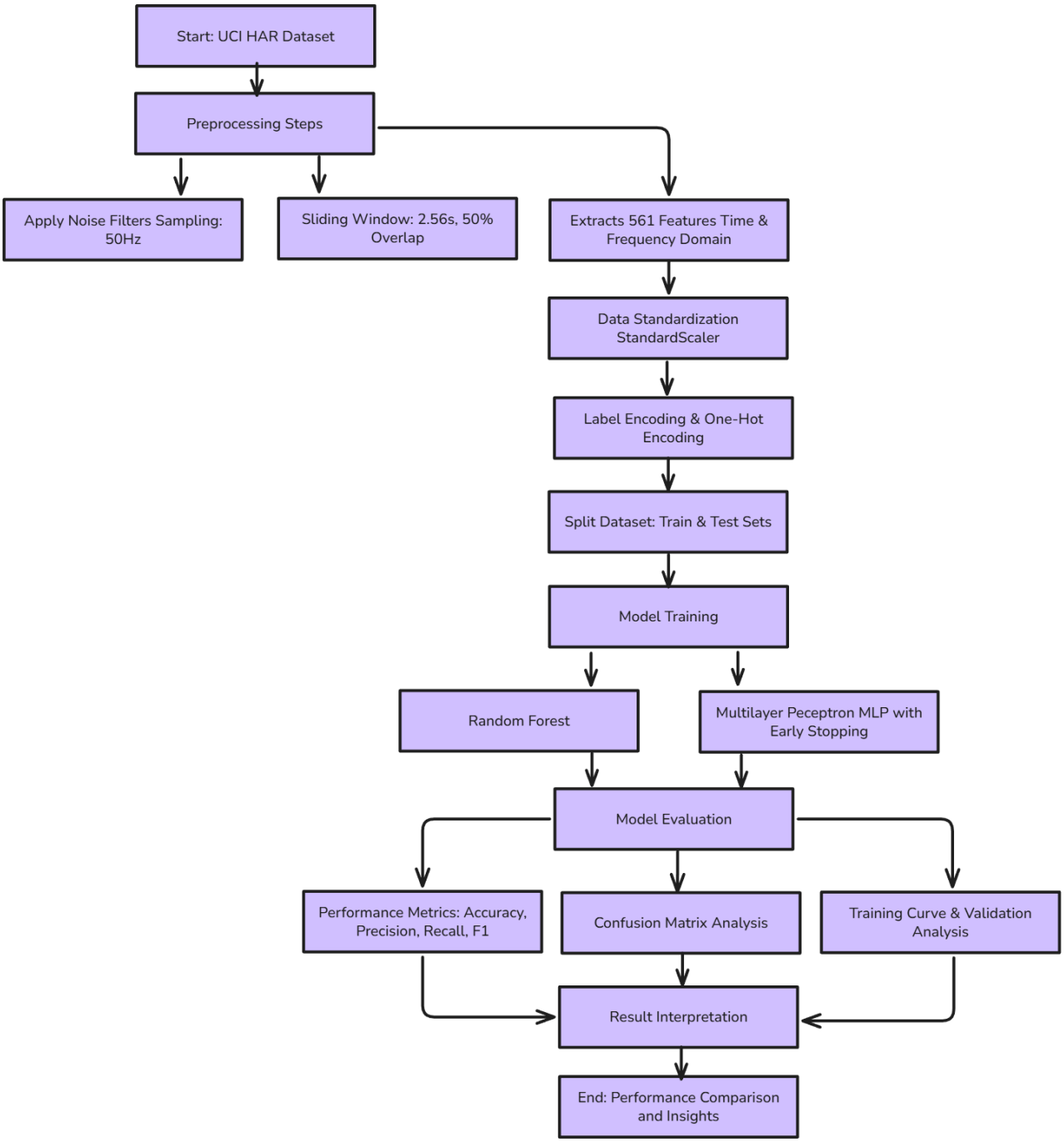


Figure 1: Flow of Research

This diagram (Figure 1) outlines the HAR methodology: starting with the UCI dataset, it proceeds through sensor data collection, preprocessing (filtering, windowing, feature extraction), standardization, encoding, and dataset splitting. Two models Random Forest and MLP trained, evaluated with multiple metrics, and compared to interpret performance and classification challenges.

4.Result & Analysis

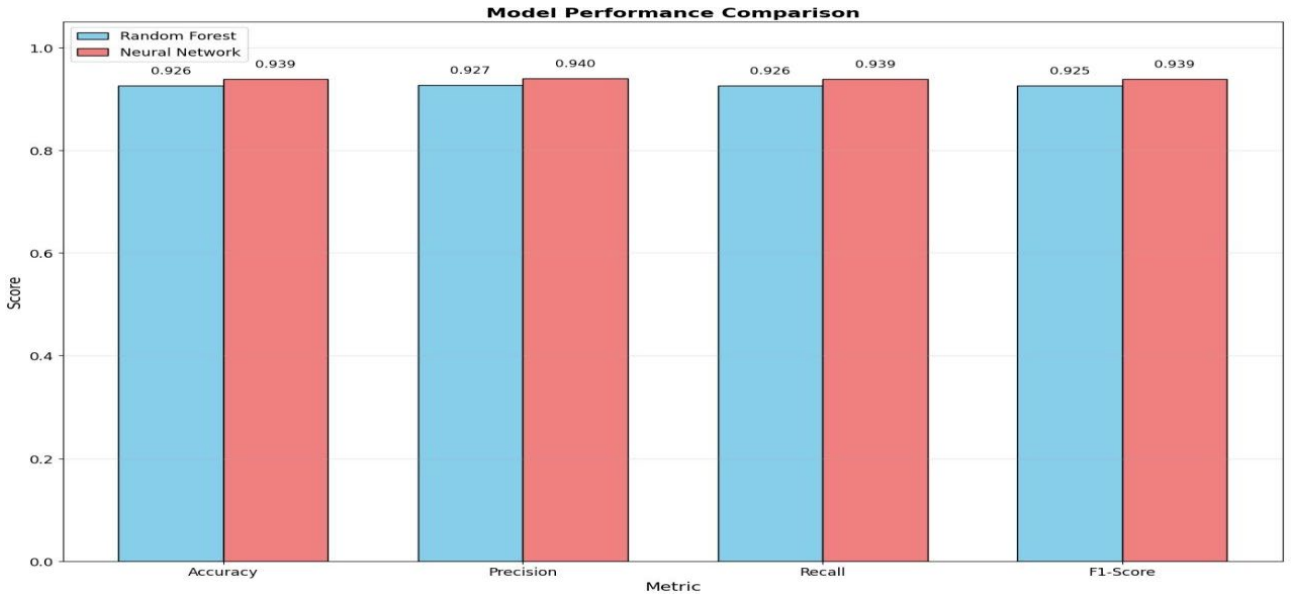


Figure 2: Model performance comparison

This bar chart (Figure 2) compares random forest and neural network using accuracy, precision, recall, and F1-score. The neural network slightly outperforms random forest across all metrics showing better overall classification performance and generalization ability.

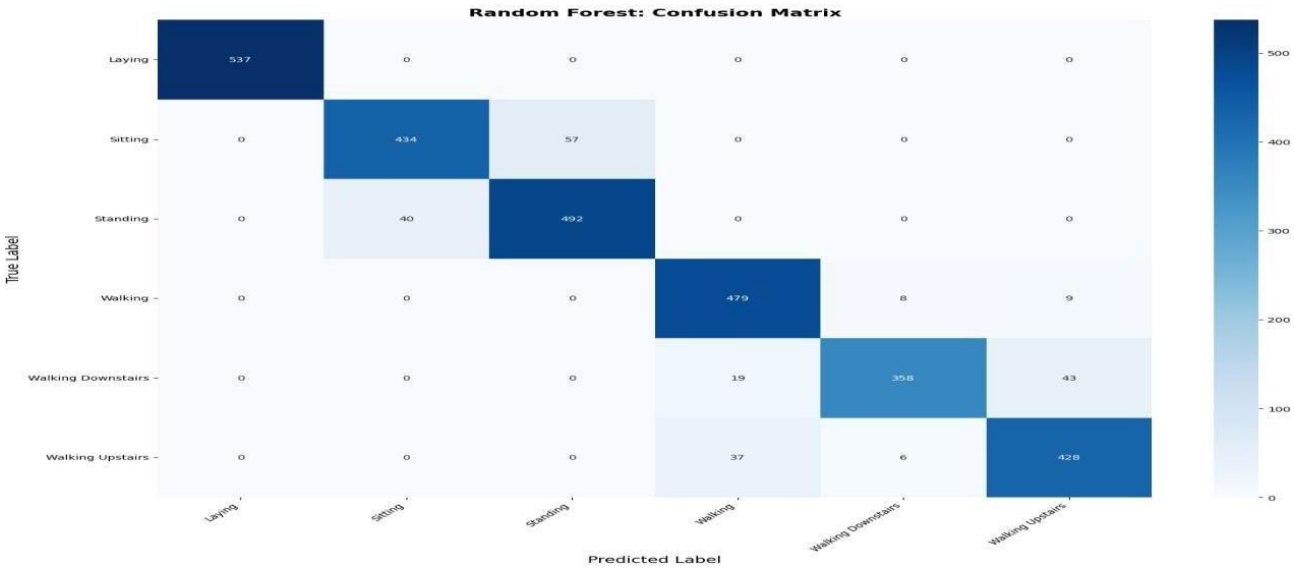


Figure 3: Random Forest confusion matrix

This confusion matrix (Figure 3) illustrates Random Forest predictions. Static activities are classified very accurately, but dynamic activities such as walking upstairs and downstairs show higher confusion, indicating limitations in capturing subtle motion differences.

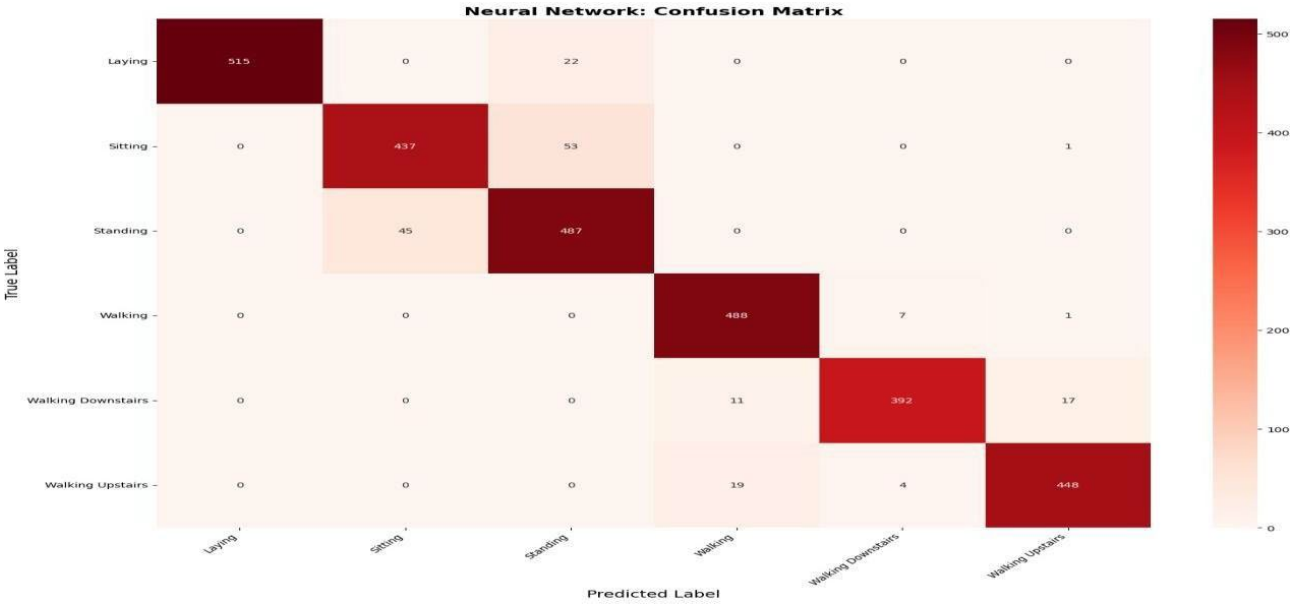


Figure 4: Neural Network Confusion Matrix

This confusion matrix (Figure 4) shows how well the neural network predicts each activity. Most predictions fall on the diagonal meaning correct classification. Some confusion appears between similar movements like sitting versus standing and walking-related activities.

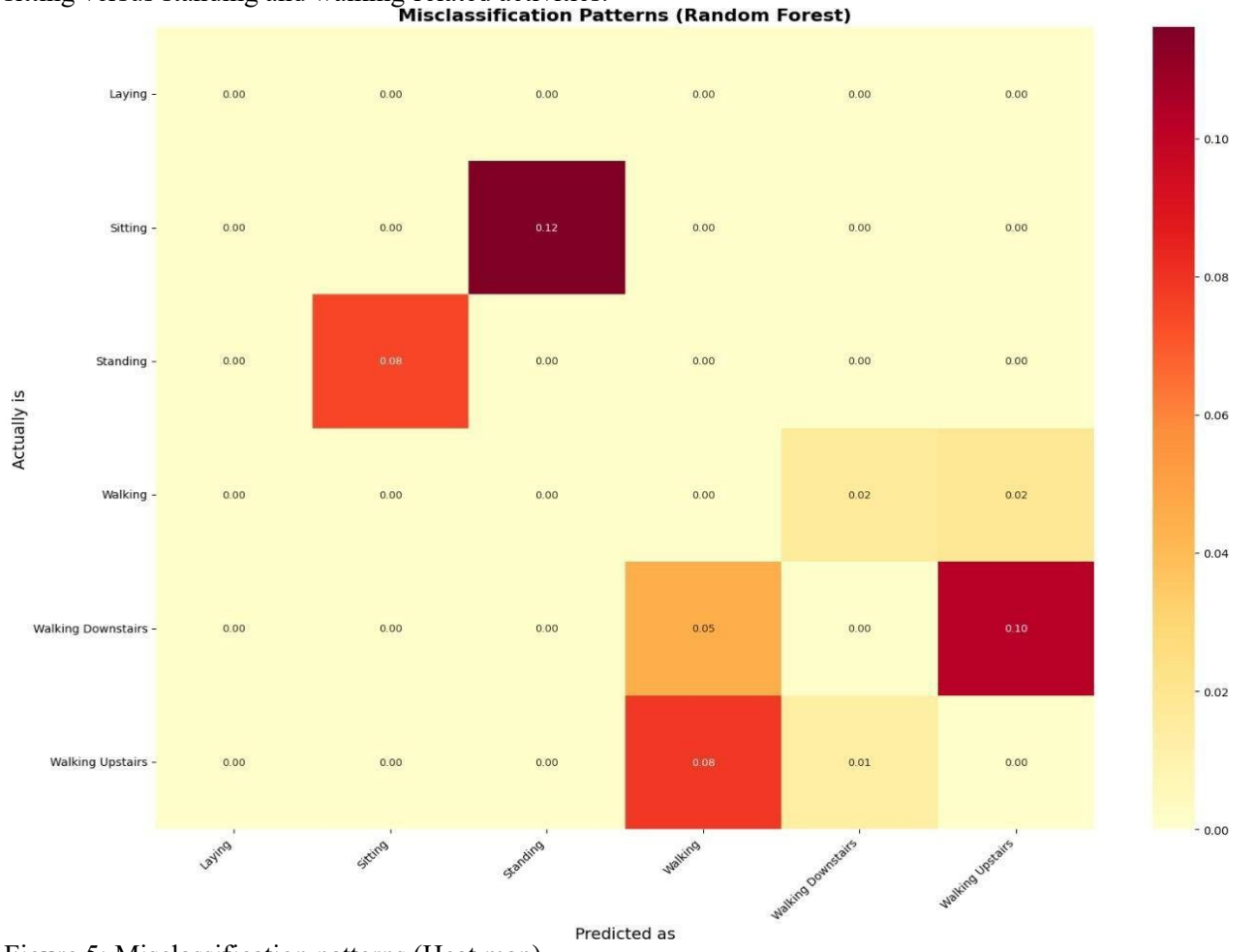


Figure 5: Misclassification patterns (Heat map)

This heatmap (Figure 5) shows where the Random Forest model makes wrong predictions. Most misclassification happen between similar activities like sitting and standing or walking upstairs and downstairs, while scary activities such as laying are almost never confused

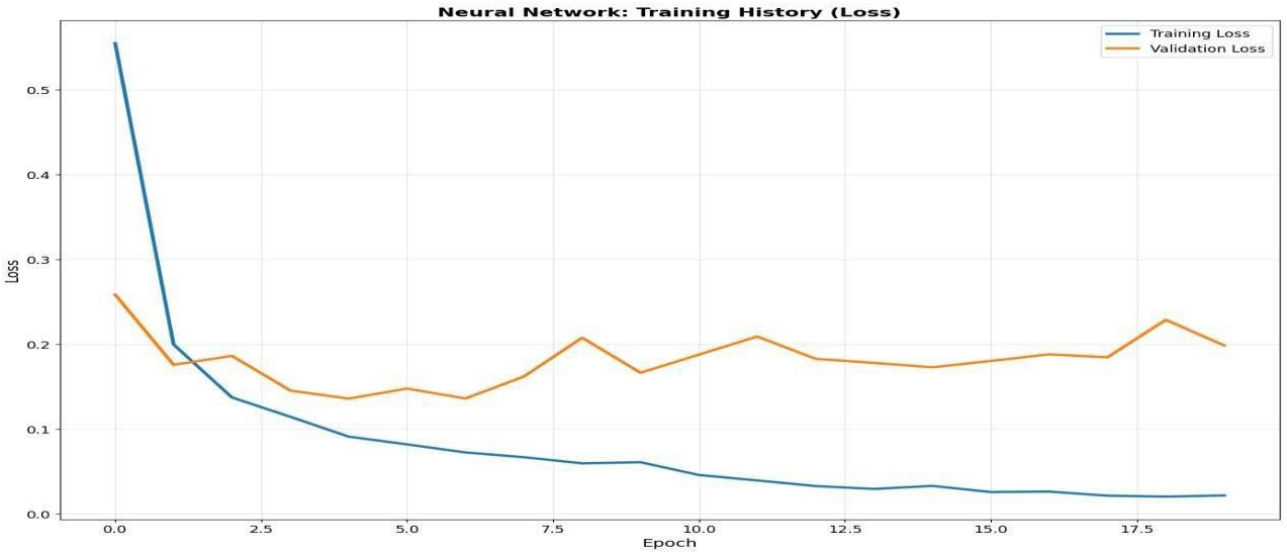


Figure 6: Neural network training history (Loss)

This plot (Figure 6) represents how prediction errors decrease over training epochs. Training loss continuously drops, meaning the model learns well while validation loss fluctuates slightly, indicating the model may begin over fitting after several epochs.

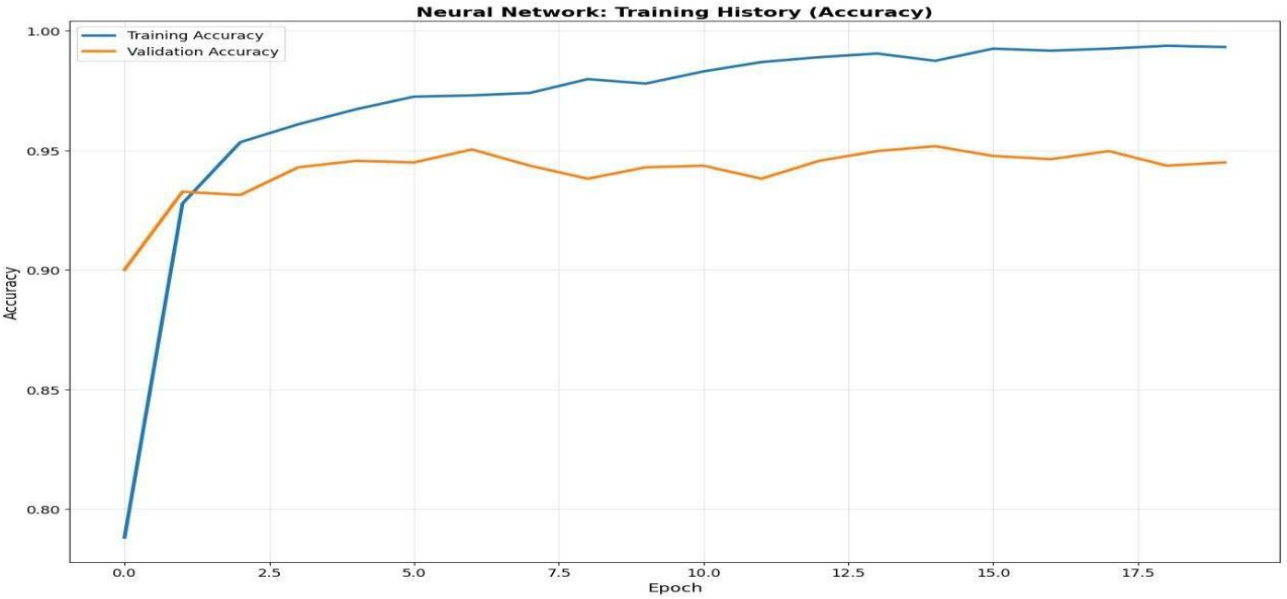


Figure 7: Neural network training history (Accuracy)

This graph (Figure 7) shows how the neural network's accuracy changes during training. Training accuracy increases steadily, while validation accuracy improves early and then stabilize, indicating good learning performance with a small gap that suggests mild overfitting.

The diagrams (Figure 2-7) collectively evaluate the and compare Random Forest and Neural Network model for human activity recognition. Misclassification patterns reveal the errors mostly occur between similar activities, such as sitting and standing or walking upstairs and downstairs. The neural network training curves show strong learning behavior, with accuracy improving rapidly and loss decreasing consistently, though some

overfitting appears as validation loss fluctuates. Confusion matrices indicate both models classify static activities like laying very accurately, while dynamic movements cause most errors. The performance comparison chart highlights that the Neural Network slightly outperforms Random Forest in all key matrices, suggesting better generalization and feature learning. Overall, both models are effective but the neural network demonstrates superior performance and robustness for this dataset.

5. Conclusion and Recommendations

In conclusion, this study demonstrates that both Random Forest and Multilayer Perceptron model achieves high accuracy in classifying human activities from smartphone sensor data, with MLP offering a slight performance edge. However, key limitations include difficulty distinguishing static activities (sitting vs. standing) due to waist-mounted sensor constraints and reliance on a single, controlled dataset. Future work should focus on integrating additional sensors (e.g., magnetometer), employing advanced deep learning architectures like CNNs or RNNs to capture temporal dynamics, and validating models on more diverse, real-world data to improve generalizability and deployment in real-time mobile applications.

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THE INTERRELATION OF ART, POWER, AND SOCIETY IN AYYUBID METALWORK (A CASE STUDY OF A WORK FROM THE MOSUL SCHOOL)

Mahsa Goreishi[91], Mehdi Mohammadzadeh[92]

Abstract
Mosul metalwork in the 7th century AH—especially the pieces attributed to Aḥmad b. ʿUmar, known as Zaki al-Naqqāsh, represents some of the most remarkable manifestations of the fusion of art, political power, and aesthetic values in the Islamic world. Despite the historical importance of these works, the close reading and precise analysis of their inscriptions and human motifs have received limited scholarly attention. The issue addressed in the present article is that the human figures and inscriptions on the metal basin attributed to Aḥmad Zaki al-Naqqāsh of Mosul, beyond their decorative aspect, carry political, religious, and identity-related messages, and can reveal the status of the artist and the patron. This basin, currently housed in the Louvre Museum in Paris, is considered one of the outstanding examples of the Mosul metalworking school.
The research hypothesis is based on the premise that this metal basin, in addition to its aesthetic and functional roles, also possessed ritual and political functions, and was produced to represent the grandeur and legitimacy of Ayyubid authority. Its inscriptions and human motifs—particularly the scenes of music, hunting, and battle—reflect the social and cultural values of their time. The study aims to uncover the relationship between the artistic quality of the work and the political status of the patron through a structural, contextual, and aesthetic analysis of the human motifs and inscriptions. The central research question is: "How do the human figures and visual ornaments of the basin convey political and cultural messages, and what information do they offer regarding the status of the artist and the visual culture of the Mosul metalworking school?" The research method is descriptive–analytical, based on library studies, examination of written sources, and comparative analysis of contemporary works. The visual structure of the inscriptions is executed in Naskh script and arranged in a continuous band system in which the name of al-Malik al-ʿĀdil Abū Bakr b. al-Malik al-Kāmil appears prominently and repeatedly. The maker's signature, presented as an independent phrase, also indicates the artist's position within the court.
The findings show that this basin, apart from its artistic value, is a political and historical document. Its human motifs and inscriptions represent the idea of the "ideal sultan" with phrases such as "Sword of the World and the Faith," "Supporter of Truth through Evidence," and "Subduer of the Rebels." This piece is thus an exceptional example for studying the interconnection of power, art, and society within the Mosul metalworking school and the broader history of Islamic art.
Keywords: Mosul metalwork, Aḥmad Zaki basin, art and power

Introduction

Islamic art represents one of the most significant cultural expressions of the Islamic world, grounded on pre-Islamic artistic traditions while simultaneously shaped by the teachings and worldview of Islam. Among its various branches, metalwork stands out as one of the most prominent and functional industrial arts. Beyond its practical applications, Islamic metalwork possessed a remarkable capacity to reflect the intellectual, social, religious, and even political conditions of Islamic societies. Despite this importance, the role of metalwork within studies of Islamic civilization and art has received comparatively less scholarly attention than other artistic disciplines.
During the early centuries of Islam, metalwork, like other art forms, gradually underwent a process of transformation. On the one hand, many manufacturing techniques and formal patterns continued pre- Islamic traditions, particularly those of Sasanian metalwork. On the other hand, the expansion of Islamic thought introduced new attitudes toward luxury, function, and ornamentation. Religious restrictions on the direct use of gold and silver for vessels encouraged artisans to employ metals such as copper, bronze, and brass, while inscriptions with devotional, ethical, and honorific content gained increased prominence in decoration. As a result, metal objects became carriers of meaning and reflections of an Islamic worldview, while still maintaining their functional role in everyday life.
Within this broader context of transformation, the city of Mosul emerged as one of the most important centers of metalwork in the Islamic world. Although Mosul had been involved in metal production since the Abbasid

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period, it reached an unprecedented level of artistic flourishing during the sixth and seventh centuries AH, particularly under Seljuk and later Ayyubid rule. The displacement and migration of Iranian and Khurasani metalworkers following periods of political instability and Mongol invasions facilitated the transfer of technical knowledge, casting and engraving techniques, and decorative motifs to Mosul. These developments contributed to the formation of a coherent and recognizable Mosul school of metalwork. Drawing upon Sasanian and Seljuk traditions while incorporating local innovation, Mosul metalworkers developed a distinctive and identifiable visual language.

An examination of surviving works from this school demonstrates that Mosul metal objects should be understood as more than purely utilitarian items. Many examples reveal clear indications of courtly order, power relations, social structures, and contemporary aesthetic preferences. From the Ayyubid period onward, metalwork in certain regions functioned as a medium for displaying splendor, reinforcing political legitimacy, and emphasizing the status of artistic patronage. The influence of the Mosul school extended beyond its immediate geographical boundaries, shaping metalworking traditions in cities such as Damascus, Aleppo, and Cairo. Consequently, the Mosul school of metalwork can be regarded as one of the most dynamic and influential artistic currents in the production of metal objects in the Islamic world, distinguished by its balance between tradition and innovation, as well as between function and meaning.

This paper focuses on introducing the Mosul school of metalwork with particular emphasis on the relationship between art, power, and society during the Ayyubid period. Through a case study of a selected work from this tradition, the study analyzes decorative techniques, modes of figural representation, and pictorial themes in order to illuminate some of the lesser-studied capacities and expressive potential of this art-industrial tradition.

Research Background / Literature Review

Despite the significant position of Mosul in the history of Islamic art, the city's metalworking tradition and its diverse dimensions have received relatively limited scholarly attention. Among the existing studies, Metal Works of Mosul in the Abbasid Period by Salah Hussein al-ʿUbaydi (2011) is the only independent work specifically devoted to the Mosul school of metalwork. This book, available to Persian- speaking scholars through the translation by Mohammad Afrough and Masoud Ahmadi, focuses on the introduction, description, and analysis of Mosul metal objects from the Abbasid and Seljuk periods. However, although the author addresses technical and decorative characteristics, the influence of earlier traditions—particularly Sasanian and Seljuk metalwork—on the Mosul school has not been examined in a systematic and analytical manner. Apart from this publication, no comprehensive study has been conducted on Mosul metalwork, especially in Persian; therefore, the present research may be regarded as one of the first scholarly Persian-language studies in this field.

Among Persian-language studies, the article "A Study of Manufacturing Techniques and Themes of the Mosul School of Metalwork: A Case Study of the Casket and Candlestick of Badr al-Din Lu'lu'" (Afrough & Qani, 2013) is one of the few works that directly addresses this school through a case-based approach, examining selected aesthetic components and thematic features of Mosul metal objects. Likewise, the article "A Critique of the Attribution of Three Metalwork Objects from Western Iran to the Mosul School in the First Half of the Seventh Century AH" (Reza-Zadeh et al., 2013) seeks to reject the attribution of certain objects to the Mosul school and to demonstrate their association with metalworking centers in northwestern Iran and Mesopotamia. Although the Mosul school is discussed, the primary focus of this study lies in reassessing earlier scholarly attributions.

In the field of international scholarship, studies on Islamic metalwork in general remain relatively limited, and the available sources are not extensive. Among early scholars, Stanley Lane-Poole identified the distinctive stylistic characteristics of the Mosul school, including the extensive use of human and animal figures, hunting scenes, and the frequent application of silver inlay (Lane-Poole, 1947). Connell, in Islamic Art, emphasized the importance of Mosul in the seventh century AH, recognizing it as a major center of metalwork and highlighting its influence on cities such as Baghdad, Damascus, Aleppo, and Cairo.

Gaston Migeon, through his examination of metal objects from Mosul, Cairo, and Damascus, identified the seventh century AH as the peak of Mosul metalwork and underscored its influence on other contemporary regions (Migeon, 1927). Christie, in The Legacy of Islam, addressed the role of Mosul in metal production and emphasized its connections with the Iranian cultural sphere and its interactions with Iranian and Armenian artisans (Christie, 1936). Ralph Harari, in The Art of Iran, argued that Mosul metalworkers were either influenced by, or maintained close connections with, the inlaid metalworking traditions of northern and northeastern Iran, particularly Khurasan (Harari, 1939).

In 1932, Gaston Wiet examined Islamic metal objects housed in the Museum of Islamic Art in Cairo and identified several works attributed to Mosul craftsmen, providing a list of known metalworkers from the city (Wiet, 1932). Dimand, in Islamic Art, devoted a section to Seljuk metalwork in Iraq and emphasized the importance of Mosul in seventh-century AH metal production (Dimand, 1958).
Zaki Muhammad Hasan, in Islamic Arts and Atlas of Decorative Arts, surveyed metal objects from the Islamic world and introduced a number of works associated with the Mosul school of metalwork (Zaki, 1948; 1956).

Douglas Barrett, based on his study of Islamic metal objects in the British Museum, identified Mosul as a major metalworking center and noted its influence on the metalwork traditions of Syria and Egypt (Barrett, 1945). Among these scholars, David Talbot Rice conducted some of the most detailed studies on Mosul metalwork. In 1949, he examined one of the earliest Mosul candlesticks, providing a detailed analysis of its decorative and figural elements (Rice, 1949). In a subsequent study in 1953, Rice analyzed three Mosul metal objects and corrected several inaccuracies in earlier scholarship (Rice, 1953).

Methodology
This research is fundamental in terms of its objective and is conducted using an analytical–comparative approach. The data collection method is based on library and electronic sources. The study relies on the examination of written scholarly materials, museum catalogues, and digital resources related to Islamic metalwork and the Mosul school.
In the present research, a metal object currently exhibited at the Louvre Museum in Paris has been selected for visual and iconographic analysis. The human figures and inscriptions engraved on this vessel are examined with particular attention to the influence of political power and social structures on their iconography and content. Through this approach, the study aims to identify how visual motifs and epigraphic elements function as carriers of political, social, and ideological meanings within the context of Ayyubid-period

Mosul metalwork
According to the Dehkhoda Dictionary, the term metalwork refers to engagement in activities involving metal, such as the production of vessels and tools, as well as the places where metal objects are manufactured, such as smithies (URL 6). Metalwork is among the artistic practices that, both before and after the advent of Islam, provided a suitable medium for artists to convey creative and aesthetically refined decorative motifs.
Zavieh and Moradi, citing Irwin, describe metalwork as one of the most significant artistic media for the transmission of innovative and refined designs over long periods of time. These designs later influenced the decorative patterns of other artistic fields, including ceramics and engraving. Given the scarcity of historical information regarding the lives of artists in the middle Islamic period—particularly metalworkers—the surviving artworks themselves constitute the primary sources of valuable information about the characteristics of their creators and the societies in which they were produced (Zavieh & Moradi, 2011).
In the art of metalworking, metal objects are produced through various techniques, and a wide range of methods is employed for their decoration. These techniques and processes are discussed in detail within the scope of the present study, particularly in relation to metalworking practices during the middle Islamic period.
The inhabitants of Mosul were known for their technical expertise, among which metalworking held a prominent position. Several factors contributed to Mosul's emergence as a major industrial center for the production of luxury metal objects, most notably access to raw materials and the high level of skill and craftsmanship of Mosul metalworkers. The Mosul school exerted a profound influence on other Islamic regions, and many of its craftsmen migrated to cities such as Cairo, Aleppo, Baghdad, and Damascus, where they established new metalworking workshops and artistic traditions.
Mosul adopted certain metalworking techniques from Iran, and it is likely that Iranian artists sought refuge in Iraq during periods of political upheaval, particularly following the Mongol invasions. Similarly, Iraqi craftsmen migrated to Egypt and Syria in the mid-seventh century AH (Hasan, 2009). One of the most significant surviving examples of Mosul metalwork is the so-called Blacas Ewer, produced by Shujaʿ ibn Manaʿ al-Mawsili. This object is distinguished by its extensive use of human figural decoration and by its iconographic themes of considerable symbolic and cultural significance (Dimand, 2010).
The Mosul School of Metalwork: Formation, Continuity, and Expansion in Relation to Power and Society
The city of Mosul is recognized as one of the prominent centers for the production of functional and luxury artworks—particularly metal objects—within Islamic civilization. From the late fifth century AH, concurrent with Seljuk dominance, Mosul entered a new phase of artistic and industrial prosperity and attained a

distinguished position among the artistic centers of the Islamic world, especially under the rule of the Zangid Atabegs. The peak of this flourishing occurred during the reign of Badr al-Din Lu'lu' in the seventh century AH, a period marked by the rulers' special attention to crafts, technical skills, and the arts, particularly the art-industry of metalworking, which facilitated remarkable advancements in this field.

Although metal objects attributed to Mosul prior to the seventh century AH have rarely survived in known collections and museums, historical evidence and the high level of craftsmanship observed in seventh-century works suggest a long-standing metalworking tradition in the city. Mosul's geographical location and proximity to major ancient centers such as Assur, Nineveh, and Hatra—renowned for their metalworking traditions—along with its inclusion within the Sasanian sphere of influence until the Islamic conquest, help explain the continuity and transmission of this art from the pre-Islamic period into the Islamic era. Given the Sasanians' advanced expertise in metalworking, the presence of Sasanian elements and motifs in Mosul metal objects appears natural; these elements were later integrated with Seljuk traditions and, more notably, with the metalworking school of Khurasan.

By the thirteenth century CE, Mosul had become one of the most important centers of inlaid metalwork in the Islamic world, to the extent that for a long period many copper and silver inlaid objects were attributed to this city. Among the factors contributing to this prosperity was access to raw materials, particularly copper, which was supplied from various regions of al-Jazira. Ibn al-Athir notes the existence of copper mines in Diyarbakir, near the fortress of Dhu al-Qarnayn. Equally significant was the patronage and encouragement of rulers and statesmen, who actively supported metalworkers by purchasing their products. As a result, metal objects produced in Mosul were not only used in palaces and aristocratic residences but also served functional purposes in mosques and madrasas. Moreover, the technical skill, artistic creativity, and favorable remuneration of Mosul craftsmen positioned the city as a leading center for the production of inlaid metal objects during the seventh century AH.

The Mosul school produced a wide range of both utilitarian and luxury objects, including candlesticks, ewers, censers, inkwells, basins, bowls, trays, caskets, vases, as well as scientific instruments such as astrolabes and sundials, and even weapons. The manufacturing processes were primarily based on traditional techniques such as hammering, casting, and molding—particularly the lost-wax method— which were further refined and developed during the Islamic period with greater precision and sophistication. Among the various stages of production, surface decoration held particular importance, with inlay (damascening) emerging as the most characteristic and widely employed decorative technique. By embedding metals such as silver, copper, or gold into the base surface, this technique created striking chromatic contrasts and visual depth.

In addition to inlay work, techniques such as openwork, niello, filigree, turquoise inlay, and pottery- related methods appear—albeit more limited—in Mosul metal objects. The decorative repertoire of these works can be classified into four main categories: animal, human, geometric, vegetal, and epigraphic motifs. These decorations were typically arranged in horizontal bands encircling the body of the object or within multi-lobed medallions.

Through the intelligent use of geometric proportions and the careful organization of visual space, Mosul artisans created works that rank among the most outstanding examples of Islamic metalwork in both technical execution and aesthetic refinement.

Following the Mongol invasion and the fall of Mosul in the mid-seventh century AH, many metalworkers migrated to Damascus and Cairo, where they continued their activities. The clear stylistic and technical similarities between Mosul metal objects and those produced in these cities provide compelling evidence for the transmission of the Mosul metalworking tradition and its skills to other major centers of the Islamic world.

INLAID METALWORK (MURSHA'AL-KARI) IN MOSUL

The new technique of inlaid metalwork (Mursha'al-kari) emerged in the western Islamic world, particularly in Mosul, a wealthy and prosperous city on the banks of the Tigris River in northern Iraq, which had strong connections with the eastern regions. Badr al-Din Lu'lu initially served as the last minister of the Zangid period and later became an independent ruler, bringing stability to the city and fostering a flourishing of the arts. He actively supported the inlaid metal industry in the capital.

The inlaid technique increased the value of Mosul's brass objects and vessels, similarly to the production in Khorasan. Luxury items, such as candlesticks, were for the first time made entirely from primary metal, many of which likely reflected high-quality local metal. Craftsmen mostly worked with brass sheets. Although Mosul metalworkers followed the eastern inlaid techniques, the forms of vessels and decorative motifs were largely designed from a set of local artworks and national treasures.

The variety of Mosul decorations was significantly broader than in Khorasan; it included scenes of astrology, hunting, coronation, battle, court life, and even daily activities. Such scenes were also common in manuscript illustrations of the period, indicating a close connection between inlaid workshops and book illustrators.
Mosul's inlaid metal artworks gained widespread fame. According to contemporary sources, including the geographer Ibn Sa'id in the mid-13th century (7th Hijri century), these inlaid productions were sold commercially and also presented as gifts to princes and foreign dignitaries. This demonstrates that brass vessels eventually gained a prominent status, competing with gold and silver to attract the most distinguished and taste-conscious patrons.
The high demand for inlaid brass objects encouraged Mosul craftsmen to establish workshops abroad, and the Mosul style and technique quickly spread to Syria, Egypt, western Iran, and Anatolia, to the extent that many inlaid artisans of the 7th and 8th Hijri centuries signed their works with "al-Mawsili" (from Mosul).
(Rachel Ward, Islamic Metalwork; translated by Dr. Mehnaz Shayestehfar)

METALWORK OF THE MOSUL SCHOOL: REFLECTION OF SOCIETAL FEATURES

Rulers were among the primary political factors influencing Mosul metalwork, and their status and authority were reflected through aesthetic conventions. These conventions included depicting the sultan seated cross-legged on a throne, positioning the sultan's hand on his knee, illustrating the sultan with a larger hat than others, and portraying the sultan larger in scale relative to other figures.
In Mosul metalwork, scenes of hand-kissing (salutation) are visible, where a figure wearing a simple hat is depicted kissing the sultan's hand. This depiction may have been influenced by the presence of the Atabegs who ruled Mosul under the Seljuk and later Ilkhanid authorities. Furthermore, the military victories achieved by the Atabegs in the region likely motivated artists to represent such events in their work.
As Mirsaydi (1396), citing Albrecht, emphasizes, artistic works often reflect political events, wars, and other societal activities. The impact of wars and conflicts during the medieval Islamic period can be observed in the decorative motifs of Mosul metal vessels. These are expressed through aesthetic conventions, such as depicting the sultan mounted on a horse with a drawn sword, or showing cavalrymen armed with lances and bows arranged around the vessel in dynamic bands.
On a Mosul metal vessel, victory scenes in battle are depicted, where the artist highlights the triumph by illustrating one of the riders beneath the horse, emphasizing the outcome of the battle. Such imagery demonstrates how Mosul metalworkers visually represented political power, societal hierarchies, and military success in their artistic creations.



CASE STUDY: THE ZAKI AL-NAQASH BASIN FROM THE MOSUL SCHOOL

As discussed in the previous sections, this basin represents the earliest metal basin from Mosul currently on display at the Louvre Museum, Paris, and is made of brass. The basin is decorated with inlaid silver motifs. This exquisite object is not only outstanding in terms of technical and artistic craftsmanship but also holds significant symbolic and conceptual value, conveying important messages in the history of Islamic art.
The dimensions of the basin are as follows: height 19 cm, diameter of the mouth 46.9 cm, and base diameter 32.3 cm.

(See Figure 2)



DECORATION OF THE BASIN

The basin is decorated both on the exterior and interior surfaces. However, most of the inlaid silver decoration on the interior has been worn away or lost, making it extremely difficult for viewers to discern and follow the original designs that once covered the inner surface of the basin.

(See Figure 3)



INSCRIPTIONS ON THE BASIN

Along the rim of the basin, there is a band featuring Kufic inscriptions that encircle the entire edge. The inscriptions include the name and titles of Sultan al-Adil Abu Bakr ibn Ayyub. Given the importance of this Arabic text, it is fully presented here.

(See Figure 4)



الكفره قامع والمسلمين الاسلام عضد والدين الدنيا سيف المرابط المجاهد المنصور المظفر المؤيد العالم المالك الملك السلطان لمولانا عز
الظالمين من المظلومين منصف المسلمين بلاد ثغور حامى بالبراهين الحق ناصر العالمين فى العدل محى المتمردين قاتل) والمشركين
مجمر الملحدين مهلك السلاطين قطب المعالى فلك ه' ل' ال ناصر الامه ركن المملكه قسيم الخلافه عماد المساكين و)اليتامى(أبواليتاما
المنائح الثغر فى بالطعن الثغور حامى بنصره المؤيد العصر أوحد العراق ملك الشام يهلوان والعجم العرب سلطان الأمم رقاب مالك المجاهدين
السلطان مولانا بن بكر أبى العادل المالك المدائح مصدق
نصره عز ايوب بن بكر ابى محمدبن المعالى أبى الكامل الملك«(

TRANSLATION OF THE ARABIC INSCRIPTION

“May our sovereign, the king and master of the world, be exalted. Confirmed by God, victorious and successful, aided and striving in jihad, the sword of religion and the world, the strong arm of Islam and the Muslims, restrainer and suppressor of infidels and polytheists, destroyer of tyrants, reviver and establisher of justice among all peoples, supporter of truth with evidence and reasoning, protector of Muslim frontiers, pillar of the caliphate, distributor of equity in the realm, foundation of this community, helper of God, center of generosity, axis of sultans, annihilator of the impious, fire of the warriors, master of the nations, sultan of Arab and non-Arab lands, champion of Syria, emperor of Iraq, the sole ruler of his era, who achieves victory through the grace of God. He strengthens the frontiers by targeting weak and insecure points, father of all generosity and giving, and bestower of praise. He is the just king Abu Bakr, son of our sovereign Sultan al-Malik al-Kamil, the father of nobility. He is none other than Muhammad ibn Abu Bakr ibn Ayyub – may his success increase continually.”
(See Figure 4)

ANALYSIS OF SELECT TITLES AND DECORATIVE SCENES

While most of the titles mentioned in the inscription have already been discussed, some of them appear for the first time in this context. One such title is “‘Amil”, which refers to a person of righteousness and virtue. The title “Malik al-‘Iraqi” indicates that the Ayyubids claimed sovereignty over all of Iraq.
Following this inscription, a wide band is decorated with scenes of hunting, set against a background of dense floral (arabesque) motifs. The depictions exhibit remarkable precision, delicacy, and dynamism, particularly in the portrayal of horses. The artist rendered various poses of the horses to convey movement and vitality: some horses appear to be leaping, others seem to descend from a height, while some follow their riders in motion. This compositional technique effectively communicates energy, action, and liveliness throughout the hunting scenes.

(See Figure 5)



HORSEMEN AND HUNTING SCENES

The horses and riders are depicted with clear and distinct movements. Some riders are shown shooting arrows from their bows, while one holds a hunting falcon in hand. Others are portrayed hunting deer, and two hunters are attempting to strike a wild boar. These hunting motifs reflect themes from Sasanian art, demonstrating the continuity and adaptation of earlier artistic traditions within the Mosul metalwork school.

(See Figure 6)



OVERALL COMPOSITION AND GEOMETRIC ELEMENTS

Overall, the scene gives the impression of a battle or combat scenario. The depiction of depth and perspective within this band demonstrates the artist's skill and understanding of pictorial principles. In general, the artist is highly successful in rendering movement and spatial arrangement in this composition.

Several rectangular motifs interrupt this band, each containing a central octagonal decorative element composed of a cruciform pattern embedded within geometric designs. The geometric basis of these motifs is the letter "T", while the surrounding areas are filled with delicate vegetal elements, enhancing the complexity and elegance of the overall decoration.

(See Figure 7)



SECOND DECORATIVE BAND: GEOMETRIC BACKGROUND AND SCENES OF ENTERTAINMENT

Following the previously described band, another band with a geometric background is present, featuring nineteen octagonal motifs depicting a variety of themes, including banquets, musical performances, and hunting scenes. For instance, hunting is represented in multiple ways, from using hunting falcons and bows and arrows to employing tamed and trained leopards. A similar hunting scene can be observed on the Shuja' ibn Mana' basin from Mosul.

Scenes of dance and celebration are also depicted in this band, prominently featuring two individuals engaged in musical performance. In one motif, one figure plays a harp, while the other plays an oud. Another motif shows two individuals, one playing a flute and the other a daf drum. In a third motif, a woman is depicted playing the oud with a graceful movement, while another person stands nearby holding a cup, indicating a festive or celebratory atmosphere.

(See Figure 8)



DECORATIVE EMPHASIS AND HUMAN FIGURES IN MOSUL METALWORK

Another notable aspect of Mosul metalwork is the artist's attention to the entirety of the decoration, whether the motifs are primary or secondary in importance, and whether they occupy a prominent or subtle position on the object. The extensive use of ornamentation likely reflects the artisan's desire to achieve high recognition, which in turn could enhance the material value of the object for its maker.

Most Mosul works include human figures, typically arranged in one or two horizontal rows on the metal surface. These figures are positioned either within horizontal bands or octagonal panels, demonstrating a diversity of characters—from rulers and governors to servants and attendants, as well as men and women musicians and singers, and even farmers and shepherds.

Many of these depictions are romanticized or imaginative, rather than strictly realistic. This is especially evident in the central figure of each composition, which is emphasized over surrounding characters. The prominence of the central figure is indicated through larger scale or compositional focus, often depicted

holding a cup, while figures around them are arranged in a way that draws attention toward the central person. This visual hierarchy reflects both social and symbolic significance within the artwork



Conclusion

The examination of Mosul metalwork, with a focus on the Zaki al-Naqash basin, reveals the intricate relationship between art, power, and society in the 7th century AH Islamic world. This object exemplifies how metalwork served not only functional and aesthetic purposes but also acted as a medium for political expression, social communication, and cultural identity. The detailed inscriptions, geometric patterns, vegetal motifs, hunting scenes, and depictions of music and festivity collectively highlight the multi-layered symbolic language employed by Mosul artisans.

The basin's Kufic inscription, enumerating the titles of Sultan al-Adil Abu Bakr ibn Ayyub, underscores the role of patronage in shaping artistic production and establishing political legitimacy. Beyond mere decoration, the placement, scale, and gestures of human figures convey social hierarchy and narrative intent. Central figures are emphasized through size and positioning, while surrounding figures reinforce their importance, demonstrating the artisans' mastery of visual storytelling.

The hunting and festive scenes illustrate both continuity with Sasanian artistic traditions and the unique creative innovations of Mosul's metalworking school. The dynamic portrayal of horses, hunters, and musicians reflects a sophisticated understanding of movement, depth, and compositional balance, emphasizing the technical skill and imaginative capacity of the artisans. Furthermore, the extensive use of ornamentation across primary and secondary motifs suggests that artisans sought recognition, social prestige, and material value through their work, indicating a conscious engagement with both patronage and audience perception.

Importantly, Mosul metalwork exemplifies the integration of cultural memory, artistic tradition, and contemporary sociopolitical context. By combining inherited motifs with locally developed techniques and themes, the artisans created objects that were simultaneously visually striking, socially meaningful, and politically resonant. The Zaki al-Naqash basin, as the earliest known basin from Mosul, provides a clear lens through which to understand the interplay of aesthetic sophistication and social function in Islamic metalwork.

In sum, Mosul metalwork is not merely an artistic production; it is a cultural artifact that encapsulates the values, ambitions, and dynamics of its society. It demonstrates how rulers, artisans, and communities

interacted, using art to express authority, commemorate events, and convey identity. This study highlights the importance of analyzing both inscriptions and iconography to fully comprehend the complex narrative and symbolic dimensions of Islamic art. The Zaki al-Naqash basin remains an exceptional example, providing enduring insight into the historical, social, and artistic significance of Mosul's metalworking tradition within the broader context of Islamic visual culture.

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THE IMPACT OF MEDIA (VIRTUAL SPACE) ON CHANGING CHILDREN'S PAINTING TASTE BEFORE AND AFTER THE COVID-19 PANDEMIC

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Abstract
Media is known as one of the most important actions influencing the transformation of taste in the contemporary world. Among them, children are most affected due to their greater impressionability when faced with this attractive world. The extent to which children are influenced by the media can be examined in the representation of their emotions in their drawings. Meanwhile, the spread of the Coronavirus has accelerated children's access to social media. By examining children's drawings in the two periods before and after the Coronavirus, we can understand the extent of the media's influence. The most important question of this research is: What changes has cyberspace brought about in the drawings of 6-12 year old children in the two periods before and after Corona? Focusing on more than three hundred examples of children's works that were purposefully selected from schools in Tabriz, it shows. Significant changes can be observed in the subjects of post-COVID-19 paintings compared to the pre-COVID-19 period, including: Themes (increased digital characters and individual activity), coloring (predominance of dark colors with high contrast), space (reduction of open space and increase of closed space), and expression of emotions. This study showed that excessive use of digital media led to reduced creativity, increased anxiety, and changes in children's artistic expression.
Keywords: Children's drawings, cyberspace, Corona

Introduction

Children's painting constitutes an open world through which their emotions and thoughts are revealed. Its importance lies in the fact that it is far closer than words to the intrinsic truth of objects, and its comprehension—unlike writing—does not require extensive effort or precision (Ferrari, 2003: 45). For children under the age of ten, painting functions as a more effective language than spoken speech, since the structure of verbal language is so complex that young children cannot easily use it to express themselves. For a child, painting serves as a means of escaping distress and revealing images connected to personal suffering that cannot be articulated through language (Ahmadi et al., 2014).

On the other hand, art, as one of the most fundamental modes of human expression, has undergone significant transformations throughout history in response to social, cultural, and technological changes (Ernst Fischer). Today, with the expansion of digital technologies, children's perceptual and artistic structures have likewise been influenced by virtual space (Mohammad Kazemvand et al., 2016). Technological transformations over the past decade—particularly the spread of virtual space—have reshaped children's lifestyles. The COVID-19 pandemic, by restricting physical activities, accelerated this transformation and turned virtual space into an inseparable part of children's daily lives. Painting, as a powerful tool for expressing children's emotions, imagination, and creativity, can therefore reflect these influences (Lowenfeld & Brittain, 1987). According to UNICEF reports, the COVID-19 pandemic created conditions that compelled all individuals—especially children—to spend significantly more time in virtual environments (Nagat et al., 2020).

This article is developed to examine and analyze the impact of external factors—particularly virtual space and media—on children's attitudes. To achieve this aim, it draws upon Neil Postman's theory regarding the role of media in transforming audience taste. Neil Postman is among the most prominent thinkers in media sociology and emphasizes the importance of interaction with, and education about, media use. According to Postman, visual media erode the boundaries of childhood by removing mediation from access to information. Virtual space, by altering children's sensory experiences, may consequently transform their patterns of painting.

The purpose of this research is a comparative analysis of children's paintings and an explanation of how these changes align with Neil Postman's theory of the Disappearance of Childhood. This theory argues that visual media, by rendering information immediate and unmediated, eliminate the boundary between children and adults, leading to the erosion of the very concept of childhood. It demonstrates how changes in media tools—particularly within the context of the global COVID-19 crisis—have accelerated this process and contributed to the collapse of traditional boundaries.

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The necessity of this research lies in addressing a specialized and educational issue in order to prevent potential harms and to avert the decline of childhood through conscious management and the maintenance of balance. In other words, this study seeks to identify the extent and nature of children's receptivity to virtual media by examining the role of virtual space in transforming children's painting in the pre- and post-COVID periods, with emphasis on Postman's theory. Through content analysis of children's paintings and comparison of works from the two periods, the study aims to answer the following questions: How has virtual space altered the painting patterns of children aged 6–12 before and after the COVID-19 pandemic? What is the relationship between the use of virtual space and children's artistic creativity?

Research Objectives

This study aims to clarify the effects of virtual space on children's expressive art by pursuing several specific objectives. The primary objective is to conduct a comparative analysis of content-related and formal changes in the paintings of children aged 6–12 across two time periods: before and after the COVID-19 pandemic. This analysis focuses on indicators such as subject matter, color usage, spatial organization, and emotional expression in order to assess the extent to which children's visual taste has been transformed under the influence of digital media. Finally, this research seeks to propose strategies for the conscious management of technology use and for maintaining a balance between the real and virtual worlds, with the aim of supporting children's psychological well-being and creative development.

Research Questions

In order to achieve its objectives and within the framework of the study entitled "The Impact of Virtual Space on the Transformation of Children's Painting Taste Before and After the COVID-19 Pandemic," this article seeks to address the following key question:

- What transformations has virtual space brought about in the thematic, chromatic, spatial, and emotional patterns of paintings by children aged 6–12 in the periods before and after the COVID-19 Pandemic

Literature Review

In the field of children's painting, numerous theories have been developed to explain the stages of development and the psychological dimensions of children's artistic works. Theorists such as Arnheim (2007) regard painting as a reflection of the child's mental and perceptual development and as an effort to organize their perceptions of the surrounding world. From the perspective of Piaget and Inhelder (2012), painting represents an attempt to depict the real world and occupies a position between play and mental imagery. Lowenfeld and Brittain (1987) likewise emphasize the importance of creative and cognitive growth through art, considering painting the most remarkable means of observing the flow of a child's thinking. These theories primarily focus on internal processes of child development and maturation.

However, in the contemporary world—where children are profoundly influenced by external stimuli, particularly visual media and virtual space—such theories alone are insufficient for a comprehensive analysis of transformations in children's artistic expression. In this study, Neil Postman's theory The Disappearance of Childhood (2013) is selected as the main theoretical framework, as it explicitly addresses the impact of media as a powerful external force on age boundaries and child identity. Postman explains how visual media, by providing unmediated access to information, dissolve the boundary between childhood and adulthood and transform the traditional concept of childhood. This perspective is directly related to the central question of the present research concerning the impact of virtual space on children's painting, as it helps explain how digital content shapes not only artistic style but also children's worldview and perception.

Therefore, compared to other theoretical approaches, Postman's theory offers a more effective framework for analyzing the deep and sociological effects of virtual space on children's art in the contemporary era, particularly within the context of the COVID-19 crisis.

The studies reviewed below outline the theoretical and practical background related to the influence of virtual space on children, the use of painting as an analytical tool, and media theories. These studies provide the necessary conceptual foundations for analyzing transformations in children's painting in the pre- and post-COVID periods. In the following section, the most significant findings of these studies are presented in detail.

Research Methodology

The present study is based on theoretical field research and falls within the descriptive-analytical type of qualitative studies. Drawing on theoretical sources, library and electronic resources, as well as practical workshop experiences in teaching children's painting classes, the research adopts a theoretical yet applied approach to explain a theory and examine its influence on art education for children.
The sample of selected paintings analyzed in this study consists of 32 works from the Naqsh Ghalam Children's Painting School in Tabriz, Iran, collected over more than a decade across two periods: before and after the COVID-19 pandemic. These samples were randomly selected from a total of 384 paintings created by children aged 6 to 12.

The World of Children's Painting

Painting is a remarkable method for observing the flow of thought and is beneficial for all ages, particularly for children. Sometimes, expressing ideas through words is not easy for children, and visual representation provides an effective means to understand and communicate their ideas (Fischer, 2007). According to Piaget, painting is an attempt to represent the real world; it exists in the space between play and mental imagery (Thomas & Silk, 2018). Children's paintings reflect their cognitive and psychological development. As a mirror of the child's mind, painting conveys the influences of social and cultural environments as well as perceptual and visual patterns. Children's artwork reflects mental, emotional, and environmental transformations (Arnheim, 2007).
In painting, a child does not merely draw lines on a page; they are organizing their perceptions of the surrounding world. As Arnheim suggests, seeing is a form of thinking, and each line and shape in a child's drawing reflects the way the child organizes their mental representation of the world. Painting serves as a tool to study the development of children's conceptual understanding, including concepts such as size, space, proportion, symmetry, and causal relationships between objects (Ahmadi et al., 2014).
One important perspective is the emotional dimension. Arnheim emphasizes that in children's art, emotional expression takes precedence over realistic representation. In other words, children often draw what they feel rather than what they see. Elements such as color, pencil pressure, shape size, and composition all convey emotional messages. For instance, bright colors and angular lines may indicate excitement or anxiety, while soft colors and curved forms typically reflect calmness (Ahmadi et al., 2014).
Another influential factor in children's painting is the social dimension. According to Arnheim, children's art does not emerge in isolation but within a cultural and social context. The subjects of their paintings, the depiction of people and environments, and even color choices are influenced by social and cultural patterns. In other words, a child's painting reflects their position within society—from family and school to media and virtual spaces (Ahmadi et al., 2014).

Psychological Indicators in Children's Painting

From early childhood, when humans first perceive colors, they begin to organize their emotions based on these colors—a skill that continues to play an important role into adulthood. In fact, color holds significant importance throughout life, from childhood to adulthood (Bakhtiari Fard, 2009). Colors can evoke emotional responses: for example, warm colors (yellow, orange) indicate happiness and energy, whereas cool colors (dark blue, purple) reflect anxiety and isolation (Halimeh Ahmadi Yousefi, 2023). Black symbolizes negative thinking, loss of interest, surrender, or final withdrawal and has a strong influence on other colors, emphasizing their characteristics and importance (Lüscher, 2001).
Space: Space is understood through perception and can guide or constrain an individual's emotions, behaviors, and interactions. Humans do not merely inhabit space; they establish emotional, cognitive, and cultural relationships with it. Every spatial element—from shape and color to light and texture—acts as a sign conveying a specific message. For instance, open spaces (parks, nature) reflect social interaction, while enclosed spaces (rooms, screens) indicate isolation and individualism.
Characters: Realistic characters (family, friends) represent the tangible world and social connections, whereas digital characters (game creatures) symbolize the imaginary and media-saturated world. These digital representations indicate a child's mental dependence on media and a reduced emotional connection to the real world, reflecting the substitution of reality with virtual experiences.

Symbols in Children's Painting

Each child's painting is unique, even among peers of the same age. However, some images consistently appear across children's artwork and can be analyzed for their shared meanings over time. Understanding these

images, which manifest as specific symbols in children's paintings, provides insights into previously unknown aspects of the child and helps guide appropriate educational and developmental strategies.
The depiction of human figures in children's art often reflects the child's self-perception or their understanding of the body and personal desires. Certain characteristics in drawn figures can correspond to the child's psychological and physical traits. The house, frequently depicted in children's paintings, symbolizes shelter and the family nucleus, which may evoke feelings of attachment or aversion for the child (Ferrari, 2003).
Changes in a child's perceptual and symbolic world directly influence their visual and cognitive patterns. Paintings that once reflected lived experiences increasingly represent a parallel, media-saturated world. Postman's Disappearance of Childhood theory asserts that childhood is a social and cultural concept that emerged in the modern era with literacy and formal education. Visual media, by delivering images and information directly, erode these boundaries—and this process has accelerated in the post-COVID era, as children engage extensively with technology, online classes, entertainment platforms, and visual media.
Analyzing children's paintings not only reveals their cognitive and psychological development but also allows an understanding of the social, cultural, and familial influences on their minds. Postman's theory provides an important framework for understanding how virtual space and media transform not only educational interactions but also the very concept of childhood (Postman, 1999).
Children, like artists, begin capturing and analyzing their surrounding world from the earliest moments of perception. Initially, they engage with the world through dreams and imagination, which is why children are sometimes observed staring at a point intently, lost in thought, or suddenly reacting with noise or tears. As their perceptual abilities grow, they seek alternative ways to interact with their environment. Language and artistic methods—especially painting—become crucial, widely practiced by children across cultures. While their initial attempts may appear as mere scribbles, over time children begin to depict forms and shapes, relating them to the surrounding world and assigning specific meanings (Azizi Yousefkand, 2012).

The Role of Social Media During the COVID-19 Pandemic

Social media, as platforms where users can create, publish, and share content, played a crucial role during the COVID-19 pandemic. These platforms maintained individual and collective communication even under quarantine and social distancing measures, at a time when traditional media might have faced limitations (Abbas et al., 2021).
COVID-19 transformed human life in many ways, making the pandemic a major focus of media attention. The crisis also brought children into unprecedented engagement with technology, as online classes replaced in-person education. In his theory, Postman predicted that media would become the primary source of information, alongside digital entertainment platforms. Studies by Kim et al. (2012), Mansour (2018), Brown et al. (2019), and numerous other researchers indicate that social media has indeed become the main reference point for audiences seeking information.

Discussion and Analysis of Samples

This section presents a visual review and analysis of children's paintings from two periods: pre- and post-COVID-19, based on the authors' direct experience in teaching these children.
Pre-COVID-19 Period: Before the pandemic, children's paintings typically reflected social interactions (family, friends, playgrounds), everyday emotional experiences (happiness, affection, fear), daily activities, and familiar environments (home, parks, pets). Common characteristics of pre-pandemic drawings included:

- Use of diverse colors to express both positive and negative emotions.
- Presence of real-life characters and interactions with others.
- Open and accessible spaces, reflecting actual experiences.

Post-COVID-19 Period: After the onset of the pandemic, significant changes in style and content were observed due to social distancing, mobility restrictions, and increased exposure to digital media. Children's paintings increasingly focused on:

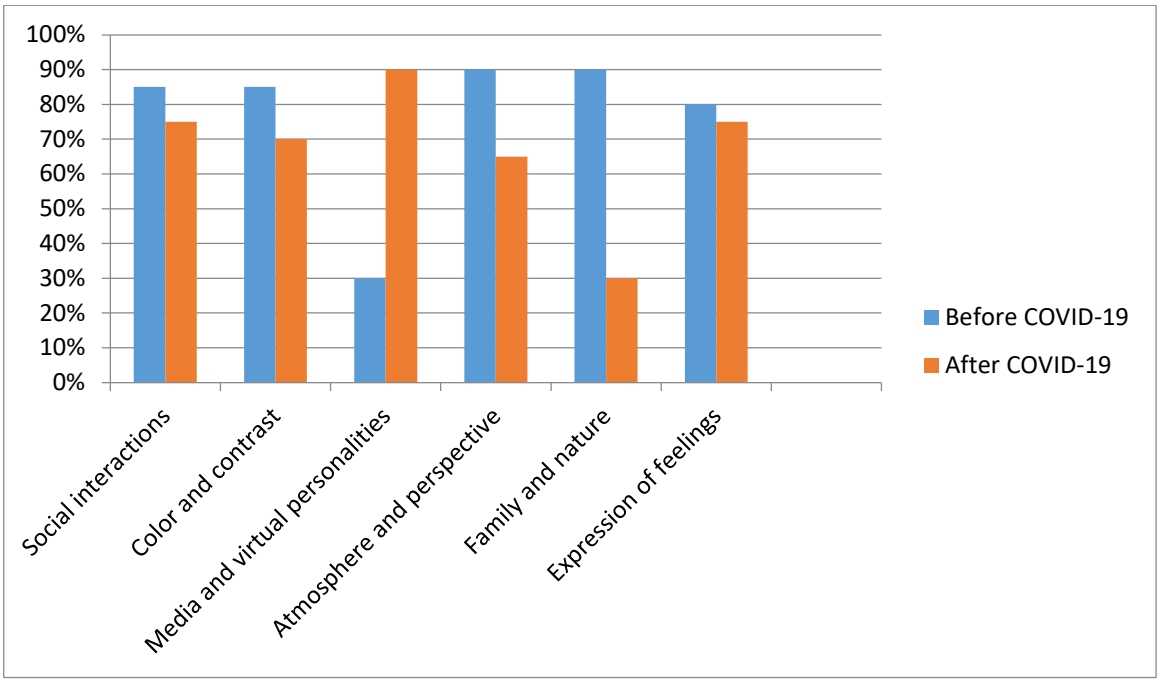
- Confined and limited spaces.
- Digital characters and cartoon heroes.
- Negative and anxiety-inducing emotions.

Quantitative Analysis: A statistical analysis of the 384 selected paintings (ages 6–11) revealed notable changes:

- Themes: Pre-pandemic, 85% of paintings depicted nature and group activities, whereas post-pandemic, 75% focused on virtual spaces and individual activities—a 60% decrease in social interaction.

- Colors: 85% of pre-pandemic paintings used bright, varied colors, while 70% of post-pandemic works featured dark colors with high contrast, reflecting increased psychological tension.
- Spatial Representation: 90% of pre-pandemic paintings showed open spaces (parks, nature), compared to only 65% post-pandemic, with closed spaces (rooms, screens) dominating—a 40% reduction in sensory experiences.
- Emotional Expression: 80% of pre-pandemic works expressed joy and social engagement, whereas 75% of post-pandemic paintings depicted loneliness and anxiety.
- Characters: Pre-pandemic paintings predominantly featured real-life characters (family, friends), whereas post-pandemic works showed a 75% increase in digital characters (game creatures), indicating a shift from real-world identity to virtual identity.

These findings clearly demonstrate that the COVID-19 crisis acted as an accelerant for the "disappearance of childhood", reinforcing Postman's theory. The pandemic intensified children's exposure to digital media, reshaping their artistic expression and highlighting the shift from experiential, social, and imaginative painting to media-influenced, individualistic, and digitally-oriented representations.



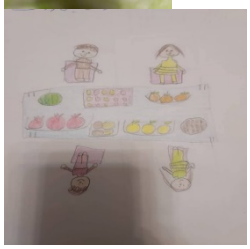
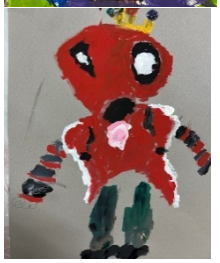
Following this brief explanation, a qualitative content analysis of the paintings was conducted to organize and present the results in a comparative table.

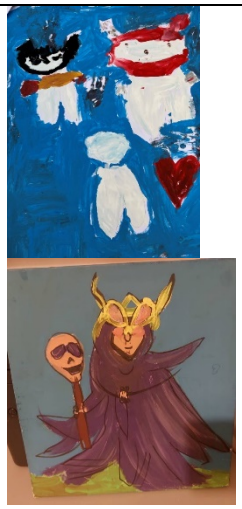
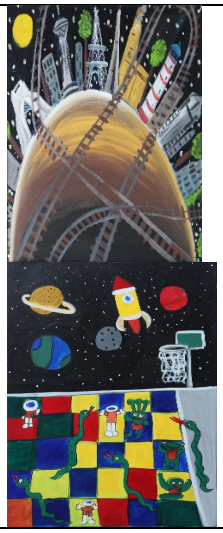
The table is structured based on the following indicators: social interactions, color and contrast, characters, space and perspective, and emotional expression, comparing the pre- and post-COVID-19 periods with reference to Neil Postman's theory. This comparative approach highlights various dimensions of adaptation, challenges, and changes expressed by children in response to the unique conditions of the pandemic.

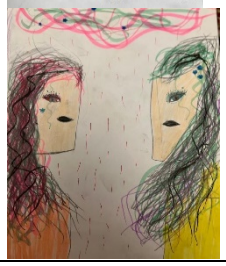
The table serves as a practical guide for psychological and educational interventions in this field. Furthermore, after presenting the table, the results will be interpreted in the context of Postman's Disappearance of Childhood, providing a theoretical lens for understanding how digital media and pandemic conditions have influenced children's artistic expression and emotional development.

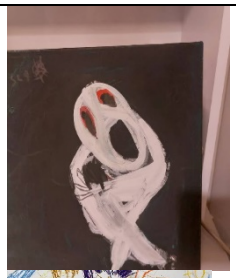
Table 1: Sample Children's Paintings Pre- and Post-COVID-19 in Alignment with the Theory of the Disappearance of Childhood (Source: Authors)

Analysis Based on Postman's Theory	**Post-COVID-19**	**Pre-COVID-19**	**Indicators**

Before the pandemic, nature, homes, and group play were evident in children's paintings. In post-pandemic paintings, individual activities, virtual spaces, and digital characters are observed.	 	 	Social Interactions
Reduced social interactions	Individual activities and virtual spaces	Nature and group play	
Before the pandemic, bright and varied colors with color harmony were present. In post-pandemic paintings, the colors are darker with greater contrast.	 	 	Color & Contrast
Increased psychological tension	Darker colors with higher contrast	Bright and varied colors	

Before the pandemic, most characters depicted were from storybooks, friends, and family. In post-pandemic paintings, characters from computer games and virtual worlds are observed.			Characters
Replacement of reality with virtuality	Computer and virtual world characters	Storybook characters	
Before the pandemic, open spaces such as parks, nature, and family gatherings were depicted; however, in post-pandemic paintings, closed spaces are observed.			Space & Perspective
Limited sensory experiences	Closed spaces and screens	Nature and open spaces	

Before the pandemic, children depicted participation in family and friend gatherings and interaction with the natural environment. In the post-pandemic period, there is a decrease in collective and social elements and a tendency toward individualism.	 	 	Family and nature
Increased individualism	Individualism	Social interaction and group activities	
Before the pandemic, sizes were normal, with occasional exaggeration for emphasis. In the post-pandemic period, size changes are used to express individual emotions and are sometimes depicted smaller.	 	 	Dimensions and sizes
Decreased self-confidence	Size variations	Normal size	

Before the pandemic, children's paintings reflected joy, liveliness, curiosity, and social interaction. In the post-pandemic period, they show loneliness, anxiety, and reflections of psychological and social changes.	 	 	Emotions and individual expression
Mental health disturbance	Loneliness, anxiety, and isolation	Joy and interaction	
Before the pandemic, the real world predominated, and the child's interaction with the actual environment was clear. The combination of imagination and reality was simple and easily distinguishable. In the post-pandemic period, imagination and reality are more intertwined, and virtual spaces have led to the emergence of digital characters and environments.	 	 	Presence of imagination and reality
The disappearance of childhood	Intertwining of the virtual and real worlds	Clear boundary between imagination and reality	

Based on the analysis of children's paintings presented in the table and grounded in Neil Postman's theory, the following characteristics can be identified:

Early media maturity: The 75% increase in digital characters replacing real-life characters, along with the use of dark colors and high contrast in post-pandemic paintings, indicates children's direct exposure to adult content. This finding aligns with Postman's theory of the erosion of age boundaries. Postman (1982) argues that visual media, by providing direct access to information, dissolves the boundaries of childhood and turns children into "little adults." Post-pandemic paintings, through digital content and the reduction of childlike elements, demonstrate the disappearance of childhood.

Reduced analytical thinking: The simplification of forms, a 60% reduction in thematic diversity, and the repetition of digital patterns reflect a weakening of independent imagination, consistent with Postman's warning about the impact of media on superficial cognition. Postman cautions that visual media, by promoting "instant perception," undermines critical and analytical thinking. Post-pandemic paintings, with decreased creativity and increased imitation of digital content, confirm this process.

COVID-19 as an accelerator: A 40% increase in closed spaces, a 60% decrease in group activities, and a 75% rise in digital characters indicate that the pandemic accelerated the process of childhood erosion. By limiting physical interactions, COVID-19 pushed children toward virtual spaces, accelerating the "disappearance of childhood."

To gain a deeper understanding of the pandemic's impact on children's paintings and its alignment with Postman's theory of the disappearance of childhood, a comparative analysis of key painting indicators before and after COVID-19 is essential. This comparison reveals content, formal, and emotional changes in children's artworks based on quantitative and qualitative data and emphasizes that the pandemic acted as an accelerator for the "disappearance of childhood." The following section analyzes these changes according to selected indicators.

The comparative analysis of key indicators in children's drawings across pre- and post-COVID periods clearly shows content, formal, and emotional changes in children's artwork, highlighting that COVID acted as an accelerator for the process of "childhood erosion."

- Main Themes: Pre-COVID, about 85% of drawings focused on nature and group play, whereas post-COVID, 75% centered on virtual space and individualism, indicating reduced social interaction and replacement of reality with virtual experiences.
- Dominant Colors: While 85% of pre-COVID drawings used bright and varied colors, 70% of post-COVID works featured dark colors with high contrast, reflecting increased psychological tension and reduced joy.
- Spatial Composition: 90% of pre-COVID drawings depicted open spaces (parks, nature), but this decreased to 65% post-COVID, with closed spaces (rooms, screens) dominating, signaling limited sensory experiences and increased isolation.
- Emotional Expression: Pre-COVID, 80% of drawings reflected joy, curiosity, and interaction; post-COVID, 75% depicted loneliness, anxiety, and isolation, indicating mental health disturbances and reduced vitality.
- Characters: Pre-COVID drawings primarily included real-life characters (family, friends), whereas post-COVID showed a 75% increase in digital characters (e.g., game characters), reflecting the replacement of real identity with a virtual one.
- Dimensions & Sizes: Pre-COVID drawings used natural sizes or occasional exaggeration for emphasis; post-COVID works showed reduced and irregular sizes, suggesting decreased self-confidence and a focus on individual emotions.
- Fantasy vs. Reality: Pre-COVID, there was a clear boundary between fantasy and reality; post-COVID, these worlds became intertwined, aligning with the theory of childhood erosion and media-induced early maturity.

Conclusion:

This study examined children's drawings during the COVID-19 crisis through the lens of Neil Postman's theory of the erosion of childhood. The results showed that virtual space induced four key changes in children's artwork: digitalization of content, darker colors, spatial isolation, and symbolic anxiety.

Virtual space plays a dual role in children's art. On one hand, it serves as a tool for accessing new resources and information; on the other hand, it leads to reduced creativity, increased anxiety, and changes in artistic expression. These changes indicate the gradual erosion of childhood due to the pervasive influence of media.
It appears essential to manage the use of technology consciously and maintain a balance between digital engagement and real-world experiences. This ensures that children can benefit from educational and recreational opportunities in the digital world while also developing social skills, creativity, and connections to reality. Families and educators play a crucial role by supervising digital content, encouraging artistic expression based on real-life experiences, and promoting appropriate use of virtual space.
Such an approach helps future generations become familiar with and skilled in new technologies without losing touch with their human and social roots. It allows children to grow in a balanced and coordinated manner, enhancing social skills, creativity, and real-world connections, enabling them to thrive in all aspects of life.
Finally, to improve the use of virtual space, it is recommended to:

- Teach media literacy in schools,
- Reinstate sensory-motor experiences in children's programs, and
- Encourage conscious parental supervision of digital content.

Recommendation:
To improve the conditions of virtual space use and its positive impact on children's drawings, it is recommended that educational policymakers and families empower children to critically engage with and use digital content through media literacy programs. Additionally, designing group activities and sensory-motor experiences in open spaces can help establish a balance between the real and virtual worlds, preventing further erosion of childhood and mitigating its psychological consequences.

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DETERMINING SPATIAL ORGANISATION CRITERIA IN LANDSCAPE DESIGN

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Abstract
This study aims to comprehensively address spatial organisation criteria in landscape design within a holistic framework based on international (UNESCO, ICOMOS, Historic Urban Landscape – HUL) and national (Turkish Urban Design Guidelines) approaches and guidance documents. International guidelines emphasise contextual harmony, scale and spatial legibility, while national guidelines highlight application-oriented criteria such as accessibility, environmental comfort and public use. The literature shows that spatial organisation criteria are mostly addressed in a fragmented manner.
Within this scope, the study identified fundamental and sub-criteria related to spatial organisation, classifying them under four main headings: formal, functional, perceptual/aesthetic, and ecological. The criteria were evaluated using a three-point Likert scale with the participation of experts from different disciplines, and their levels of importance were determined. The findings provide an evaluation framework that enables designers to make more systematic and conscious spatial organisation decisions.
Furthermore, the study has created a quantitative data base for the future use of spatial organisation in artificial intelligence-based design processes. This database aims to contribute to a more rational, consistent, and sustainable approach to spatial design and organisation.
Keywords: Spatial Organisation, Landscape Design, Artificial Intelligence

1. INTRODUCTION

Today, urban and rural spaces, which are changing and taking shape as a result of human activities for different purposes and actions, are increasingly demanding and diversifying in terms of aesthetics and functionality. The goal of creating a healthy, liveable, sustainable and high-quality spatial organisation that is fit for purpose is accepted as the fundamental approach.
Space is not merely a void; it is an environment that separates humans from their physical surroundings to a certain extent, enabling actions to be carried out, and is open to perception, experience, and visual interaction. In this sense, space is a multidimensional concept that gains meaning through the relationship it establishes with the user, extending beyond its physical boundaries. The concept of space is a complex and physical environment consisting of structures (buildings) and the natural and cultural landscapes surrounding them. In other words, it is an intertwined and interconnected system that encompasses all components of life, including the physical, social, cultural, economic, technological, political, temporal, and three-dimensional aspects (Gül, 2016). Spatial organisation refers to the process of relating, conceptualising and arranging all tangible and intangible components of a physical space in accordance with specific objectives and goals. This process encompasses a planning and design approach that produces systematic answers to fundamental questions such as 'What?', 'Why?', 'How?', 'Where?' and 'When?'. Spatial organization is a phenomenon that considers not only the physical arrangement of space but also its scientific, technical, functional, aesthetic, ecological, social, economic, political. perceptual, and behavioral dimensions from a holistic perspective (Gül, 2016).
Spatial organisation is a fundamental design approach in landscape architecture that expresses the orderly and meaningful relationship established between the physical components of a space, user movements, perceptual processes, and ecological systems. This concept aims to provide a holistic response to questions such as how space is perceived, how it is used, and how it interacts with environmental conditions, rather than merely arranging open spaces aesthetically or functionally. Spatial organisation presents a multi-layered structure formed by the combined evaluation of form, scale, proportion, texture, colour, circulation, functional zoning, and natural landscape components (UNESCO, 2011). In the international literature, spatial organisation, particularly within the Historic Urban Landscape (HUL) approach, is addressed as the management of the

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relationship between the morphological structure of space and its cultural, natural and social layers. The HUL approach defines space not as a static design product, but as a dynamic system that transforms over time, is shaped by user behaviour, and is in constant interaction with environmental processes. In this context, spatial organisation is evaluated through contextual harmony, scale-morphology relationship, visual integrity, spatial legibility, and the integration of environmental layers (UNESCO, 2011).

In Turkey, the concept of spatial organisation is defined through more concrete and application-oriented criteria via Urban Design Guidelines. In these guidelines, spatial organisation is addressed in line with criteria such as material and texture continuity, silhouette and height control, accessibility, circulation systems, signage, safety, environmental comfort and ecological sensitivity. The guidelines aim to ensure the long-term sustainability of the space by requiring that formal and functional decisions in landscape design be evaluated in conjunction with user experience and ecological performance (T.C. Çevre ve Şehircilik Bakanlığı, 2016a; 2016b).

This study aims to determine the fundamental and sub-criteria that can be used in landscape spatial organisation and to classify them according to their level of importance. The goal is to obtain a quantitative database that enables the evaluation of spatial organisation decisions within a multidimensional framework. This approach will enable global spatial design principles and elements to be addressed within a holistic model alongside local guidelines, and will allow spatial organisation criteria to be interpreted systematically.

2. METHOD

This study was conducted using qualitative research methods to determine spatial organisation criteria in landscape design. The research process involved reviewing the international and national literature on spatial organisation, identifying and examining accepted fundamental/sub-criteria. Thus, a methodological framework was adopted to determine spatial organisation criteria for landscape spaces within the context of global approaches and general spatial organisation.

The primary materials for this study were the UNESCO Historic Urban Landscape (HUL) approach at the international level (UNESCO, 2011) and the conservation and design guidelines published by ICOMOS (ICOMOS, 2013). Urban Design Guidelines prepared at the national level in Turkey (T.C. Çevre ve Şehircilik Bakanlığı, 2016a; 2016b) have been taken into consideration. In addition, criteria specified in the context of spatial organisation in various national and international literature were taken into account (Table 1). Furthermore, Kevin Lynch's theories of urban perception were utilised in the evaluation of concepts such as spatial legibility, wayfinding, and user perception.

Table 1. Literature studies conducted within the scope of spatial organization criteria

Reference	Sub-criterion	The Source's Approach to Spatial Organisation
ICOMOS (2013) – Burra Charter	Morphological organisation	The relationship between structure and open space emphasises the preservation of morphological continuity and spatial integrity.
UNESCO (2011) – Historic Urban Landscape	Scale–ratio relationship	It considers human scale, urban fabric and silhouette integrity as the basis of spatial organisation.
UNESCO (2011)	Silhouette and height	It states that height decisions must be consistent with the historical and natural context.
Carmona et al. (2010)	Doluluk–boşluk dengesi	Balance between fullness and emptiness
Lynch (1960)	Circulation systems	Pedestrian movement forms the backbone of the spatial organisation of main axes and nodes.
Özbek (2019	Colour and perception	It demonstrates that the use of colour is effective in guidance and perceptual continuity.
Gehl (2011)	User behaviour patterns	It argues that spatial organisation should be evaluated based on user behaviour.
Çatalbaş & Somer (2021)	Cultural identity	The production of cultural meaning and a sense of place is fundamental to the HUL approach.
FAO (2016); IUCN (2016)	Ecological integrity	It states that spatial organisation compatible with natural systems is essential for sustainability.
Burkut (2023)	Spatial legibility	It comprehensively analyses the concept of spatial legibility based on the literature.
EPA (2014; 2017)	Heat island control	It reveals the effect of spatial arrangements on microclimate and thermal comfort

Auckland Transport (2025)	Wayfinding	Signage in public spaces is addressed through the principles of legibility, consistency, accessibility and visual hierarchy.
Brisbane City Council (2004)	Security	Spatial organisation is addressed through the principles of natural surveillance, access control, spatial definition and maintenance.
Department for Transport (2021)	Inclusive Design	It presents best practice principles for accessibility and circulation patterns in pedestrian and transport infrastructure.

The spatial organisation established as a result of the general evaluations was presented to 30 experts from different disciplines (architect, interior designer, landscape architect, urban and regional planner, civil engineer) for the determination and prioritisation of basic criteria and sub-criteria. Each primary/secondary criterion was scored by the experts using a three-point Likert scale, and their relative levels of importance were presented comparatively.

The qualitative data obtained were converted into percentage values to make them comparable and analysable, thereby creating a quantitative database that enables the evaluation of spatial organisation decisions within a multidimensional framework. This approach has made it possible to address global principles and local guidelines within a holistic model and to systematically interpret spatial organisation criteria.

The analysis resulted in the classification of spatial organisation criteria under four main headings: formal, functional, perceptual, and ecological. This classification allows the criteria to be evaluated not as individual and independent elements, but as parts of a system that interact with each other. The proposed method offers a comprehensive analysis model that enables the evaluation of design decisions in landscape spaces both theoretically and practically (UNESCO, 2011; T.C. Çevre ve Şehircilik Bakanlığı, 2016b).

This methodological approach enables spatial organisation to be addressed not only through physical layout decisions but also within the context of user experience, perceptual processes, and ecological sustainability. The method developed in this study serves as a reference for future academic research and application-oriented studies aimed at determining spatial organisation criteria in landscape design, particularly for artificial intelligence algorithms.

3. FINDINGS

In this study, all criteria for evaluating spatial organisation were categorised and defined as four fundamental criteria. The identified fundamental criteria were scored by 30 experts using a three-point Likert scale, and their levels of importance were determined. In line with the expert ratings, the sub-criteria were grouped under four main criteria headings: formal, functional, perceptual, and aesthetic-ecological (Table 2).

Table 2. Importance levels of the four main criteria:

Criteria	Level of Importance (%)
Functional Criterion	%28,33
Ecological (Environmental) Integrity	%26,11
Formal Composition	%23,89
Perceptual/Aesthetic Quality	%21,67

Expert evaluations revealed that spatial organisation criteria exhibit a specific order of priority in professional practice. This hierarchy indicates that the space must first be designed correctly in functional and ecological terms, followed by formal and perceptual/aesthetic decisions.

This hierarchical classification demonstrates that spatial organisation is not a one-dimensional design approach; rather, it is a holistic system in which functional, ecological (environmental), formal, perceptual/aesthetic dimensions must be considered together (ICOMOS, 2013; UNESCO, 2011; Duman, 2018).

Functional Criterion:

Functional criteria encompass circulation, accessibility and usability elements that ensure the space is accessible, safe and can be used effectively by its users. Such functional principles are supported in sustainable urban design literature by the need to create user-centred spaces; at the same time, UNESCO's historic urban

landscape approach encourages planning and design practices to be sustainable and inclusive (UNESCO, 2011; Scannell & Gifford, 2010).

- **Ecological (Environmental) Integrity:**

Ecological (environmental) criteria encompass criteria that assess the compatibility of spatial organisation with natural systems, ecosystem continuity, and resilience to climate change. Integration with the natural landscape, water management, use of local plant species, and climate-sensitive design approaches are defined as key elements that enhance the environmental sustainability and long-term ecological performance of the space (Erdoğan Onur, 2013).

- **Formal Composition:**

The principles that evaluate the physical integrity of a site and its relationship with its environmental context can be addressed within the framework of international heritage management standards. The Burra Charter provides a value-based framework for the conservation and management of culturally significant places and recommends a holistic approach to the contextual and historical fabric of the spatial fabric (ICOMOS, 2013).

- **Perceptual/aesthetic Quality:**

Perceptual and aesthetic quality encompasses the criteria that define how a space is perceived by its users, their visual preferences, and their sense of spatial identity. In this context, spatial perception and aesthetic evaluations are made based on elements such as visual clarity, the arrangement of natural elements, and spatial character. Analysing these elements from a landscape architecture perspective reveals them to be important factors determining the perceptibility and visual quality of the space (Tanrıbir & Akten, 2020).

After the basic criteria were determined, the sub-criteria that should be included in each basic criterion were presented to 30 experts. Each sub-criterion was determined to be in which basic criterion category it should be, and the importance levels of the sub-criteria were determined using a three-point Likert scale (Table 2).

Table 2. Importance levels of sub-criteria in functional criteria:

Basic Criteria	Sub-criteria	Levels of Importance (%)
Functional Criterion:	Universal Design	15,3
	Functional Zoning	15,2
	Spatial Capacity Analysis	15,1
	Circulatory Systems	13,1
	Reinforcement Systems	10,9
	Security	10,2
	Lighting	10,1
	Management and Maintenance	10,1

General definitions of the sub-criteria included in the functional criterion,

a. Circulation Systems: The continuity of pedestrian, bicycle and vehicle circulation within a space constitutes a fundamental functional criterion in terms of accessibility, ease of orientation and safe use. The design of circulation systems in an open, legible and hierarchical manner enables users to experience the space in a seamless and controlled manner. (Network Rail, 2021; Samad, 2009).

b. Functional Zoning: Organising different usage areas in a way that avoids overlap reduces spatial complexity, thereby increasing functional efficiency and user comfort. When integrated with circulation systems, harmonious zoning decisions enhance the perceptibility and quality of use of the space (Hong Kong Planning Department, n.d.; Samad, 2009).

c. Spatial Transport Capacity Analysis: A balanced assessment of the relationship between space size and user density is important in preventing overuse and spatial pressure. Planning in line with carrying capacity contributes to maintaining user comfort and the sustainable use of space (Scannell & Gifford, 2010).

d. Universal Design: The universal design approach aims to provide equal, independent and safe access to the space for all user groups, regardless of age, physical ability and mobility. This approach is considered a fundamental criterion in terms of ensuring functional justice and creating an inclusive spatial organisation (Network Rail, 2021).

e. Security: Ensuring open sightlines, reducing blind spots and increasing spatial control helps users feel safe in the space. The perception of a safe space directly affects users' attachment to the space and continuity of use (Scannell & Gifford, 2010).

f. Furnishings: Seating elements, guidance systems and fittings that support social use are complementary elements that enhance the functional quality of the space. Positioning fittings in a manner consistent with the spatial organisation enhances user interaction and the effective use of the space (Network Rail, 2021).
g. Lighting: Lighting arrangements that support night-time use and enhance wayfinding have a direct impact on spatial perception, safety and visual comfort. Balanced and controlled artificial lighting improves the pedestrian experience by supporting the perceptual continuity of the space (Radicchi & Henckel, 2023).
h. Management and Maintenance: Opting for low-cost, durable and sustainable systems ensures the long-term functionality of the space. Effective management and regular maintenance processes play a critical role in ensuring the continuity of functional organisation (Hong Kong Planning Department, n.d.).

Table 3. Importance levels of sub-criteria in ecological criteria:

Basic Criteria	Sub-criteria	Levels of Importance (%)
Ecological Criterion:	Natural Landscape Integration	16,5
	Microclimate	16,3
	Water Management	15,5
	Plant Design	14,5
	Ecosystem Sustainability	13,1
	Energy Performance	13,4
	Heat Island Control	10,7

General definitions of sub-criteria included in ecological (environmental) criteria (Table 3);.
a. Microclimate: Microclimate regulations created through shading elements, planting, wind direction and surface materials aim to increase thermal comfort in open spaces. Microclimatic control enables users to utilise the space for longer periods and more comfortably throughout the year, and is considered one of the fundamental components of environmentally responsive design that adapts to climatic conditions (EPA, 2017; WHO, 2016).
b. Water Management: The use of permeable surfaces, rain gardens, and systems designed to retain rainwater on-site aims to reduce surface runoff, thereby lowering flood risk and supporting the natural water cycle. Sustainable water management is an important part of ecological design and plays a critical role in the efficient use of water resources and adaptation to climate change (EPA, 2012; UNEP-DHI, 2018).
c. Plant Design: Selecting plant species that are compatible with local climatic conditions and ecological structure reduces maintenance requirements while contributing to the conservation of biological diversity. Ecological plant design both strengthens ecosystem services and enhances environmental quality by increasing users' interaction with nature (FAO, 2016; Erdoğan Onur, 2013).
d. Energy Performance: LED lighting systems and renewable energy applications aimed at increasing energy efficiency seek to reduce the environmental footprint of the space. High energy performance designs are considered an important criterion in creating sustainable urban environments and provide long-term environmental benefits (EPA, 2014).
e. Heat Island Control: Reflective surface materials, increasing green spaces and intensive planting schemes contribute to reducing the urban heat island effect. Such measures are considered effective strategies for improving microclimate and enhancing user comfort, particularly in densely built-up areas (EPA, 2014; EPA, 2017).
f. Ecosystem Sustainability: Ecological corridors, green connections and design decisions that support habitat continuity ensure the protection of natural life and the continuity of ecosystem integrity. Ecosystem-based approaches are fundamental elements of sustainable environmental planning in terms of maintaining biological diversity and supporting natural processes (IUCN, 2016).
g. Natural Landscape Integration: Designing in harmony with the existing topography, natural landscape elements and ecosystem contributes to the preservation of environmental integrity. Natural landscape integration offers a sustainable approach that aims to minimise the environmental impact of human intervention while enhancing the ecological values of the area (UNESCO, 2011; FAO, 2016).

Table 4. Importance levels of sub-criteria in formal criteria:

Basic Criteria	Sub-criteria	Levels of Importance (%)

Formal criterion:	Morphological Organisation	14,9
	Morphological Sustainability	14,8
	Scale and Proportion Relationship	14
	Density–Vacancy Organisation	13,1
	Spatial Hierarchy	13
	Silhouette and Height Control	11
	Material	9,7
	Textural Harmony	9,5

General definitions of sub-criteria included in formal criteria (Table 4);

a. Morphological Organisation: Massing, structural arrangement, and geometric form decisions are fundamental formal elements that directly influence how a space is perceived and how easily it can be navigated. A consistent morphological organisation facilitates users' mental processing of the space while creating an infrastructure that enhances spatial legibility (Lynch, 1960; Burkut, 2023).

b. Scale and Proportion Relationship: Designing building masses and open spaces in proportions that are compatible with human scale enhances the perceptibility of the space and improves its comfort of use. Scale and proportion decisions are considered an important formal criterion that determines the quality of the spatial experience by regulating the visual and physical relationship between the user and the space (Gehl, 2011; Duman, 2018).

c. Morphological Sustainability: The continuity of morphological components such as road widths, plot layout and building heights ensures the long-term integrity of the spatial fabric. This continuity contributes to the sustainability of spatial identity by preventing the fragmentation of the urban form over time.

d. Density–Vacancy Organisation: A balanced ratio between built-up areas and open spaces allows for the creation of focal points that facilitate orientation within the space. The relationship between fullness and emptiness supports spatial depth and perceptual continuity, enabling users to experience the space in a more legible manner (Lynch, 1960; Burkut, 2023).

e. Silhouette and Height Control: Preserving the urban silhouette and addressing building heights in a manner consistent with the environmental context plays a decisive role in ensuring visual integrity. Height control supports the continuity of spatial identity while contributing to the creation of a formal structure that is compatible with the historical and cultural environment (Çatalbaş & Somer, 2021; UNESCO, 2011).

f. Material: Material selection, texture and colour continuity are fundamental elements that support the formal integrity and perceptual identity of a space. The use of harmonious materials contributes to the holistic perception of a space by providing visual continuity between different spatial components (T.C. Çevre ve Şehircilik Bakanlığı, 2016b).

g. Textural Harmony: The arrangement of building and landscape textures in harmony with the environmental context enhances spatial continuity and perceptual integrity. Textural harmony is considered a formal criterion that strengthens the relationship between the space and its surroundings, thereby enhancing both aesthetic and perceptual quality (Duman, 2018).

h. Spatial Hierarchy: The hierarchical arrangement of primary and secondary circulation axes enhances the movement pattern and directional clarity within the space. Spatial hierarchy enables users to interpret the space more easily, while allowing for a strong relationship between circulation systems and formal organisation (Lynch, 1960; Network Rail, 2021).

Table 5. Importance levels of sub-criteria in perceptual/aesthetic criteria:

Basic Criteria	Sub-criteria	Levels of Importance (%)
	Cultural Identity	15,5
	User usage intensity	14,8
	Visual Organisation	14,1
	Spatial Legibility	13,1
	Composition of the View	11,6
	Wayfinding	11,5
	Colour and Perception	11,3
	Sensory Experience	8,1

General definitions of sub-criteria included in perceptual/aesthetic criteria (Table 5);

a. Spatial Legibility: Spatial legibility is one of the fundamental perceptual criteria that enables users to mentally perceive their surroundings quickly and accurately. Clearly defining the relationships between building masses, open spaces, circulation axes, and focal points allows the space to be easily deciphered through mental maps. Legible spaces facilitate the orientation process for users while reducing cognitive load (Lynch, 1960; Samad, 2009; Burkut, 2023).

b. Colour and Perception: The use of colour is an important perceptual tool in terms of spatial orientation, distinguishing areas and reinforcing spatial identity. Colours can guide users' movements within a space while also supporting the perception of spatial continuity and integrity. Appropriate colour choices increase the legibility of a space, thereby reducing perceptual confusion (Özbek, 2019; Samad, 2009).

c. Visual Organisation: Silhouette, perspective, visual corridors and the arrangement of sightlines are fundamental components that enhance the perceptual continuity and visual integrity of a space. Visual organisation enables the user to perceive the space holistically rather than in fragments. Particularly in open spaces, the deliberate design of visual axes and corridors provides perceptual cues that support spatial orientation (Hong Kong Planning Department, n.d.; Lynch, 1960).

d. Wayfinding: Pictographic signs, typography, spatial reference points and structural guidance elements are fundamental perceptual support elements that enable users to move around without getting lost. Effective guidance systems reduce spatial stress and uncertainty while speeding up the decision-making process for users. Guidance systems that are clear, consistent and accessible directly increase spatial legibility (Auckland Transport, 2025; Network Rail, 2021).

e. Sensory Experience: Sensory components such as light, sound, texture, and smell are elements that shape the spatial experience and directly influence user perception. Lighting levels, acoustic environments, and surface textures determine the atmosphere of a space, thereby affecting users' perceptual evaluations of it. Spaces that appeal to multiple senses enhance the quality of experience by creating perceptual richness and spatial awareness (Radicchi et al., 2023; Gehl, 2011).

f. Cultural Identity: The perceptibility of cultural layers and local values strengthens the unique character of the space and users' sense of belonging to it. Historical traces, local architectural elements, and cultural references enable the perceptual reading of spatial identity. Spaces with a strong cultural identity contribute to the development of users' emotional connection to the place (UNESCO, 2011; Çatalbaş & Somer, 2021; Scannell & Gifford, 2010).

g. User usage intensity: The analysis of users' movement, stopping, and interaction behaviours within a space reveals the perceptual performance of the spatial organisation. High-traffic areas create perceptual focal points, while user behaviours indicate which parts of the space are more attractive or legible. Usage intensity is considered a dynamic indicator of spatial perception (Gehl, 2011; Scannell & Gifford, 2010).

h. Composition of the View: The deliberate design of visual focal points, perspective depth and landscape relationships enhances spatial perception and aesthetic quality. Landscape design strengthens the visual relationship the user establishes with the space, making the spatial experience more meaningful and directive. The joint consideration of natural and built environment elements plays an important role in ensuring perceptual integrity (Lynch, 1960; Hong Kong Planning Department, n.d.).

4. CONCLUSION

The spatial organisation of urban and rural areas is of great importance and must be addressed holistically, taking into account universal standards to ensure they are healthy, liveable, sustainable and of high quality.

The criteria and sub-criteria determined in line with the findings obtained will enable designers to organise spaces more easily and consciously. In addition, a data foundation has been created to enable space organisation using artificial intelligence-based software. This is because creating a database will greatly facilitate the future use of artificial intelligence in space design and organisation. The sub-criteria within the proposed basic criteria can be diversified.

This study has established a data-driven foundation that will guide the consideration of the complex structure of spatial organisation within a holistic framework of functional, ecological, formal, and perceptual/aesthetic criteria.

The criteria developed in this context enable the evaluation of not only physical arrangements in the spatial organisation process, but also multidimensional factors such as user experience, environmental sustainability and perceptual quality. This contributes to the more rational and consistent adoption of design decisions.

The fact that the proposed set of criteria can be adapted to spatial design studies at different scales broadens the scope of application of the study. A flexible assessment framework is presented that can be used in different spatial contexts, primarily urban open spaces, public spaces and landscape designs.

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EVALUATING UNIVERSAL DESIGN IN SHOPPING MALL FACILITIES FOR ELDERLY USERS

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Abstract
This study investigates the level of compliance and effectiveness of universally designed amenities for elderly users in a shopping mall located in Malaysia's Klang Valley. With the rapid growth of the ageing population, the demand for inclusive and user-friendly public environments has become increasingly critical. Shopping malls, as significant social and commercial hubs, play an essential role in supporting the independence and well-being of elderly communities. Universal Design (UD) seeks to create environments that are usable by individuals of all ages and abilities without the need for specialised adaptations. A mixed-method research approach was employed, integrating qualitative site observations with quantitative data gathered through structured questionnaires. The observational assessment was guided by the MS 1184:2014 Universal Design and Accessibility standards, focusing on key spatial components including circulation pathways, entrances, restrooms, seating areas, and signage systems. These observations provided an objective evaluation of physical design compliance. In parallel, questionnaires were distributed to elderly respondents aged 60 and above, utilising Likert-scale items and open-ended questions to capture users' perceptions, experiences, and challenges within the mall environment. The findings revealed varying levels of compliance with Universal Design principles. While certain facilities met the required standards, others demonstrated shortcomings that affected usability. Survey responses indicated moderate levels of user satisfaction, with recurring concerns related to accessibility, physical comfort, and ease of navigation. Overall, the study underscores the importance of effectively implementing Universal Design principles in public spaces such as shopping malls. The findings provide evidence-based recommendations to enhance facility design, thereby improving safety, promoting independence, and fostering greater inclusivity for elderly customers.
Keywords: Universal Design (UD), Elderly Users, Shopping Mall, Accessibility

1. Introduction

Universal design, or UD, is a fundamental concept in creating inclusive spaces that can serve individuals of all ages, abilities, and backgrounds without requiring specialised adaptation (Erdtman et al., 2021). As societies experience significant demographic shifts due to longer life expectancy and lower birth rates, the proportion of the population that is elderly is rising quickly. In Malaysia, where it is increasingly crucial to create environments that support ageing populations, this trend is particularly apparent (Gu et al., 2021; Abdullah & Jian, 2020). In response to this demographic shift, the built environment must be reassessed to support better physical, emotional, and social well-being for older adults.

Shopping malls, which serve as both commercial hubs and important social gathering places, must adapt to the needs of elderly customers. With a variety of services and social opportunities that are particularly beneficial for elderly communities, malls have developed into a hub for lifestyles (Hamzah et al., 2020). However, these environments often lack amenities that fully comply with universal design principles, especially in areas such as wayfinding, seating, circulation, and restrooms (Chen et al., 2007). The difference is indicative of a more significant problem, namely the ignorance of designers and stakeholders regarding the application of UD principles during implementation (Caltenco et al., 2014). According to Dautova (2020), inadequate facilities for the elderly are often the result of a lack of awareness of their needs, which leads to mistakes in inclusive planning. Furthermore, accessibility in public areas is often determined by minimal compliance rather than encouraging proactive inclusion, resulting in unequal user experiences (Song & Calautit, 2024; Abdul Kadir & Jamaludin, 2018a).

Malaysia's UD implementation is still disjointed. Standards such as MS 1184:2014 offer a clear framework for accessibility and universal design, but they are not always adhered to in public and commercial settings (Abdullah & Jian, 2020). According to Wang et al. (2020), effective management and upkeep are crucial to the success of design guidelines, even when they are in place. This is particularly concerning in shopping

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centres, where elderly individuals may face barriers that jeopardise their freedom, security, and mobility. Hence, this research intends to examine the compliance and effectiveness of universally designed facilities for elderly customers at a shopping centre in the Klang Valley. To assess current design practices and suggest enhancements that promote inclusive environments, the research will combine site observations based on MS 1184:2014 with user feedback from elderly customers.

2. Literature Review

2.1 Poor Implementation of UD in Public Places

The process of developing environments, products, and systems that are usable by everyone without the need for special design or adaptation is known as Universal Design (UD), according to Erdtman et al. (2021). It acknowledges the fundamental diversity of human abilities while attempting to eliminate social and physical barriers in design. Instead of providing specialised solutions for the elderly or people with disabilities, UD supports a single, inclusive solution for everyone. UD places a strong emphasis on proactive design excellence that benefits everyone, not just those with special needs, in contrast to traditional accessibility approaches (Steinfeld & Maisel, 2012). The goals of UD serve as a guide for designers as they create environments that promote social, emotional, and physical well-being. Steinfeld and Maisel (2012) outlined eight goals: body fit, comfort, awareness, wellness, understanding, social integration, personalisation, and cultural appropriateness. These goals serve as design strategies that help create environments that accommodate a wider range of users in more meaningful ways.

UD applies not only to services and digital interfaces, but also to buildings and public spaces, promoting comfort, autonomy, and dignity for all users. Abdul Kadir and Jamaludin (2018b) emphasise that a universally designed environment offers comfort, adaptability, and flexibility, helping to minimise the impact of changes across the human life cycle while fostering greater participation of the individuals within the community. While Malaysia's MS 1184:2014 standard outlines explicit guidelines for universal design and accessibility, actual implementation in the built environment is inconsistent (Abdullah & Jian, 2020). Chen et al. (2007) state that accessible facilities, such as handrails, ramps, accessible restrooms, and clear signage, are frequently absent from public places. To ensure universal access and user satisfaction, Wang et al. (2020) emphasised the importance of proper physical maintenance and operation. The inability of designers to practically integrate UD into their projects is a concerning issue (Caltenco et al., 2014). In addition, Dautova (2020) pointed out that designers usually overlook the needs of older users, even though their requirements differ significantly from those of other age groups, such as children.

2.2 The Importance of Elderly Friendly Shopping Malls

Due to the increase in Malaysia's ageing population, a universally designed living environment for the elderly community is even more crucial. Shopping malls must exceed the minimum accessibility code requirements to adequately serve the needs of elderly customers (Abdullah & Jian, 2020). Shopping malls functions as the social and commercial places where older people visit frequently. Malls often serve as crucial locations for daily routines, social interaction, and physical activity for elderly users (Aboutalebi, 2018). However, many shopping malls in Malaysia do not entirely follow UD principles, despite their significance. For instance, Song and Calautit (2024) emphasised how neglecting thermal comfort in mall design could negatively affect the experiences of elderly users. The design of shopping malls needs to be more responsive because they are essential to the everyday lives of urban elders. The implementation of UD in mall amenities, such as restrooms, seating, circulation routes, signage, and customer service, guarantees that elderly customers can use the area with dignity and comfort.

Details in designing elderly-friendly shopping malls can be implemented in various ways. Jung and Mahmoud (2023) emphasised the value of seating areas in enhancing the comfort and willingness of elderly customers to use mall spaces. Comfort includes both mental and physical ease for older users who may be more prone to stress or discomfort. Awareness relates to the clarity of information and navigation, ensuring users can easily navigate (Evcil, 2012). The comfort and body fit of elderly customers are supported by the thoughtful placement of mall seating, as highlighted by Jung and Mahmoud (2023) in their study. Wellness in spatial design emphasises how design can support the mental and physical health of users (Prilleltensky, 2024). An understanding of a space focuses on making the design user-friendly and intuitive for users, regardless of their familiarity with the surroundings (Bringolf, 2018). Both wellness and understanding are crucial components to ensure a shopping mall environment that supports the safe and comfortable use of elderly customers.

3. Methodology

This study adopted a mixed-method approach to evaluate the effectiveness and compliance of universally designed facilities for elderly users in a selected shopping mall located in Klang Valley, Malaysia. The research combined qualitative site observation with quantitative survey data. Site observations were conducted using a checklist of requirements based on the MS 1184:2014 Universal Design and Accessibility Code of Practice, focusing on components such as entrances, circulation paths, rest areas, toilets, and signage. This method intends to assess the compliance of universally designed mall facilities for the elderly in Klang Valley. Simultaneously, structured questionnaires were distributed to 30 elderly respondents aged 60 and above, consisting of Likert-scale and open-ended questions to capture their experiences related to accessibility, comfort, and ease of navigation within the mall. This research method aims to investigate the effectiveness of universally designed facilities in the shopping mall on the well-being of elderly individuals. The process of collecting 30 sample questionnaires took four days, using a manual face-to-face approach. Each elderly customer was asked to complete a paper-based questionnaire with a pen, and guidance was provided throughout the process, from the beginning to completion. The observation results were analysed based on compliance with the standard, while the survey responses were reviewed using frequency analysis and thematic interpretation to identify key issues and users' feedback.

4. Findings

4.1 Site Observation Findings

The site observation was conducted to evaluate the physical environment of the selected shopping mall in accordance with the MS 1184:2014 Universal Design and Accessibility Code of Practice. Each component was assessed on-site to determine the mall's level of compliance with universal design standards. The findings provide insight into how well the mall accommodates elderly users and highlight specific areas that require improvement to ensure full inclusivity and safety.

Table 1. Observation Results Based on MS 1184:2014

Facilities Component	Compliance Level	Remarks
External Environment and Access Routes	Moderate	The pedestrian path exceeds the minimum width requirement (approx. 6400mm), and the surface is firm and slip-resistant, which supports safe movement for elderly users. Clear signage is present and legible at access points. However, tactile paving is absent at crossing points.
Accessible Parking	High	Accessible parking is well-marked, located near the entrance, and on a flat, unobstructed surface.
Entrances and Doors	High	Entrances are level, wide, clearly marked, and equipped with accessible handles and visual contrast.
Ramps and Steps	Moderate	Ramp meets width, slope, and surface standards, but handrails are not provided on both sides of all ramps.
Internal Circulation and Resting Areas	High	Corridors are wide with non-slip flooring, clear markings, and resting areas are provided on each floor.
Lift and Vertical Circulation	Moderate	Lifts and escalators are available on all floors with accessible features, though voice floor announcements are missing.
Sanitary Facilities (Toilet)	High	Accessible toilets are available on all levels with adequate space, grab bars, lever taps, and emergency pull-cords.
Signage and Wayfinding	Moderate	Signage is clear and visible with good contrast, but Braille or tactile maps are not provided.

Overall, the mall has implemented several core elements of UD but still requires targeted improvements to ensure a fully inclusive environment for ageing visitors. Enhancing overlooked features such as tactile guidance, consistent handrail placement, and accessible wayfinding tools would significantly improve usability and independence for elderly users.

4.2 Questionnaire Findings

To support the site observation results, a structured questionnaire was distributed to 30 elderly respondents aged 60 and above who visited the selected shopping mall. The aim was to understand their personal

experiences and satisfaction levels regarding the mall's effectiveness in terms of its accessibility and facilities. The close-ended questionnaire is divided into three sections: Demographic Background, Experience with Universal Design Facilities, and Responses on Perceived Impact on Well-Being. Additionally, the respondents were asked open-ended questions about their difficulties while using the mall facilities and their suggestions for improvement. The feedback gathered reflects the practical challenges and positive aspects observed by elderly users, offering a user-centred perspective on the mall's implementation of universal design principles.

I. Demographic Background

The survey involved 30 elderly respondents, all of whom were aged 60 and above. The majority of participants stated that they frequently visited shopping centres, often using them for leisure activities, social interaction, and walking in addition to shopping. The sample included both independent individuals and those who required mobility aids such as walking sticks or assistance from companions. This variety offered a comprehensive view of how various elderly customers engage with the mall setting. The group, which represented a typical urban elderly demographic in terms of gender and background, provided valuable insights into the advantages and disadvantages of the mall's implementation of universal design from the users' perspective.

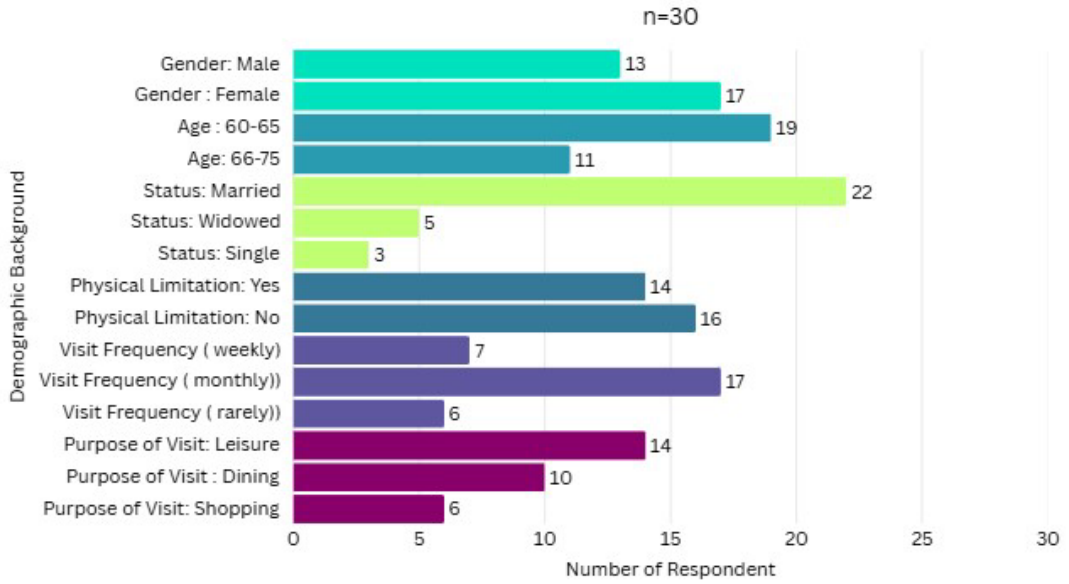


Fig. 1. Section A: Demographic Summary of Research Respondents

II. Experience with Universal Design Facilities

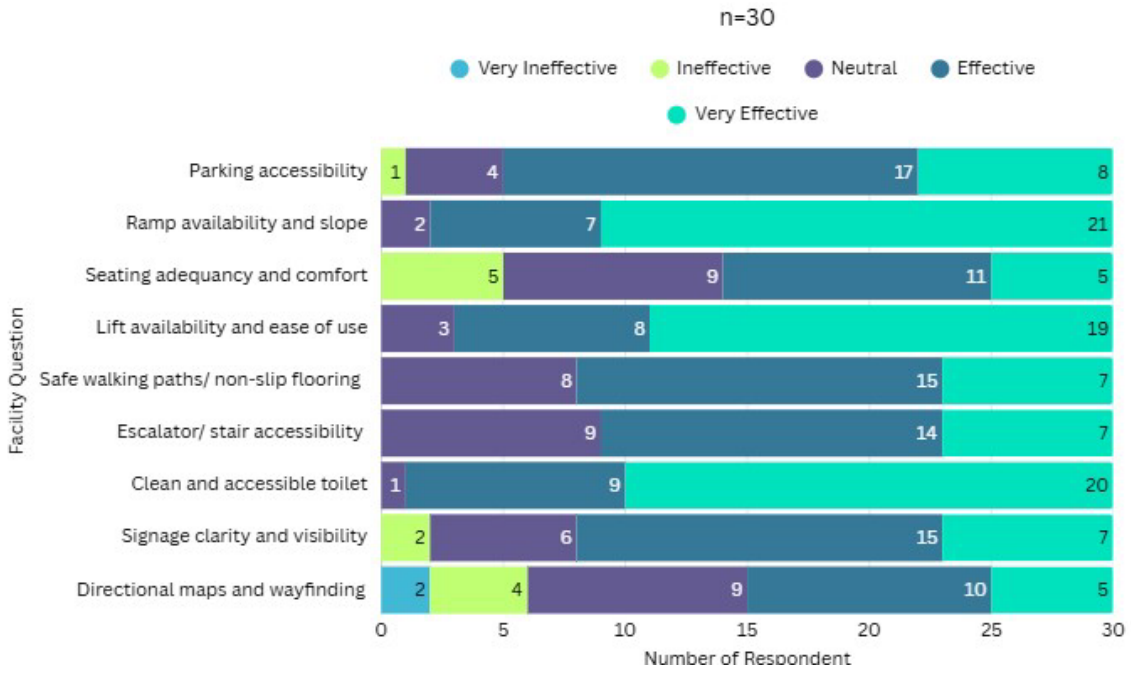


Fig. 2 Experience with Universal Design Facilities

Respondents generally found entrances and circulation paths to be accessible and comfortable. However, rest areas and signage were frequently criticised for being lacking. Many respondents noted that seating areas have no backrest and armrests, making it quite uncomfortable, and that directional maps and wayfinding are confusing, especially for those with visual impairments. These findings align with the observational data, confirming inconsistencies in the usability of the assessed mall's facilities.

III. Responses on Perceived Impact on Well-Being

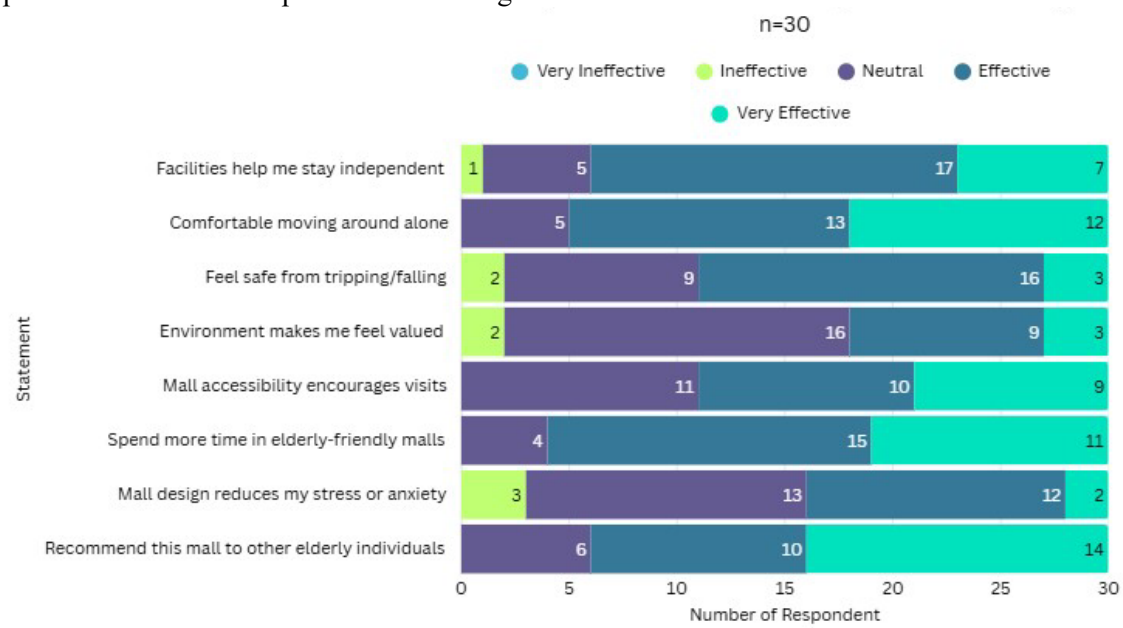


Fig. 3 Experience with Universal Design Facilities

Participants expressed that an accessible environment positively influences their independence and comfort, making them more likely to visit the mall. However, incomplete or inconsistent design features, such as unclear directions and unclear signage, were reported to discourage prolonged visits. The responses indicate that a well-implemented universal design not only enhances mobility but also contributes to emotional well-being.

IV. Open Ended Feedback

Table 2. Difficulties Faced While Using the Mall Facilities

No.	Suggested Improvement	No. Of Respondents

1	Some elderly users fear using escalators due to unsteady footing and fast speed.	3
2	Got confused with the layout, not enough easy to read maps.	7
3	Difficulty reading signs from afar.	6
4	Complaints about long waiting times during peak hours for lifts.	17

Table 3. Suggestion for Improvement

No.	Suggested Improvement	No. of Respondents
1	Add more resting seats with backrests and armrests	19
2	Have staff or volunteers available to assist elderly patrons	5
3	Improve visibility and font size on directory signs; add pictograms and bilingual text	8

Open-ended responses revealed specific concerns, such as the need for more resting spots with backrests, clearer signage with bigger fonts, and improved toilet cleanliness and accessibility. Several respondents also emphasised the importance of having staff assistance or help counters, especially for elderly individuals with additional support needs.

5. Discussion

According to the results of the site observation and the questionnaire, the mall demonstrates a basic but uneven application of universal design principles, indicating partial compliance with MS 1184:2014. In terms of accessibility and environmental integration, the mall does well in areas like entrances, circulation areas, elevators, and restrooms. The favourable comments from numerous respondents also demonstrated how these features facilitate elderly visitors' ease of access and mobility.

But the study also found important gaps, especially in the areas of rest areas and signage. For elderly customers, particularly those with visual or mobility impairments, the mall's overall usability is reduced by the absence of Braille signage, tactile maps, tactile paving, and adequate handrails on certain ramps. These problems were further supported by questionnaire responses, which showed that many senior participants had trouble finding their way around and had insufficient seating for rest. The inconsistent application of universal design elements is a crucial finding from both the observation and user feedback. Although some components are in compliance, others are not, indicating that the needs of elderly users may not have been fully taken into account when making design choices. The difference runs counter to the main goals of universal design by potentially setting up obstacles to comfort, safety, and independence.

Finally, the study emphasises how critical it is to incorporate UD more thoroughly and consistently, particularly in settings like malls that are common public and social gathering places for senior citizens. The accessibility and inclusivity of such areas can be greatly increased by paying attention to minor but crucial details like rest areas, tactile instructions, and clear signage.

6. Conclusion

This research examined the implementation and effectiveness of universal design (UD) features for elderly users in a selected shopping mall in Klang Valley, Malaysia. With the country's aging population steadily increasing, the study emphasized the importance of creating public environments that are accessible, inclusive, and aligned with MS 1184:2014 Universal Design and Accessibility Code of Practice. The aim was to determine the compliance of universally design in mall facilities for elderly in Klang Valley and to investigate the effectiveness of universally design facilities in the shopping mall on the well-being of elderly individuals.

A mixed-method approach was adopted, combining site observations with a questionnaire survey involving 30 elderly respondents. The observation checklist revealed that the mall performed well in key areas such as entrances, internal circulation, toilet facilities, and lifts, showing high compliance with universal design standards. However, components such as signage, rest areas, ramps, and tactile guidance features demonstrated only moderate compliance or partial implementation. These gaps reduce overall accessibility and create barriers, especially for elderly users with mobility or visual impairments. The observational data was supported by the questionnaire results, which showed that many respondents were only moderately satisfied. While they

agreed that some areas of the mall were easy to get to, they also expressed worries about the mall's poor wayfinding, lack of suitable rest areas, and challenges for independent shoppers. Improved staff support, additional seating, and better signage were suggested by the respondents through the open-ended feedback, to make the mall more accessible to elderly users.

In a conclusion, although the mall has made progress in implementing universal design elements, the application is still lacking and inconsistent. The results emphasise the necessity of increased awareness, stronger enforcement, and more inclusive planning, especially in public spaces with heavy traffic, such as shopping malls. These settings can be made safer, easier to access, and more encouraging for Malaysia's ageing population by fixing the flaws that have been found.

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DISASTER MITIGATION EDUCATION AS A MEANS OF BUILDING COMMUNITY RESILIENCE FOR FUTURE CIVILIZATION

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Abstract
The increasing frequency and impacts of disasters in Indonesia throughout 2025 indicate that disaster mitigation challenges have become increasingly urgent for society and future civilization. According to official data, Indonesia recorded thousands of natural disaster events between January 1 and mid-December 2025, including floods, extreme weather events, landslides, and earthquakes occurring across various regions. Severe floods and landslides in Sumatra alone resulted in hundreds of fatalities and affected millions of people. These data reflect the magnitude of social and ecological vulnerability faced by Indonesia in its efforts to build community resilience amid climate change and escalating environmental risks. This situation underscores the need for disaster mitigation strategies that extend beyond technical and structural approaches to incorporate social and educational dimensions in a comprehensive manner. Disaster mitigation education plays a strategic role in shaping resilient communities by strengthening risk awareness, preparedness, and collective responsibility toward disaster threats. Within the context of future civilization, education functions as a cultural instrument that transmits values, knowledge, and social norms essential for societal sustainability. This study aims to examine the role of disaster mitigation education in strengthening community resilience in Indonesia as a foundation for future civilization. Employing a qualitative approach, the study explores how educational practices particularly within social studies education contribute to the development of social awareness, adaptive capacity, and social capital in the context of high disaster risk exposure. Data were analyzed through a review of relevant literature and contextual observations of community-based disaster mitigation education initiatives, with particular attention to the internalization of mitigation values at both individual and collective levels. The findings indicate that disaster mitigation education significantly enhances community resilience through increased risk awareness, participatory learning processes, and the strengthening of social cohesion. Educational initiatives that integrate local knowledge, cultural values, and social capital have proven effective in encouraging adaptive behaviors and collective action within disaster-prone communities. Furthermore, disaster mitigation education contributes to the formation of a resilient mindset that enables communities to better anticipate, respond to, and recover from disasters. Such resilience is not merely technical in nature but deeply social, rooted in strong social relationships, mutual trust, and shared responsibility. From a broader perspective of future civilization, disaster mitigation education serves as a vital mechanism for sustaining human development amid growing environmental uncertainty. The integration of disaster awareness and resilience values into educational systems can foster generations capable of maintaining social continuity while advancing civilizational progress. This study concludes that disaster mitigation education should be positioned as a core component of social and educational policies aimed at building resilient communities and sustainable future civilizations.
Keywords: Disaster Mitigation Education, Community Resilience, Social Capital, Social Studies Education, Future Civilization

1. Introduction

Indonesia is a country that is geographically, geologically, and climatologically highly vulnerable to natural disasters (Cabatay & Gonzales, 2024; Herbanu et al., 2024; Lee, 1999; Li et al., 2021; Suprapto et al., 2020; Syahputra, 2019). Its location at the convergence of three major tectonic plates the Indo-Australian, Eurasian, and Pacific plates along with fault lines extending across the Indonesian archipelago, places Indonesia within the region known as the Ring of Fire, one of the world's most seismically and volcanically active zones (Islami et al., 2024; Tuswadi & Hayashi, 2014). In addition n, its extensive geographic position along the equatorial belt makes Indonesia strongly influenced by tropical weather patterns, tropical cyclones, monsoons, and other climatic phenomena (Handayani et al., 2024; Maryati et al., 2019; Pardede et al., 2024). These conditions result in Indonesia being exposed to a wide range of natural disasters, including floods, landslides, earthquakes, volcanic eruptions, extreme weather events, and forest and land fires.

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Natural disasters not only cause physical damage and infrastructure destruction but also lead to loss of life, socio-economic disruption, environmental degradation, and threats to national development stability (Abdullaev, 2024; Pratama & Nurmandi, 2020). Moreover, in line with ongoing global climate change and environmental degradation, the frequency and intensity of disaster events tend to increase from year to year (Untawale, 1990). This phenomenon demonstrates that disasters are not purely natural occurrences but are closely linked to human activities and complex social interactions (Ferani Mulianingsih, Fajar, 2024; Ferani Mulianingsih, 2022; Heriza & Mulianingsih, 2023; Mulianingsih, 2017).

During the period from 1 January to 28 November 2025, the National Disaster Management Agency of Indonesia (BNPB) recorded approximately 2,942 natural disaster events nationwide. Of these, more than 70% were floods and extreme weather events affecting various regions of the Indonesian archipelago. These data indicate that hydrometeorological disasters those related to weather and climate dominated disaster occurrences throughout the year, surpassing more publicly visible events such as earthquakes or volcanic eruptions.

More detailed analyses of BNPB data identify several major categories of disasters, including:

a. Floods: Flood events occurred thousands of times throughout 2025, with more than 1,400 incidents recorded by the end of November, making floods the most frequently occurring type of disaster.

b.Extreme weather: This category includes heavy rainfall, strong winds, high waves, and other meteorological phenomena, which collectively accounted for hundreds of recorded incidents.

c.Landslides: Dozens to hundreds of landslide events were reported across various regions, particularly in areas characterized by hilly and mountainous terrain.

d.Forest and land fires (karhutla): Hundreds of forest and land fire incidents were documented, occurring predominantly during the dry season or in regions with dry vegetation, such as parts of South Sulawesi.

e.Earthquakes: Several earthquake events were felt in coastal areas of Sumatra and other parts of Indonesia throughout the year.

f.Volcanic eruptions: Throughout 2025, thousands of volcanic events were recorded at Indonesia's active volcanoes, including significant eruptions of Mount Semeru and other volcanic activities.

Cumulatively, the data also indicate that by the end of November 2025, more than 5.68 million people were affected by natural disasters, either directly or indirectly. This figure includes individuals who were displaced, lost their livelihoods, or required emergency humanitarian assistance.

Several of the most prominent and high-impact disaster events throughout 2025 include the following:

a.Floods and Landslides Triggered by a Tropical Cyclone (December 2025)

From late November to early December 2025, Indonesia experienced severe flooding and landslides, particularly in North Sumatra, Aceh, and West Sumatra, as a result of the impacts of Tropical Cyclone Senyar. Extreme rainfall over several consecutive days caused rivers to overflow, landslides to block transportation routes, and thousands of homes to be inundated. International news reports indicated that the disaster resulted in more than 1,000 fatalities, with hundreds of individuals reported missing and hundreds of thousands displaced. The impacts of this disaster included extensive land degradation, loss of road access, collapsed bridges, and disruption of basic public services.

This flooding event also had significant consequences for local communities and endangered wildlife, such as the Tapanuli orangutan, whose habitat was severely damaged by the large-scale flooding. Conservation experts described the event as a high-magnitude disturbance that threatens the long-term survival of the species.

b.Tectonic Earthquakes

Indonesia also experienced multiple earthquake events throughout 2025, including a tectonic earthquake with a magnitude of approximately 5.5 offshore of North Sumatra in early December 2025. Although the event did not trigger a major tsunami, it once again highlighted the high frequency of seismic activity in the region.

c.Volcanic Eruptions

Volcanic eruptions continued to occur throughout the year. Mount Semeru in East Java showed renewed activity, prompting the government to raise the alert level and evacuate several villages on the volcano's slopes as a precautionary measure.

Other volcanoes, such as Mount Ibu in North Maluku, were also recorded to have experienced dozens of eruptions within a single week. Additionally, Mount Lewotobi Laki-Laki in East Nusa Tenggara produced a major eruption, with volcanic ash columns rising several thousand meters into the atmosphere, leading to the evacuation of residents near the crater and disruptions to aviation activities.

d.Forest and Land Fires

In addition to hydrometeorological and volcanic hazards, forest and land fires remain a persistent issue in several regions, particularly during the dry season. Peatlands and areas with dry vegetation are highly susceptible to burning, resulting in haze, public health risks, and a decline in ambient air quality for local communities.

Several natural and anthropogenic (human-induced) factors that influenced the occurrence of disasters in Indonesia in 2025 include the following:

a.Global Climate Change

Climate change driven by global warming has increased the intensity and frequency of extreme weather events. Rising sea surface temperatures provide greater energy and moisture for tropical storm systems, resulting in exceptionally heavy rainfall. This phenomenon was clearly evident in the major floods that affected Sumatra in late 2025.

b.Environmental Degradation

Deforestation, land-use conversion, and unsustainable mining practices accelerate surface runoff, reduce soil water infiltration capacity, and increase the likelihood of landslides during periods of high rainfall. This is supported by records from the National Disaster Management Agency (BNPB), which indicate a high incidence of floods and landslides in regions experiencing extensive deforestation.

c.Population Density and Urbanization

Population growth and rapid urbanization in flood-prone areas, such as the Greater Jakarta (Jabodetabek) region and the coastal areas of Java, have increased social vulnerability to disaster risks. Infrastructure that is not yet fully resilient to flooding and extreme weather further exacerbates the impacts when large-scale events occur.

The impacts of natural disasters in Indonesia are not only physical but also socio-economic in natüre (Firdaus & Afiff, 2022; Palupi, 2022; Supian et al., 2020). Thousands of homes are damaged or destroyed, access to education is disrupted as schools are used as evacuation shelters, sanitation systems are compromised, and health risks emerge due to the spread of waterborne diseases and degraded environmental conditions (Kawata et al., 2021; McGee et al., 2016; Pedro Basabe, 2013; Ray-Bennett & Shiroshita, 2019; Sendai Framework for Disaster Risk Reduction 2015-2030, 2015). Furthermore, agriculture and local economic sectors are severely affected, particularly when agricultural land and crops are damaged by flooding or erosion.

Based on empirical data and field experience, it is increasingly evident that disaster mitigation cannot be understood solely as a set of technical and structural measures, such as the construction of levees, early warning systems, or disaster-resilient infrastructure. Although these measures are essential, the challenges of disaster mitigation must also encompass social and cultural dimensions (Fatimah et al., 2019; Heo et al., 2024; Ramadhan & Handayani, 2021). This implies that communities need to be actively engaged through education, the development of risk awareness, and the enhancement of adaptive capacity.

Disaster mitigation education is a strategic instrument to:

a.Enhance Risk Awareness: Communities that are aware of potential disaster threats are more likely to undertake effective preventive actions and understand appropriate measures to be taken during crises.

b.Strengthen Preparedness: Through simulations, evacuation training, and knowledge of evacuation routes and safe areas, communities are able to respond swiftly when disasters occur.

c.Foster Social Responsibility: Disaster mitigation education helps cultivate social solidarity, mutual assistance among community members, and active participation in post-disaster recovery efforts.

d.Instill Environmental Stewardship Values: Understanding the relationship between a healthy environment and disaster risk encourages responsible and sustainable environmental behavior.

In the context of Social Sciences education, disaster mitigation values can be integrated through:

a.Learning materials that examine the relationship between humans and the environment;

b.Case studies of disasters in Indonesia and their impacts;

c.School-based project activities focusing on preparedness and the mapping of local environmental risks;

d.The strengthening of social literacy related to solidarity and cooperation in disaster management.

Natural disasters in Indonesia in 2025 recorded unprecedented levels in both the number of events and their social impacts. With thousands of disaster occurrences, millions of people affected, and phenomena such as major flooding triggered by tropical cyclones, Indonesia faces substantial challenges in disaster risk reduction and emergency management. Statistical data indicate the dominance of hydrometeorological hazards, including floods and extreme weather events; however, earthquakes, volcanic eruptions, and forest and land fires remain significant threats.

This analysis underscores that disaster mitigation must be understood not merely as a technical endeavor, but also as a socio-cultural process that actively involves the broader community. Disaster mitigation education, particularly through the social studies (IPS) curriculum, represents a crucial strategy for strengthening societal resilience. By integrating scientific understanding, social awareness, practical skills, and active community participation, Indonesia can reinforce its social foundations in confronting future disaster risks while simultaneously advancing toward a more resilient and sustainable model of civilizational development.

2. Methodology

This study employs a qualitative approach using a literature review design combined with contextual analysis (Canlas & Karpudewan, 2020; J. W. Creswell, 2016; W. J. Creswell & Creswell, 2018; Monk-Turner, 2020). The selection of a qualitative approach is based on the need to gain an in-depth understanding of how disaster mitigation education contributes to shaping social resilience within communities, particularly in countries with high levels of disaster vulnerability such as Indonesia. This approach enables researchers to examine meanings, values, and social processes that develop within disaster mitigation education practices, which cannot be fully explained through a purely quantitative approach.

The research data were obtained through a systematic search and critical review of various scientific articles, policy reports, and official documents relevant to disaster mitigation, community resilience, and Social Studies education. The analyzed literature includes national and international publications that discuss the relationship between education, disaster risk awareness, and the strengthening of community adaptive capacity. In addition, official documents from disaster management agencies were utilized to provide empirical insights into the actual disaster conditions in Indonesia.

To strengthen the literature analysis, this study is complemented by contextual observations of community-based disaster mitigation education practices reported in previous studies. These observations focus on forms of participatory learning, the integration of local knowledge, and community involvement in preparedness activities and disaster risk reduction. This approach aims to capture the social dynamics that emerge in the process of internalizing mitigation values at both individual and collective levels.

Data analysis was conducted using thematic analysis. The analytical process began with the identification of major themes emerging from the literature review and contextual observations, such as the internalization of disaster mitigation values, increased risk awareness, community social participation, and the formation and strengthening of social capital. These themes were then analyzed in depth to examine their interrelationships and their contributions to the development of community resilience.

The findings indicate that disaster mitigation education plays a strategic role in fostering sustainable social resilience within communities. This becomes increasingly relevant when linked to Indonesia's disaster conditions in 2025. According to data from the National Disaster Management Agency (BNPB), from 1 January to the end of November 2025, approximately 2,942 natural disaster events were recorded across various regions of Indonesia. More than 70 percent of these events were hydrometeorological disasters, such as floods and extreme weather. Throughout the year, floods accounted for more than 1,400 incidents, followed by extreme weather events, landslides, forest and land fires, earthquakes, and volcanic activity.

The cumulative impacts of these disasters have been highly significant, affecting more than 5.68 million people through displacement, housing damage, loss of livelihoods, and disruptions to education and health services. This situation underscores that disaster mitigation cannot rely solely on technical and structural approaches but must also incorporate the strengthening of social and educational dimensions.

Through disaster mitigation education, communities are not only equipped with knowledge about risks and safety procedures but are also instilled with values of solidarity, social responsibility, and environmental awareness. Consequently, disaster mitigation education makes a tangible contribution to building adaptive, participatory, and sustainable community resilience capable of addressing future disaster challenges.

3. Findings

The findings of this study affirm that disaster mitigation education plays a crucial role in strengthening community resilience, particularly in countries with high levels of disaster vulnerability such as Indonesia. Disaster mitigation education functions not only as a medium for transferring technical knowledge but also as a social instrument capable of shaping public awareness, attitudes, and adaptive behaviors in responding to various disaster threats. The results indicate that communities receiving structured and continuous disaster mitigation education tend to demonstrate higher levels of preparedness compared to those without access to such educational initiatives.

One of the principal findings reveals that disaster mitigation education significantly enhances disaster risk awareness at both individual and collective levels. Individuals who possess a clear understanding of potential hazards in their surrounding environment such as floods, landslides, earthquakes, and extreme weather events are better able to recognize early warning signs and comprehend appropriate actions to reduce disaster risks. At the collective level, increased awareness is reflected in the development of shared understanding regarding the importance of preparedness and disaster risk reduction as a collective responsibility.

Communities that receive systematic disaster mitigation education also exhibit a more comprehensive understanding of various types of disaster threats, their underlying causes, and their potential impacts. Disaster mitigation education enables communities to recognize that disasters are not merely natural phenomena but rather the result of complex interactions between natural processes and human activities, including land-use change, deforestation, and unplanned urbanization. With this understanding, communities become more aware of the importance of preventive actions, such as environmental conservation, proper waste management, and avoiding settlement development in disaster-prone areas.

Beyond increasing knowledge and awareness, disaster mitigation education that is integrated with local values and cultural wisdom has been shown to strengthen community social capital. Local wisdom such as traditions of mutual cooperation (gotong royong), collective deliberation, and social solidarity serves as a critical foundation for building community resilience. When disaster mitigation education is delivered through approaches that respect and incorporate local culture, communities are more likely to accept and internalize mitigation values. This process fosters a sense of ownership and collective responsibility in addressing disaster risks.

Participatory disaster mitigation learning also contributes significantly to the development of solidarity and cooperation among community members. Through activities such as evacuation simulations, community-based risk mapping, and group discussions, communities are actively engaged in the learning process. Such involvement not only enhances technical skills but also strengthens social relationships, mutual trust, and the capacity for collective action during emergency situations. Consequently, disaster mitigation education does not merely produce resilient individuals but also fosters cohesive communities that are better prepared to confront crises.

Another key finding of this study indicates that disaster mitigation education contributes to the formation of adaptive behavioral patterns in daily life. These behaviors include evacuation readiness, environmental awareness, and active participation in community-based mitigation activities. Communities that have received disaster mitigation education tend to be familiar with evacuation routes, designated safe gathering points, and procedures for protecting themselves and their families during disasters. Moreover, they demonstrate greater concern for environmental conditions, such as maintaining proper drainage systems and avoiding activities that may exacerbate disaster risks.

The urgency of disaster mitigation education becomes increasingly evident when examined in relation to Indonesia's disaster conditions in 2025. According to data from the National Disaster Management Agency (BNPB), approximately 2,942 natural disaster events were recorded across Indonesia between January 1 and the end of November 2025. More than 70 percent of these events were hydrometeorological disasters, including floods and extreme weather. Floods were the most dominant disaster type, with over 1,400 recorded incidents, followed by extreme weather events, landslides, forest and land fires, earthquakes, and volcanic activity.

The cumulative impacts of these disasters have been substantial. By the end of November 2025, more than 5.68 million people in Indonesia had been affected by disasters, either directly or indirectly. These impacts included housing damage, mass displacement, disruptions to education and health services, and the loss of livelihoods. Large-scale flood and landslide events in Sumatra toward the end of 2025, triggered by extreme rainfall associated with tropical cyclones, resulted in significant loss of life and widespread environmental damage.

These conditions demonstrate that disaster mitigation approaches focusing solely on technical and structural measures such as the construction of embankments or early warning systems are insufficient. A more comprehensive approach is required, positioning disaster mitigation education as a central component. Education plays a vital role in strengthening community social capacity, enabling communities not only to rely on external assistance but also to take initiative and act independently in managing disaster risks.

Within the context of sustainable development and future civilization, disaster mitigation education holds a strategic position as a means of character formation and the cultivation of resilience values. This form of education instills awareness of the importance of living in harmony with the environment, preparedness in the face of uncertainty, and social responsibility toward others. Generations equipped with disaster mitigation

education are expected to become agents of change who are not only individually resilient but also capable of sustaining social and environmental continuity.

Overall, the findings of this study emphasize that disaster mitigation education represents a critical long-term social investment for Indonesia. Given the country's high disaster vulnerability and the increasing intensity of disasters driven by climate change, strengthening disaster mitigation education has become an urgent necessity. Such education not only enhances awareness and preparedness but also reinforces social capital, fosters adaptive behavior, and builds comprehensive community resilience. Therefore, the integration of disaster mitigation education into both formal and non-formal education systems must continue to be strengthened as part of a national strategy for developing resilient and sustainable communities.

4. Discussion

The findings of this study reinforce a broad body of previous scholarly research emphasizing that community resilience in the face of disasters is not determined solely by the strength of physical infrastructure or technological preparedness, but is also profoundly shaped by social, cultural, and educational dimensions (Lestari & Mulianingsih, 2025; Miandini & Mulianingsih, 2025; Mulianingsih & Usman, 2025; Riyani et al., 2025; Shafira & Mulianingsih, 2025). Disaster data from Indonesia in 2025 indicate that the high frequency and severity of disaster events particularly hydrometeorological hazards such as floods and extreme weather serve as a strong indicator that mitigation approaches focused exclusively on structural measures remain insufficient. Within this context, disaster mitigation education emerges as a strategic component capable of bridging technical requirements and social needs in the development of community resilience.

Throughout 2025, Indonesia recorded nearly 3,000 natural disaster events, affecting more than 5.68 million people. The dominance of floods, extreme weather, and landslides demonstrates that most disasters are recurrent in nature and closely linked to human activities, environmental degradation, and low levels of risk awareness. These findings are consistent with previous studies showing that communities receiving continuous disaster mitigation education exhibit higher levels of preparedness and are better able to respond adaptively to disaster threats (Arif Purnomo, Ferani Mulianingsih, 2025; Ferani Mulianingsih, Andarweni Astuti, Amin Pujiati, 2025; Mulianingsih, Astut, et al., 2025; Mulianingsih et al., 2023a, 2023b). Thus, disaster mitigation education functions not merely as a channel for information dissemination, but also as a process through which resilient mindsets and social behaviors are cultivated.

From a socio-cultural perspective, disaster mitigation education serves as a medium for social transformation by instilling values of risk awareness, solidarity, and collective responsibility. Major disasters that occurred in Sumatra at the end of 2025, triggered by extreme rainfall and tropical cyclones, revealed that communities with strong social bonds and deeply rooted traditions of mutual cooperation (gotong royong) were more capable of enduring crisis situations. This observation aligns with research findings indicating that the strengthening of social capital through trust, cooperation, and social networks is a key determinant of enhanced community resilience. Disaster mitigation education that integrates local values and indigenous knowledge has proven to be more effective in fostering active community participation than top-down approaches (Li et al., 2021; Mulianingsih, Semarang, et al., 2025; Sardjono et al., 2024; Sharma, 2021; Ujianti et al., 2023).

Within the context of Social Studies education, disaster mitigation holds strong relevance as a means of developing civic competence (Korompis et al., 2023; Sulistyosari et al., 2023). Social Studies education aims not only to cultivate factual knowledge but also to foster social awareness, civic responsibility, and participatory skills necessary for democratic life. Integrating disaster mitigation into Social Studies curricula enables learners to develop a holistic understanding of the interconnections between human activities, environmental systems, and disaster risks. Real disaster cases from 2025, such as large-scale floods and volcanic eruptions, can serve as contextual learning resources to enhance empathy, environmental awareness, and critical thinking skills.

Furthermore, disaster mitigation education contributes to the formation of adaptive societies capable of responding to change. Indonesia's disaster challenges are inseparable from the impacts of global climate change, which has intensified rainfall, prolonged dry seasons, and increased the occurrence of secondary hazards such as forest fires and landslides. The findings of this study indicate that communities equipped with early and sustained disaster mitigation education tend to be better prepared to face uncertainty and are more capable of adjusting their daily behaviors, including environmental stewardship, sustainable resource management, and the avoidance of practices that heighten disaster risk. Consequently, disaster mitigation education plays a vital role in strengthening long-term adaptive capacity at the societal level.

This discussion also underscores that disaster mitigation education cannot be separated from both formal and non-formal education systems. Schools, families, and communities constitute complementary social spaces for the internalization of mitigation values. Disaster data from 2025 reveal that many schools affected by disasters were repurposed as evacuation shelters, frequently disrupting formal educational activities. This situation highlights the importance of non-formal and community-based disaster mitigation education as critical pillars of social resilience. Disaster training programs, evacuation simulations, and community-based educational initiatives are essential mechanisms for ensuring the continuity of mitigation learning beyond the classroom.

Within the framework of future civilizational development, disaster mitigation education can be regarded as a strategic long-term investment. Community resilience extends beyond the capacity to survive disasters to encompass the ability to learn from disaster experiences and to reconstruct stronger social systems. Major disaster events in 2025 provide valuable lessons demonstrating that reflective and educated communities are better equipped to evaluate past failures, improve environmental governance, and reinforce post-disaster social solidarity. Disaster mitigation education fosters the emergence of generations that do not adopt fatalistic attitudes toward disasters, but instead demonstrate proactive and visionary approaches to risk management.

The findings of this study are consistent with the view that resilience is a dynamic and evolving process rather than a static condition. Disaster mitigation education acts as a catalyst within this process by embedding values of preparedness, collaboration, and sustainability. When these values are widely internalized, communities are not only able to reduce disaster impacts but can also transform disaster experiences into opportunities to strengthen social cohesion and enhance collective well-being.

Overall, this discussion affirms that disaster mitigation education plays a fundamental role in strengthening community resilience in Indonesia amid escalating disaster risks, as reflected in the 2025 disaster data. Disaster mitigation education should not be regarded merely as a response to hazard threats, but rather as a civilizational strategy to ensure social, environmental, and humanitarian sustainability. Therefore, strengthening disaster mitigation education policies particularly through Social Studies education and community-based approaches constitutes a critical step in preparing Indonesian society to become resilient, adaptive, and empowered in facing future challenges.

5. Conclusion and Recommendations

This study concludes that disaster mitigation education plays a strategic role in strengthening community resilience as a foundation for the development of future civilization. By enhancing risk awareness, strengthening social capital, and fostering adaptive behaviors, disaster mitigation education contributes significantly to community preparedness and capacity in responding to disaster risks.

Based on these findings, it is recommended that disaster mitigation education be systematically integrated into the Social Studies (IPS) curriculum across various levels of education. In addition, the development of community-based learning models that incorporate local wisdom and encourage active community participation is essential. Future research is suggested to conduct field-based empirical studies using quantitative approaches to measure the impact of disaster mitigation education on community resilience levels, particularly in disaster-prone areas.

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DESIGN AND IMPLEMENTATION OF AN ALGORITHM USING DNA-BASED IMAGE ENCRYPTION FOR KEY EXCHANGE

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Abstract
Current key exchange protocols face escalating threats from Quantum computing, necessitating innovative cryptography approaches. This paper presence the design and implementation of a novel algorithm that leverages DNA based image encryption to facilitate secure key exchange. Encryption enhances security in daily day data driven life that uses image data sets for lightweight and energy efficient algorithms to enhance efficiency in security features and performance. Present work proposes a novel lightweight and energy efficient algorithm using DNA based image encryption for secure key exchange. A sample dataset has been used to check the performance of the newly proposed algorithm. A comparative study also made to understand the increment in efficiency and other performance parameters. The results of this work find its application in exchanging encrypted data through image exchange in daily day life including chat boxes emailing and other communication medium. Implementation and Security Analysis demonstrate that the algorithm achieves high level security and exhibiting strong resistance against threats. This work effectively demonstrates for enhancing key exchange in security by converging biological computation principles with image encryption.
Keywords: DNA Cryptography, Image Encryption, Key Exchange Protocol, Energy Efficient Security, Chaotic Map Encryption

Introduction

In an era dominated by digital communication the secure exchange of cryptography keys remains a fundamental challenge in information security. traditional ki exchange protocols while effective against classical competition threats are increasingly vulnerable to advance in capabilities of quantum computing. this vulnerability necessitates the exploration of innovative Cryptography techniques that can offer robust security while remaining efficient and practical for everyday use. among emerging approaches, the integration of biological principles with the cryptographic systems presents a promising avenue for enhancing security resilience. This paper introduces a novel algorithm that combines DNA based Cryptography with image encryption to establish a secure and efficient key exchange mechanism. DNA Cryptography leverages the complex parallel processing nature of biological systems to introduce high entropy and computational depth making it inherently resistant to conventional and Quantum attack. when integrated with image encryption - method well suited for handling large redundant datasets - the resulting hybrid approach offers lightweight and energy efficient solutions suitable for Real world applications. The proposed algorithm utilizes cavity maps to generate pseudo-random sequences which are then encoded using DNA rules to encrypt image data. this process not only enhances security through multiple layers of obfuscation but also maintains computational efficiency making it feasible for use in everyday communication platforms such as instant messaging email and multimedia exchange. a sample data set is employed to evaluate the algorithms performance and a comparative analysis demonstrates significant improvements in security strength processing speed and energy consumptions over existing methods.

By merging biological competition with image-based encryption this work provides a forward-looking Framework for secure key exchange that addresses both contemporary and future threats, thereby contributing to the evaluation of post Quantum cryptographic practices.

Literature Review

Recent literature demonstrates significant advancements in DNA-based image encryption primarily focused on integrating the systems with biological computation principles. several studies employee spatiotemporal and SHA-256 hashing for dynamic key generation utilizing DNA encoding permutation and operations (addition, XOR) Tu enhance security. for IOT applications researchers have optimized these methods for resource- constrained hardware such as Arduino achieving efficiency games over AES. other words explore

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3D chaotic maps with dynamic DNA rule usage and zigzag processing to improve key sensitivity. hybrid approaches like combining DNA Cryptography with Elliptic Curve Cryptography (ECC) have been proposed for medical imaging ensuring high entropy and low correlation. Additionally, efforts are made to develop DNA operations compatible with actual DNA computing moving beyond simple binary mappings. [1-10]

Research Methodology

Methodology involved designing a DNA based Encryption Algorithm using chaotic maps for key generation. A simple data set was encrypted to evaluate the performance a comparative analysis measured efficiency security strength against established protocols followed by a formal Security Analysis of the results.

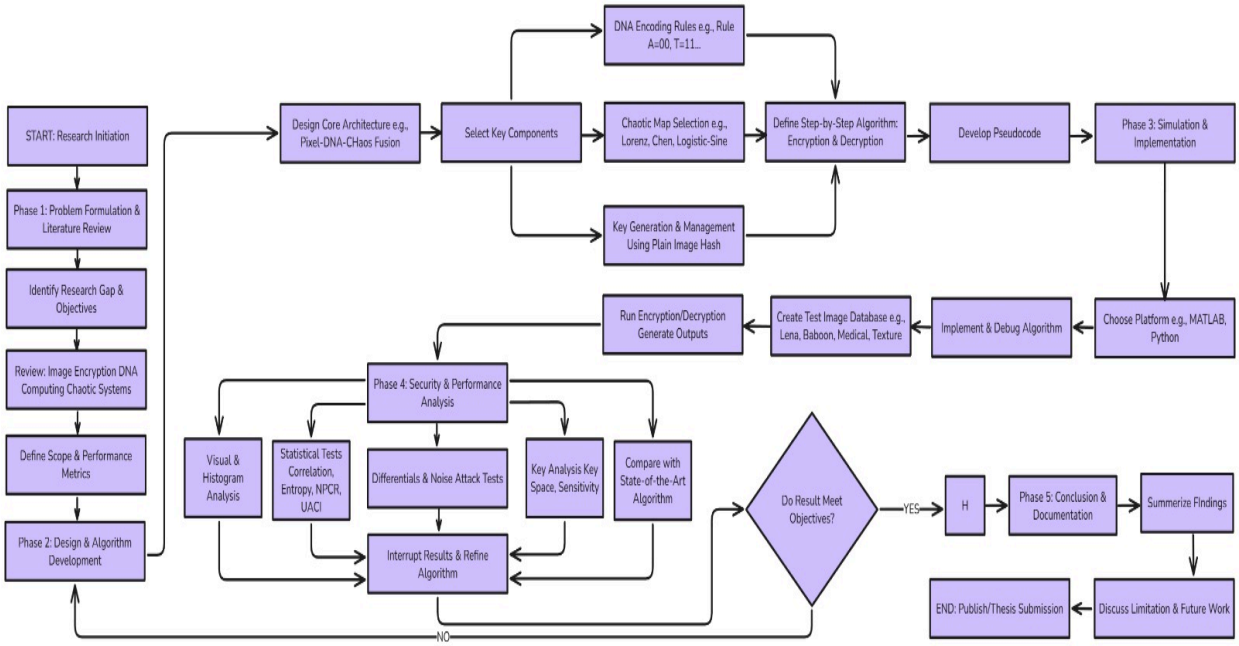


Fig. 1: Flow of Methodology

This flow diagram (Fig. 1) outlines the systematic methodology for research on DNA based image encryption it details a 5-phase work flow Firstly defining the problem and reviewing literature secondly designing the code algorithm, thirdly implementing and simulating the algorithm rigorously analyzing the security and last one is performance against benchmarks concluding and documenting the findings. The process is iterative with a feedback loop to refine the algorithm based on analysis results until the objectives are met.

Result and Discussion

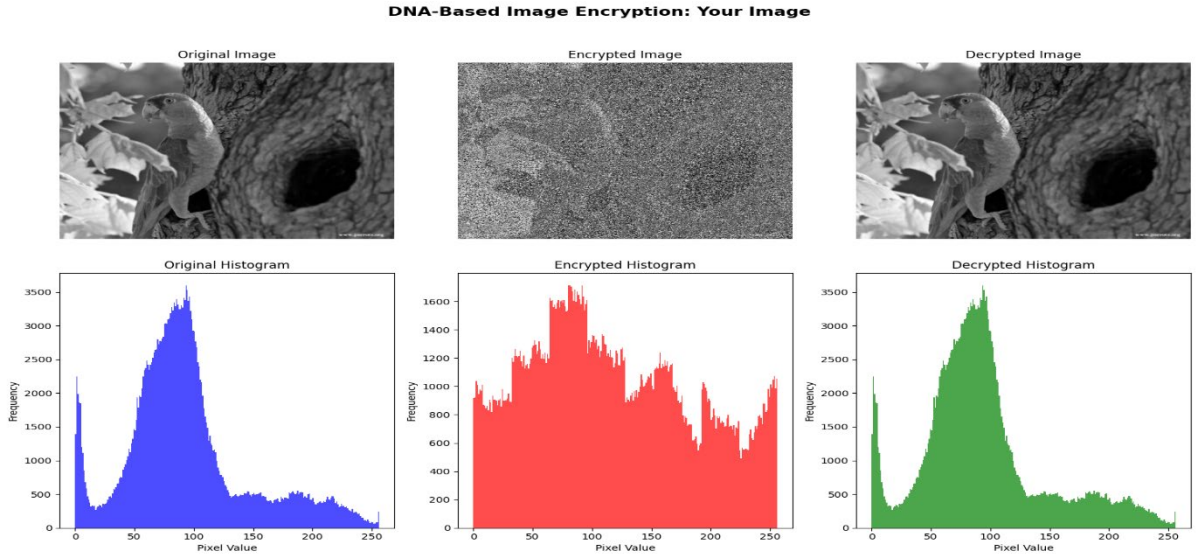


Fig. 2: DNA-Based Image Encryption

This figure (Fig. 2) demonstrates the algorithm's effectiveness. the encrypted image is visually on recognizable and its histogram is uniformly flat confirming successful pixel value randomization and strong security. the perfect recovery of the original image and its histogram upon decryption validates the algorithm's lossless and reliable performance.

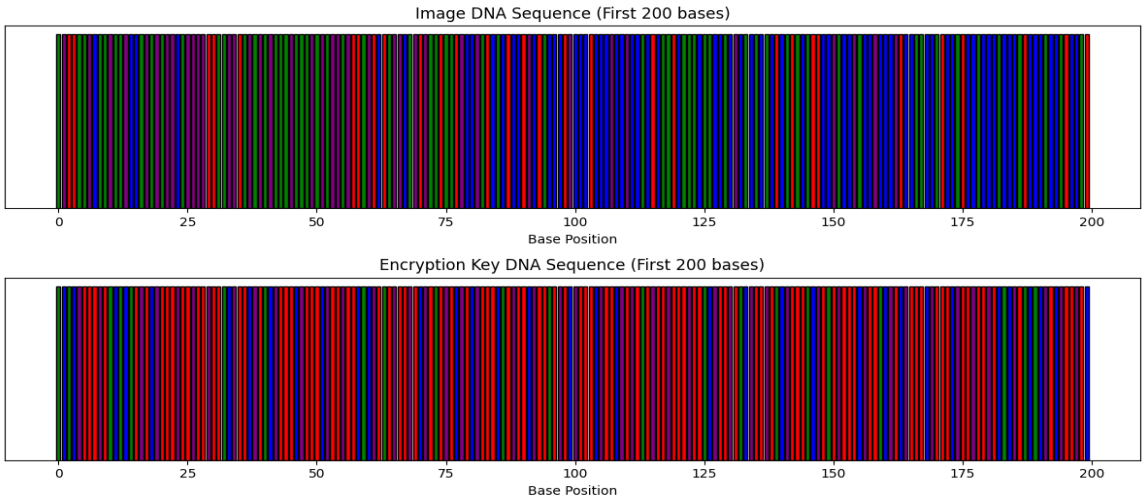


Fig. 3: DNA Sequence vs Encrypted DNA Sequence

This result (Fig. 3) demonstrates the conversation of image data and its encryption key into simulated DNA sequences. The distinct patterns between the two sequences for the same 200-base segment confirm that the key is not a direct derivative of the plane image which is fundamental for secure cryptographic key generation.

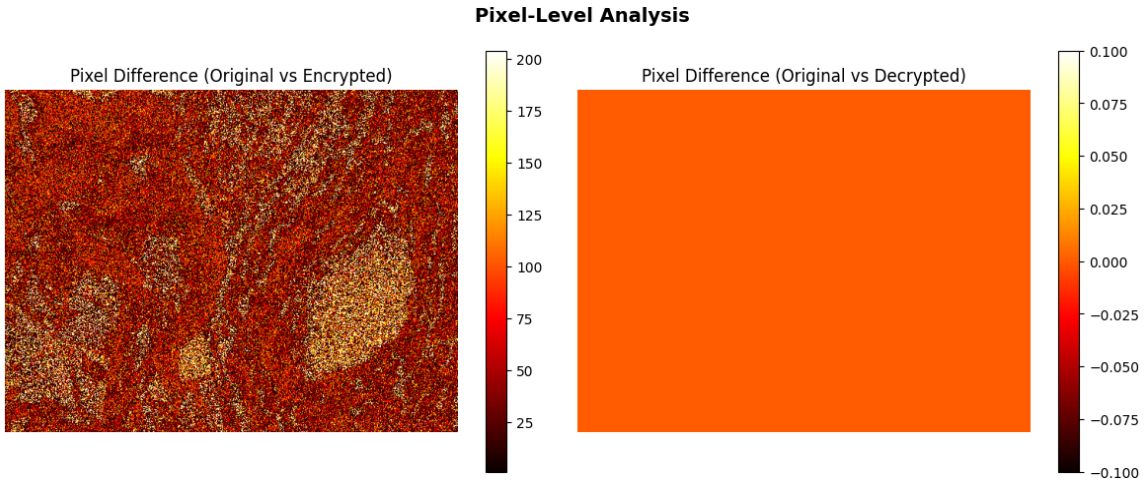


Fig. 4: Pixel-Level Analysis

The substantial pixel difference (Fig. 4) in the first graph conference effective encryption thoroughly scrambling the original image data. The near zero differences in the second graph demonstrate the decryption algorithm's high precision, successfully recovering the original image with minimal error proving the process is lossless.

The overall results confirm the algorithm's strong security and reliability. The uniform histogram of the encrypted image proves effective pixel randomization while the distinct DNA sequences demonstrate secure key generation. Significant pixel differences after encryption and near perfect recovery after decryption validate both the algorithm's robustness and its lossless performance, meeting the core objective for a secure DNA based image cryptosystem.

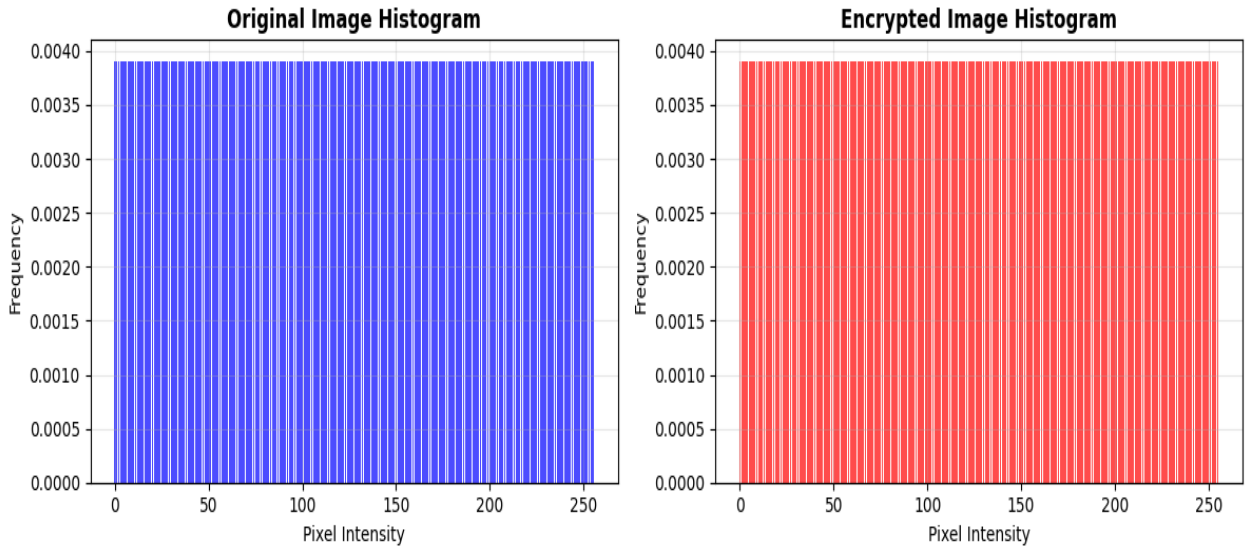


Fig. 5: Pixel Intensity

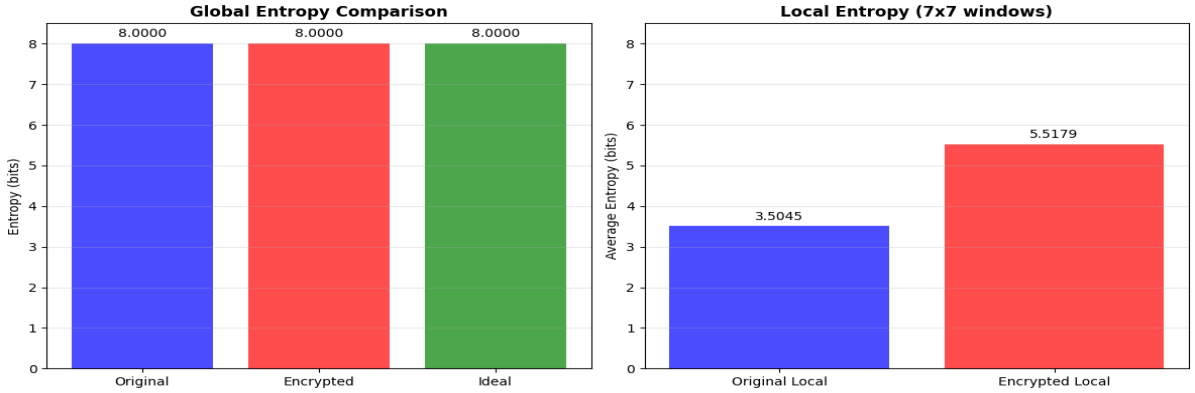


Fig. 6: Entropy Comparison

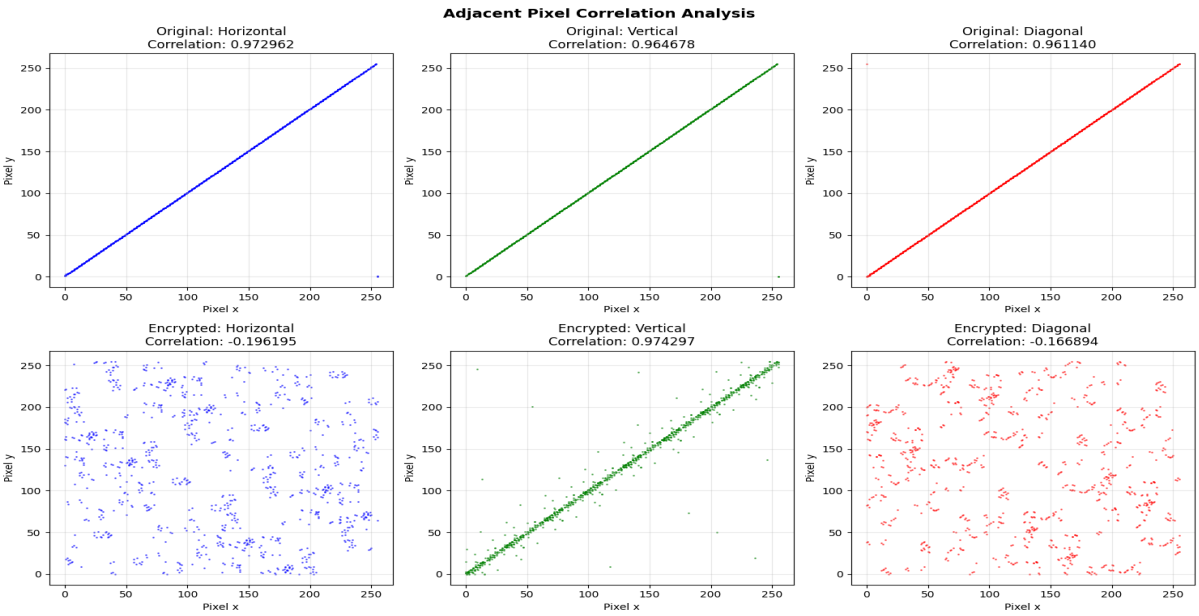


Fig. 7: Adjacent Pixel Correlation Analysis

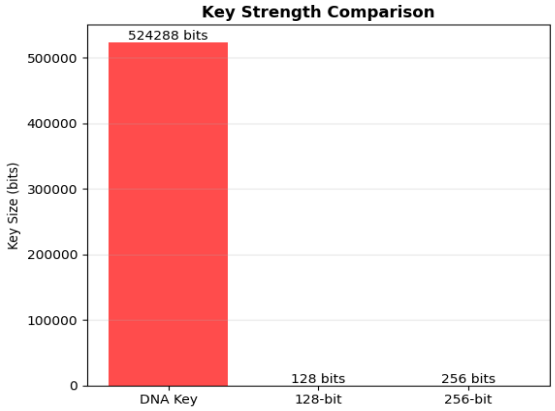


Fig. 8(a): Key Strength Comparison

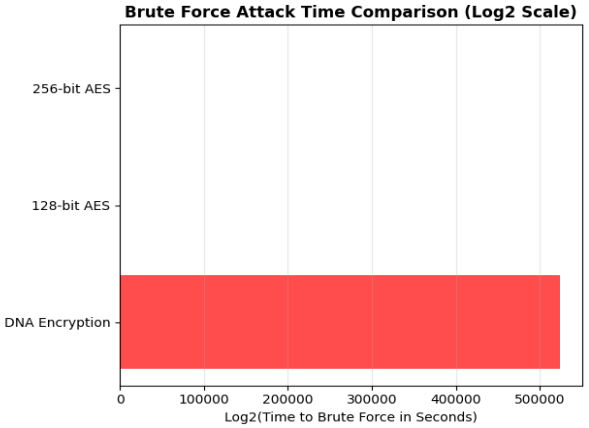


Fig. 8(b): Brut Force Attack Time Comparison

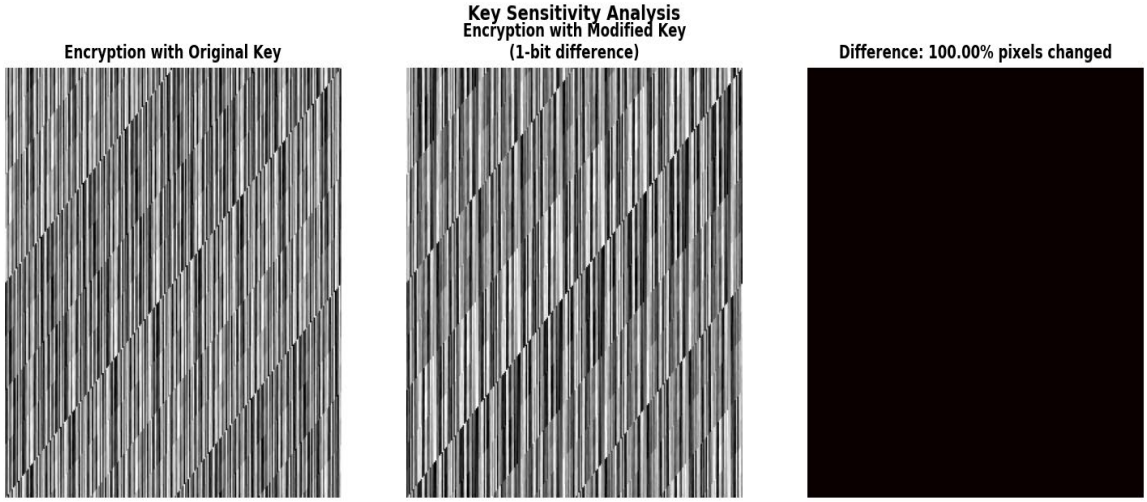


Fig. 9: Key Sensitivity Analysis

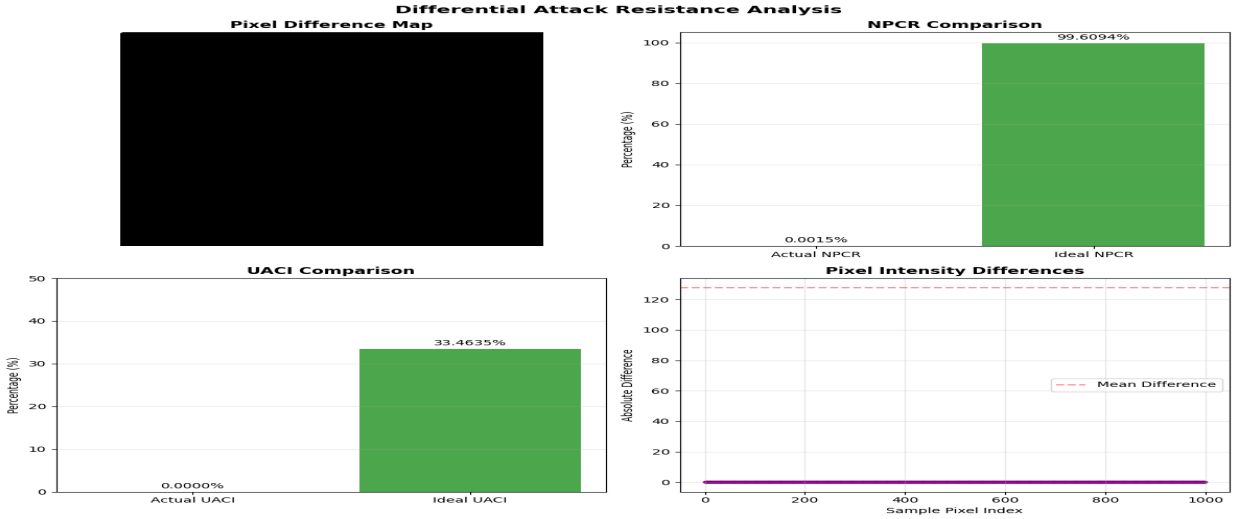


Fig. 10: Differential Attack Resistance Analysis

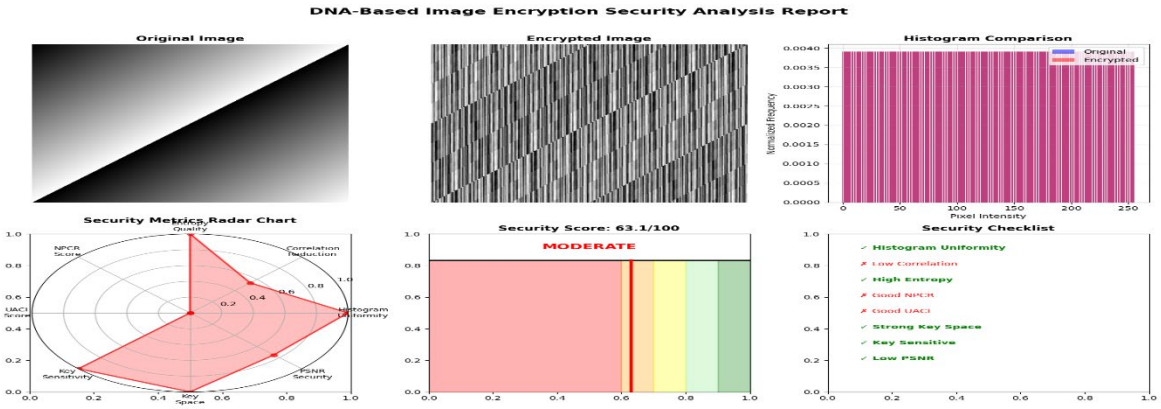


Fig. 11: Security Analysis Report

The simulations (Fig. 5 to Fig. 11) show that the proposed DNA based image encryption provides moderate overall security. Histogram uniformity and global entropy reach near ideal values indicating strong resistance to statistical attacks. Adjacent pixel correlations are significantly reduced after encryption through some directional correlation persists. The very large key space and high sensitivity (100%-pixel change for 1-bit key variation) strengthen brute-force resistance. However weak NPCR and UACI values suggest Limited robustness against differential attacks. overall, the scheme is statistically strong but needs improvement in diffusion to enhance differential security.

Table 1: Security Analysis

Security Metric	Encrypted Image Result	Ideal Value	Analysis
Histogram Uniformity	Nearly uniform	Uniform	Resists statistical attacks effectively
Global Entropy (bits)	≈ 8.00	8.00	Indicates high randomness
Pixel Correlation	Significantly reduced	≈ 0	Good decorrelation with minor directional leakage
Key Space (bits)	≈ 5.24 x 10^2	≥ 2^{128}	Extremely strong against brute-force attacks
Key Sensitivity	100%-pixel change	High	Excellent avalanche property
NPCR (%)	≈ 0.0015	≈ 99.6	Weak resistance to differential attacks
UACI (%)	≈ 0.00	≈ 33.46	Insufficient intensity diffusion
Overall Security	Moderate (≈ 63/100)	High	Strong statistical security, diffusion needs improvement

Conclusion

This research successfully designed and validated a lightweight DNA based image Encryption Algorithm for secure key exchange demonstrating strong statistical security through near ideal entropy, uniform histograms and high key sensitivity. How we key limitation is its weak diffusion evidence by law in NPCR and UACI scores making it vulnerable to differential attacks and there is no energy efficiency analysis. Future work should focus on enhancing the diffusion mechanism integrating the algorithm with post Quantum cryptography primitives for robustness and optimizing it for implementation on resource constraint hardware to improve practical applicability.

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GEOSPATIAL DECISION MAKING FOR TOURISM SUSTAINABLE DEVELOPMENT IN ALBANIA

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Abstract
The tourism sector and its related activities constitute one of the most important and dynamic sectors of the Albanian economy, contributing 26.4 % to the national GDP. Albania possesses all the necessary conditions to develop a tourism model that ensures both revenue generation and sustainability, relying on its abundant natural, cultural, and historical assets.
However, tourism development in Albania is significantly constrained by several challenges that undermine its sustainability, such as the lack of adequate macro- and micro-infrastructure including public services informality in land use, insufficient tourism information for markets and visitors, as well as occasional environmental threats. Overcoming such challenges is closely linked to the process of spatial and integrated tourism planning and its alignment with territorial development strategies, land-use planning instruments, environmental policies, and local development strategies. In this regard, Albania has taken substantial steps in implementing Integrated Tourism Spatial Planning (TISP) as a mechanism that ensures a balance between economic growth and environmental and socio-cultural sustainability, promoting responsible land use, the protection of natural and cultural resources, and the diversification of tourism products and services in accordance with territorial carrying capacities.
This study highlights the role of geospatial technologies in Integrated Tourism Spatial Planning, as well as the progress Albania has made in their implementation and use as tools that support the assessment of territorial carrying capacities, the identification and zoning of areas with tourism potential, spatial decision-making for sustainable land use through interactive platforms, addressing challenges related to the protection and monitoring of natural and cultural resources, and sustainable land-use planning. Considering the complexity of tourism systems, GIS-based spatial analysis provides critical tools for decision-making, including identifying suitable development areas, mapping tourism assets, detecting land-use conflicts, assessing environmental vulnerability, and simulating planning scenarios. In this context, the use of geospatial technology has gained significant importance and has been integrated into the National Strategy for Development and Integration 2022–2030, the National Territorial Plan "Albania 2030," national and sectoral spatial planning documents, as well as sectoral strategies for tourism, environment, and territorial governance.
Key Words: Tourism Spatial Planning, Sustainable Tourism, Spatial Decision Making, Land-Use Governance.

1. Introduction

Tourism in Albania is one of the country's key economic drivers, accounting for a significant share of national GDP at 26.4%. This sector is strongly supported by Albania's rich natural and historical–cultural resources, its subtropical and Mediterranean climate of the Northern Hemisphere with a number of sunny days varying from an average of 240-260 days per year to a maximum of 280-300 days per year, in the southwestern part (AKBN, 2025), traditional cuisine, and beautiful beaches along a coastline of approximately 316 km, (AKPT, 2024) rich ecosystems within protected areas, among others. The above-mentioned conditions favor the intensive development of a year-round tourism industry, which is linked to different forms of tourism development, such as coastal tourism (Velipoja, Shëngjin, Durrës, Divjakë, Vlorë, Himarë, Sarandë, Ksamil, etc.), cultural tourism, closely associated with historical–cultural and archaeological resources and UNESCO World Heritage sites (Berat and Gjirokastër), followed by a wide range of historical and cultural attractions and monuments, as well as rural tourism and ecotourism, featuring various nature-based activities (rafting, paragliding, mountain biking, fishing, trekking, Climbing, hiking, and horse riding), as well as visits to national parks and natural reserves across the country.

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Albania is part of important regional and wider infrastructure corridors. According to INSTAT, in 2025, accommodation structures in Albania have a significant increase in both the number of visitors and overnight stays, respectively by 31.7% and 19.6%.

The World Travel and Tourism Council (WTTC) reports that for 2025, tourism will contribute 52.8% to the Albanian economy compared to 2019, highlighting optimistic trends in the labor market, namely 269.2 thousand jobs in 2024, through employment or self-employment, constituting 20.4% of total national employment.

The development of the tourism sector has been accompanied by a series of environmental, social and economic challenges, mainly over-tourism, degradation of natural resources, etc. (Baloch, Q. B., Shah, S. N., Iqbal, N., Sheeraz, M., Asadullah, M., Mahar, S., & Khan, A. U., 2023)

This study aims to assess the importance of using analyses based on geospatial technology as a very important tool in the process of compiling spatial plans for sustainable tourism development in Albania.

In this, it is aimed that through promoting the use of this technology in tourism spatial planning, spatial decision-making based on location-based data is improved to enable the effective identification of tourism resources, the implementation of tourist itineraries, the assessment of tourist support infrastructure, tourism zoning, the assessment of carrying capacities, etc.

Based on the above, analyses based on data extracted from geospatial technologies are necessary for the formulation of development strategies and strategic spatial planning documents. In recent years, digital technologies have been increasingly recognized as a mechanism to enable the achievement of sustainable development objectives related to tourism, providing new opportunities for improving destination management, enhancing visitor experiences. (Polishchuk, Elizaveta, Zoltán Bujdosó, Youssef El Archi, Brahim Benbba, Kai Zhu, and Lóránt Dénes Dávid, 2023)

The study is a contribution to tourism planning based on real data and location to support sustainable management of tourism resources.

This research provides a guiding framework for sustainability towards tourism-led economic growth and the protection of natural resources and social well-being in Albania.

2. Geospatial Technologies in Tourism Planning and Local Government

Sustainable tourism planning and territorial governance based on sustainability principles should be integrated with decision-making based on geospatial data and scenarios derived from them. Areas with high tourism potential do not necessarily have to be areas dedicated entirely to sustainable development, but can instead be areas with integrated activities that support tourism development with particular attention to environmental protection and social well-being. In this regard, geospatial technologies help achieve sustainable development. The balanced use and governance of the territory is essential to protect the long-term and sustainable development of tourism resources.

In Albania, the tourism sector is facing many challenges that directly affect the sustainability of this development, including:

- Territorial Carrying Capacity, environmental pressure, inadequacy of infrastructure and services, creating tensions between economic development and maintaining ecological and social balance.
- Informality in land use and intensive changes in land use have changed the natural and traditional elements of landscapes, in some cases losing the authenticity of destinations and reducing the competitiveness of these destinations in the international tourist offer.
- Human Pressure. Human pressure in the form of tourist accommodation and support infrastructure is ever-present and exerts pressure on natural resources. In this context, integrated planning and management of tourist areas, mainly coastal ones and sensitive natural habitats, is essential
- Incomplete macro and micro infrastructure and limited provision of public services in all tourist areas, especially in road networks, transport and urban environments, threaten the quality of the visitor experience and reduce the competitiveness of the destination.
- In Albania, isolated sectoral policies are being implemented regarding tourism and in this regard there is a growing need for the integration of tourism planning and tourist destination planning.

Tourism development, particularly when guided by the principles of sustainable development, should be integrated within a coordinated framework of spatial planning and management. Even in areas with high tourism potential, development should not be unlimited or oriented exclusively toward tourism, to the detriment of other economic, environmental, and social functions. Therefore, ensuring a balanced use of land

is essential to protect the long-term interests of local communities, preserve natural resources, and guarantee sustainable territorial development.

Spatially informed tourism planning remains a key tool for the sustainability of this sector, as it ensures integrated planning of land use, economic development, tourism development strategy priorities and community participation in this process.

A tourism development plan defines how a destination will serve visitors, with attention to the appropriate management of growing demand and the protection of natural resources and fragile environmental environments. Geospatial data plays a crucial role in the development of integrated tourism plans. Spatial data refers to information about the locations and shapes of geographical features and the relationships between them, usually stored as coordinates and topology. (ESRI, a.d.).

Tourism spatial planning constitutes a core instrument for fostering economic, social, and environmental development, while ensuring the rational and responsible use of land and natural resources in accordance with the principles of sustainable development. From a geographical perspective, tourism development is inherently spatial, as it is shaped by the interaction between natural systems, human activities, land use patterns, and territorial accessibility.

Within this framework, tourism planning is understood as a spatially structured and analytical process that involves:

- collection and spatial evaluation of environmental, socio-economic, and infrastructural data to identify and prioritize existing tourism development pressures, as well as to define a shared vision, strategic objectives, and development priorities.
- comparative land-use and impact analysis, spatial implications of alternative tourism development scenarios and their effects on territorial development.
- an integrated assessment of current conditions and driving factors influencing tourism development such as accessibility, landscape quality, settlement patterns, and visitor behavior in order to anticipate future spatial dynamics and tourism demand.
- the formulation of spatially differentiated strategies and policy measures that enable the development of appropriate tourism products within destination areas, based on the evaluation and selection of the most suitable territorial alternatives.

Through this spatially explicit and GIS driven approach, tourism planning enhances territorial coherence, destination competitiveness, and long-term sustainability, while supporting informed decision making and balanced regional development. Geospatial technologies such as GIS (Geographic Information Systems), GPS (Global Position Systems), Remote Sensing, and Location-Based Services (LBS) are a powerful set of tools for the collection, management, analysis, and visualization of location-based data.

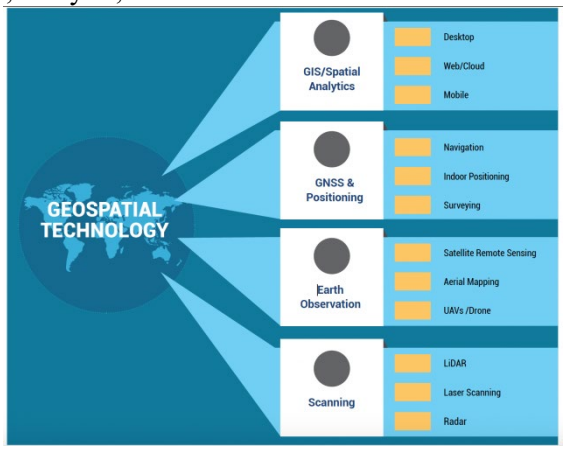
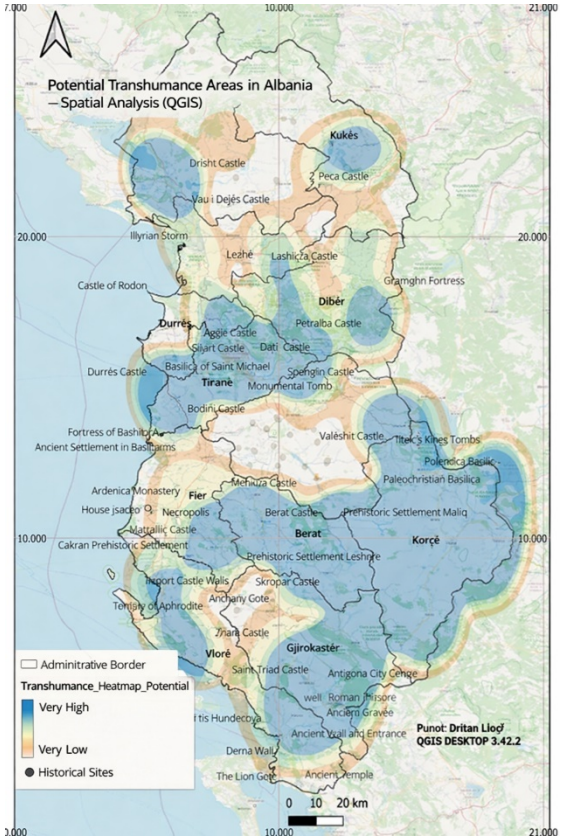


Figure 1: Geospatial technologies. Credits: Geospatial Global Outlook Report 2017/ GeoBuiz Report 2017

GIS provides advanced control over spatial data and adds significant value to the tourism planning process. (Bahaire, T., & Elliott-White, M., 1999)

Geospatial analyses in GIS can more effectively guide the tourism planning and development process by supporting improved spatial decision-making related to the development of tourism systems across the territory.



Map 1: Potential Transhumance Areas in Albania. Source: Dritan LLoci, QGIS, 2025.

Through advanced GIS analyses, key actions for tourism management and planning can be carried out, including:

- GIS-based analyses enable the assessment of location suitability and the spatial distribution of tourism assets, supporting the definition of appropriate tourism typologies, facilities, and service provision. By integrating and sharing spatial data from multiple locations, GIS facilitates informed and multi-level decision-making. In this context, topographic information constitutes a fundamental component of spatial planning, playing a key role in identifying suitable areas for tourism development and ensuring environmental sustainability. It provides information on natural terrain, land cover, including the extent of land, basic land use (such as houses, transportation facilities, location of sewer and drainage facilities and infrastructure, etc.), environmentally sensitive areas that require protection and conservation and showing areas prone to natural disasters (floods, etc.) in which settlements should be avoided, as well as potential development areas. (Nikolli P., Draci B.,Idrizi B.,, 2014)
- The assessment of territorial carrying capacity and the guidance of tourism activities involve evaluating an area's ability to accommodate new tourism products or services, by identifying the most suitable locations as well as areas that should be protected or conserved. This analysis examines conflicting and complementary land uses, infrastructure availability, and natural resources in order to determine the potential of an area to develop as a tourism destination. (Khwanruthai Bunruamkaew & Yuji Murayama,, 2012)
- The modelling of land-use scenarios and the identification of conflicts. GIS supports the detection of spatial patterns and relationships based on defined criteria, thereby enhancing and informing decision-making processes. (McAdam, 1999) This methodology enables the evaluation of alternative land-use options, the simulation of potential impacts, and the identification of areas of conflict between competing interests (such as tourism, agriculture, and environmental protection), thereby supporting integrated decision-making.
- Tourist flow management and tourism marketing. In this context, GIS enables space–time analyses of tourist behavior through online platforms. By analyzing visitor numbers and their socio-economic and demographic characteristics, GIS improves the management of infrastructure and tourism activities, while also supporting environmental protection. (Farsari, Ioanna & Prastacos, Poulicos, 2001)

In relation to an applicable model of tourism spatial planning in Albania, which can be operationalized through GIS analyses and the use of official geospatial data, a conceptual scheme has been developed. This scheme can be considered the outcome of a multifactorial analysis aimed at supporting decision-making based on integrated spatial information and at categorizing coastal areas according to their development orientation. It contributes to the identification of priority zones for tourism development, the restriction of interventions in environmentally sensitive areas, and the achievement of a balanced relationship between tourism, the environment, and other land uses.

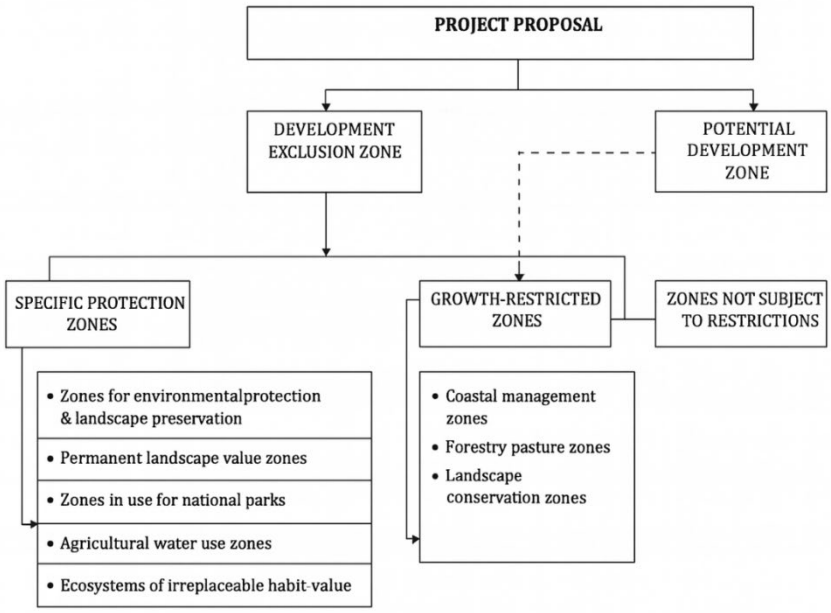


Figure 2: Geospatial technologies. The modelling of land-use scenarios and the identification of conflicts. Source: Authors (2025)

Figure 2 clearly illustrates the spatial logic underlying integrated tourism planning, reflecting the core principles of sustainable territorial development addressed in this study. The division of the territory into development exclusion zones, growth-restricted zones, and potential development zones directly corresponds to the need to manage tourism pressures in relation to territorial carrying capacity, environmental sensitivity, and landscape values. This approach reflects Albania's spatial reality, where coastal areas, protected ecosystems, and landscapes of high natural and cultural value require clearly defined development constraints in order to prevent degradation and overexploitation.

Sustainable tourism development in Albania is a spatial process that requires integrated planning supported by geospatial technologies, particularly in response to growing pressures on land, ecosystems, and communities. From a geographical perspective, GIS-based planning enables territorially informed decision-making, supporting balanced tourism development, resource protection, and the long-term sustainability and competitiveness of destinations.

3. Tourism and Geospatial Technologies as a Platform for Territorial Governance

In Albania, there have been several initiatives aimed at the preparation of tourism development programs and plans. The National Tourism Strategy 2014–2020 represents an important document for the development of tourism in Albania, serving as the main platform linked to policies, reforms, and measures in the tourism sector. In recent years, with the support of the World Bank and the European Investment Bank, in partnership with the European Union and UNDP, Albania has undertaken the preparation of integrated coastal zone management (ICZM) plans, coordinated with Mediterranean countries, particularly those of the southern and eastern regions. These initiatives aim to address spatial, environmental, and territorial constraints to sustainable development through coherent policies, planning instruments, and investment programs. They operate across national, bilateral, and multilateral scales, reflecting a multi-level governance approach to coastal and territorial planning.

Another important document is the National Tourism Strategy, which defines the medium- and long-term vision for tourism development in the country by identifying priority tourism products, national clusters, and measures aimed at enhancing competitiveness. The geospatial data underpinning this strategy support analyses and action plans for diversifying the tourism offer, improving service quality, upgrading infrastructure, and steering the tourism industry toward sustainable development models.

Geospatial data for a tourism area such as its location, size, boundaries, accessibility, physical and functional characteristics, natural and infrastructural resources, and development constraint or exclusion zones are essential for land-use suitability assessment and for the effective planning and management of development. The creation and maintenance of topographic (spatial) databases have traditionally been the responsibility of state institutions responsible for surveying and cartography. The spatial data required for spatial/territorial planning in Albania, provided by state institutions, although not yet fully integrated into GIS, generally meet the requirements in terms of quantity, completeness, compatibility, quality, accuracy, and geographical and thematic suitability. (Nikolli P., Draci B.,Idrizi B.,, 2014)

Meanwhile, the National Spatial Plan 2015–2030 sets out objectives related to spatial development, the protection of natural resources, the orientation of urbanization, and the development of national infrastructure issues that are closely linked to tourism spatial planning and to achieving balanced territorial development among sectors such as the environment, agriculture, and industry. A sectoral plan related to areas with high development potential and areas subject to strict environmental constraints in relation to tourism is the Intersectoral Plan for the Coastal Belt 2030.

In this context it is crucial to demostrate how the systematic use of spatial data supports sustainable land-use allocation, enables the assessment of territorial carrying capacity, and informs strategic decisions aimed at developing competitive, resilient, and environmentally responsible tourism destinations.

Table Nr.1: Geospatial Data Framework for Tourism Spatial Planning in Albania (INSPIRE-Context). Source: Authors (2025)

System / Data Provider	INSPIRE Theme	Data Category	Relevance for Tourism Spatial Planning
National Land Information System	Elevation, Land Cover, Geographical Names, Transport Networks	Topographic and Elevation Data	Supports site suitability analysis, landscape assessment, accessibility analysis, risk-sensitive planning, and identification of environmentally suitable areas for tourism development.
Immovable Property Registration System	Cadastral Parcels, Administrative Units	Cadastral and Property Data	Provides legal and spatial clarity on land ownership, parcel boundaries, and land-use rights, essential for zoning, investment planning, and conflict mitigation.
Public Service Sector Management Systems	Utility and Government Services	Infrastructure and Service Networks	Enables assessment of infrastructure capacity (transport, water, energy, communications) to support tourism demand and improve destination competitiveness.
Integrated Environmental and Ecological Information System	Protected Sites, Environmental Monitoring Facilities, Soil, Hydrography	Environmental and Ecological Data	Supports carrying capacity assessment, environmental impact analysis, conservation planning, and sustainable management of sensitive coastal and natural tourism areas.

The above table of contents constitutes a guiding framework for identifying sustainable development objectives related to sustainable development and the role of geospatial technologies in supporting their achievement. The main geospatial systems used for tourism spatial planning in Albania, harmonized with the

INSPIRE principles and adapted to policy decisions, provide a key framework for linking tourism development with sustainable development objectives, enabling the monitoring of the economic, environmental and social impacts of this sector. Evidence-based and real-world data-based tourism spatial planning promotes sustainable tourism development throughout the country.

Table Nr.2: National Geoinformation Systems and Sustainable Tourism Planning Platform, Albania Context. Source: Authors (2025)

Data System / Source	SDG Framework	Key Indicators and Relevance for Tourism
Earth Observation and Monitoring Systems	SDG 8: Valuable employment and economic growth	- Tourism contribution to GDP - Tourism employment share
National Spatial Data Infrastructure	SDG 12: Responsible Consumption and Production	- Instruments for monitoring tourism sustainability
National Statistical Systems	SDG 14: Life Below Water	- Marine protected areas - Coastal pollution index
National Administrative Data	SDG 15: Life on Land	- Protected terrestrial areas - Mountain ecosystem conservation
National Geoportal	SDG 11: Sustainable Cities and Communities	- Expenditure on cultural heritage protection - Access to public spaces
Big Data Sources	SDG 13:Climate Action	- CO_2 emissions from tourism, renewable energy use in accommodation facilities - climate adaptation measures.
Other Data Sources	SDG 5, SDG 1, SDG 10, Equalitya nd Poverty Reduction	- women's employment in tourism, - impact on rural households, - reduction of social and regional inequalities.

Tourism is a sector that needs an integrated and dedicated planning system, including other sectors. In this regard, it is worth highlighting the important role of the State Authority for Geospatial Information ASIG), which supports decision-making institutions and the latest geospatial data through a national open data portal, creating an environment in which data on different topics are integrated.

This Institution has played a central role in the development of the National Spatial Data Infrastructure (NSDI) by ensuring the harmonization of geospatial datasets, the creation of national geospatial registers, standardization in line with INSPIRE Directive.

This progress involves topographic data, cadastral data,environmental data, natural resources data, infrastructure datasets, supporting tourism spatial planning.

Together with other institutions such as the National Territorial Control Agency, the National Agency for Territorial Planning (AKPT), and the State Cadastre Agency national standards have been established for spatial enhancing planning.

GIS-based tourism analyses are increasingly integrated into the National Spatial Plan, Coastal Intersectoral Plans, Local General Plans, etc.

The uses of geospatial technologies also include platforms related to digital governance mainly in community applications for building permits, cadastral services, etc. supporting tourism development scenarios, land suitability analyses, tourism infrastructure planning forecasts, identifying priority areas for tourism development, etc.

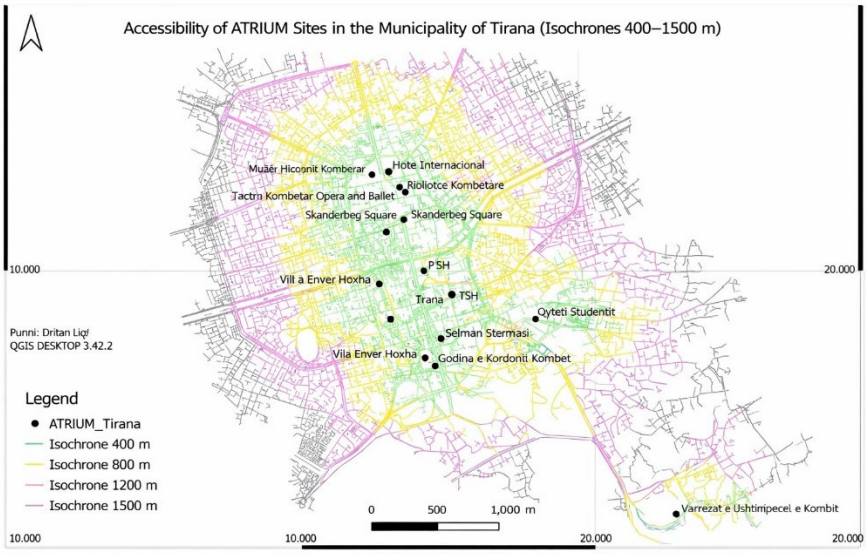
4. Using GIS technology in Council of Europe Cultural Routes-Territory of Albania Case

The Cultural Routes of the Council of Europe can be understood as territorial networks that bring together heritage sites, landscapes, services, and communities, connected through a shared narrative (CE, 2025). In Albania's case, this approach is particularly useful because tourism pressure, infrastructure standards, and environmental sensitivity are not uniform, but vary significantly from one area to another. In this context, GIS turns the "itinerary idea" into concrete planning questions: where the key nodes are, how they are interconnected, which corridors are realistically feasible, and in which sections protective measures or stricter visitor management are required.

This case study directly supports the paper's aim to improve sustainable tourism decision-making through itinerary mapping, infrastructure assessment, zoning, and carrying-capacity-oriented management.
Geographic Information Systems (GIS) play an important role in the documentation, analysis, and spatial planning of cultural routes certified by the Council of Europe. Although these itineraries are gaining increasing importance at the European level, Albania remains poorly represented in official European data and maps referring to certified routes. The lack of georeferenced information reduces visibility and makes it more difficult to integrate Albania's cultural heritage into the broader European cultural landscape.
The maps presented below have been prepared using GIS technologies as a contribution to the identification, documentation, and planning of cultural itineraries in Albania. They aim to support evidence-based spatial planning, strengthen territorial coherence, and facilitate Albania's future inclusion in the European network of certified Cultural Routes.

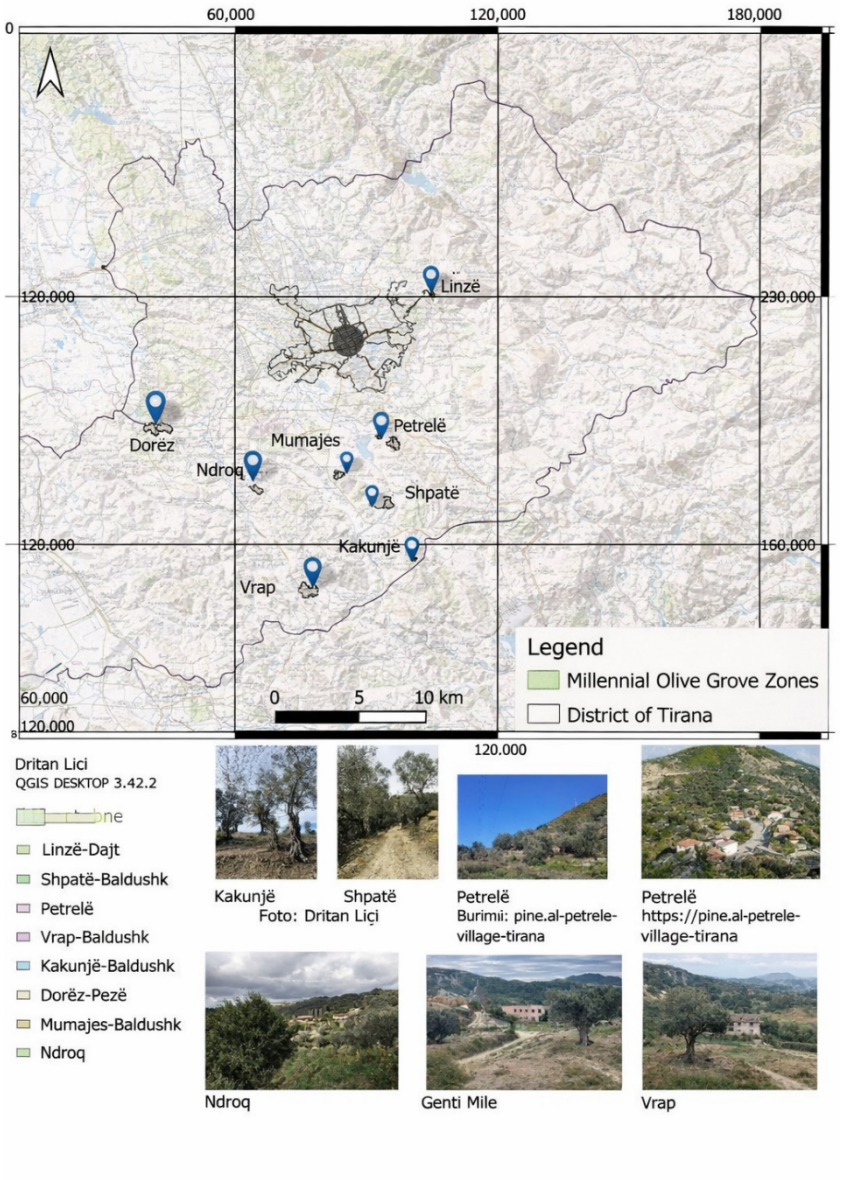


Map 2: ATRIUM – Architecture of Totalitarian Regimes in Europe's Urban Memory (Tirana, Albania) a European Cultural Route (certified by the Council of Europe) Source: Dritan LLoci, QGIS, 2025.



Map 3: Accessibility of ATRIUM Sites in the Municipality of Tirana (Isochrones 400–1500 m). Source: Dritan LLoci, QGIS, 2025.

The route inventory is divided into three types of map elements: points (places to visit and services), lines (route sections and the connections between them), and areas/polygons (landscape zones, protected areas, and planning zones). To make different itineraries comparable, a set of basic information is recorded for each element: its category, whether it is protected, how accessible it is, whether it is seasonal, what services are available, and short notes on management. Where possible, photos and references/sources are also included as part of the data to support interpretation and monitoring.
The data are collected by combining official layers (administrative boundaries, roads, land cover, protected areas, elevation) with local inventories and field verification. If geotagged photos are taken in the field and short mobile forms are completed on site, accuracy improves and consistent information can be gathered on site conditions and small-scale infrastructure needs.



Map 4: Spatial Distribution of Millennial Olive Groves in the Tirana District. Source: Dritan LLoci, QGIS, 2025.
After mapping, a few simple GIS analyses can quickly produce clear planning insights. You can assess how easy it is to reach an area by looking at how far it is from roads and settlements, and when better network data

are available, you can also estimate travel time. You can also see where attractions are concentrated along possible corridors, to identify strong clusters of points of interest and "gaps" where the route offer is weak.
Then environmental constraints are added: protected areas and other sensitive zones are overlaid on the map to clearly show the segments where interventions should be limited or development should be restrained. To decide what to address first, a simple scoring approach (e.g., 1–5) can be used for each node or segment, based on factors such as accessibility, the importance of the asset, the availability of services, and environmental sensitivity.
The outputs are designed for practical use by institutions and local actors. They include maps showing the route type, areas that need priority action and areas with constraints, as well as ranked lists of nodes and segments where small but useful investments should be made (interpretation, signage, trail maintenance, small visitor services). An interactive online map helps with field validation, coordination between institutions, and updates as conditions change.
These products help connect route development with land-use planning and tourism planning, making the process clearer and more coordinated.
A GIS-based workflow makes trade-offs more visible: for example, you can test whether better access would harm sensitive areas, or whether expanding the route matches service capacity and environmental limits. It also creates a shared evidence base that helps stakeholders communicate in the same "language" and makes long-term monitoring easier.
The main challenge is that local data are often incomplete or uneven across areas and require regular updates. That is why clear metadata standards, interoperable datasets, and an institutional routine for keeping route layers and attributes up to date are essential.

5. Conclusions and Recommendations

The development of tourism in Albania is guided by the planning of the development of the territory in general, spatial differentiation and the interactions of nature, man, environment. The uneven distribution of tourist resources, accessibility, infrastructure and environmental sensitivity throughout the territory highlights the need for a planning approach respecting the regional diversity of tourist and supporting resources, but also the limitations of the development of protected areas or fragile natural environments.
GIS-based tourism spatial planning provides a theoretical, practical and analytical framework to understand land use patterns, development scenarios as well as the carrying capacity of the territory and the economic and environmental impacts of tourism development.
The integration of geospatial technologies enables the interpretation of tourism as a territorial system, where natural assets, cultural heritage, settlements, and infrastructure interact within defined spatial limits.
Using geospatial data and generating predictive geospatial models to assess current conditions and future scenarios often face several challenges, including:

- Lack of complete digitization of the data needed for tourism planning;
- Lack of real-time monitoring platforms for activities related to tourism and its impact on the environment;
- Limited institutional capacities to effectively implement and use geospatial technologies;.

GIS-based assessments of landscape sensitivity, ecological vulnerability and territorial carrying capacity should guide central and local decision-making for tourism zoning, accessibility models, avoiding traditional development models and promoting location-based tourism strategies. Spatial planning based on GIS strengthens the capacity to manage tourism growth while preserving natural and cultural resources, in support of balanced regional development

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HETEROGENEOUS SENSIBILITY AND THE POLITICS OF HOUSING ADAPTATION: SYRIAN DISPLACED FAMILIES IN BEIRUT VERTICAL SETTLEMENT

Goran Ivo MARINOVIC[112]

ABSTRACT
Dwelling adaptation by displaced populations is a widespread phenomenon, arising from precarious living conditions, survival strategies and community resilience. Yet these adaptations remain confined either to narratives emphasising their resourcefulness or to critiques framing them as violations, without sufficient understanding of how and why they emerge under conditions of displacement. Existing frameworks that attribute housing modification solely to housing scarcity, legal precarity and architectural constraints ultimately prove insufficient. This paper examines dwelling adaptation amongst Syrian migrant families through analysis of the Wizarat Al-Iqtissad building in Beirut. Drawing attention to the impact of cyclical mobility on the intensity and distribution of housing modifications, it invokes the concept of 'heterogeneous sensibility' to argue that residents do not merely occupy places passively but collectively enact negotiated activities within a self-regulatory process that challenges the dominant building codes. The heterogeneous sensibility of housing encompasses agency through spatial reframing, the performativity of marginalised practices and overlapping temporalities, transcending representational conceptions of shelter.
Key Words: Jacques Rancière; migrants' dwelling practices; informal settlements; dwelling adaptation; community building; urban migrants in the city centre.

Revolution is possible because the community […] has a double nature – it is a work of art that escapes when we try to seize hold of it. (Rancière, 2011, p.142)

1. Introduction

This paper makes three contributions to housing and displacement studies by operationalising the sensibility aesthetic framework. First, we demonstrate the ways in which Jacques Rancière's concept of heterogeneous sensibility informs architectural analysis of informal inhabitation. Rather than categorising vertical settlements as either humanitarian crisis or resilient adaptation, this approach reveals them as sites where housing solutions become contestable—where the boundaries between inhabitable and uninhabitable, between home and ruin, prove fundamentally unstable and politically charged.

Second, we document previously unexamined adaptation strategies within the Wizarat Al Iqtissad building, revealing the means by which displaced communities collectively reshape multi-storey structures for communal dwelling. These documented practices illustrate the heterogeneous sensible in material form: showing uninhabited buildings becoming dwelling places, structural ruins becoming community infrastructure, spaces designated for growth and monetary values becoming homes of marginalised populations. This documentation makes visible the sophisticated spatial intelligence embedded in informal housing practices—intelligence typically rendered illegible by professional standards that recognise only formally authorised habitation.

Third, we propose a methodological approach for architects to learn from the housing innovations of marginalised communities rather than imposing external solutions. This methodological reorientation addresses what Rakowitz (2013, p. 45) identifies as architecture's lost political potential that has been overwhelmed by economic realities. By treating vertical settlements as sites of architectural knowledge rather than merely humanitarian need, we attempt to shift professional practice from designing for displaced populations to learning from their heterogeneous housing strategies.

The Wizarat Al Iqtissad building, locally known as the Ministry of Economy due to its proximity to the former ministry location, in Beirut's Hamra district, provides the empirical foundation for these theoretical elaborations. This uninhabited 13-storey structure, spontaneously occupied by Syrian migrant households, exemplifies what Lancione (2020, p. 3) describes as housing that appears uninhabitable and threatens to render their inhabitants not really or fully human due to professionals' and authorities' failure to provide affordable, safe living environments. The inhabitation occurs within wider structural forms of violence, including patriarchy, racism, class exploitation, and, of course, deprivation of shelter (Lancione, 2020, p. 3), making it a

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critical site for understanding the emergence of heterogeneous housing from conditions of extreme marginalisation.

Paradoxically, whilst armed, political, social, and economic conflicts create transformative opportunities for housing innovation (Abenia, 2015), this potential has been suppressed under social, economic, and political apathy. We counter such apathy by demonstrating how the vertical camp embodies the heterogeneous sensible: it is simultaneously a survival strategy and housing innovation, simultaneously a marginalised dwelling and sophisticated spatial practice, simultaneously excluded from the built environment and generative of new inhabitation possibilities.

From August 2024 to May 2025, a research team conducted a qualitative case study using a methodology that engaged with participants and documented the building's transformation, capturing households' perspectives on informal vertical settlement. This approach develops theoretical insights on future dwelling practice (Creswell & Creswell, 2018), specifically tracing through social action and economic disparity, producing possibilities for heterogeneous housing. The methodology identifies what Curien (2024, p. 55) calls the epistemological effects of this commitment to learning from marginalised inhabitation practices, addressing three key questions: What dwelling adaptation strategies do Syrian migrants employ in vertical settlements? In what ways do these housing strategies challenge conventional building codes through the heterogeneous sensible? In what ways can documentation of informal housing practices recognise migrants' political dimensions?

Through analysing these dynamics, the paper reveals the fragmentation and reimagination of inhabitation through adaptation to extreme living conditions, ultimately arguing for architects' accountability in proposing the appropriation of existing buildings rather than generating resource-intensive new construction. More fundamentally, we analysed how vertical settlements exist simultaneously as uninhabited structures and lived spaces caught between the autonomy of self-organised dwelling and the heteronomy of structural violence and dispossession.

We demonstrate the capacity of the heterogeneous sensible to provide a theoretical framework for understanding migrants' inhabitation beyond formal/informal, adequate/inadequate, or authorised/unauthorised. By focusing on the spatial alternations of vertical settlements, the paper argues for heterogeneous housing whilst remaining critically aware of the structural violence that forced migrants to occupy abandoned buildings. This approach enables excluded and invisible communities to step beyond stigmatisation through the very act of making their adaptive spatial strategies visible within—not only as a resilient adaptation, but as evidence of the political possibilities embedded in that mode of living.

[…], rationalization of the different phases of activities becomes a response both to the old hierarchical order and to the 'aesthetic revolution'. The whole motto of the political aesthetic regime, then, can be spelled out as follows: let us save the 'heterogenous sensible'. (Rancière, 2011, p.142/3)

2. Literature Review

2.1. Theoretical Context

Jacques Rancière's conceptualisation of heterogeneous sensible forms and material structures for a life to come (2017, p. 12) provides the theoretical foundation for understanding how housing practices by forced displaced populations challenge building codes. Central to Rancière's philosophy is the concept of heterogeneous sensible—the disruption of the established order through practices that introduce new subjects and possibilities into the common world (Rancière, 1999). Heterogeneous sensibility reveals how seemingly mundane acts of occupation function as political interventions that challenge who can legitimately inhabit urban buildings, and under what conditions.

This paper mobilises Jacques Rancière's concept of the heterogeneous sensible to theorise how informal inhabitation practices disrupt established orders of housing legitimacy. The heterogeneous sensible describes a condition where inhabited spaces exist simultaneously as themselves and as something other than themselves, occupying a threshold between categories that makes transformation possible (Rancière, 2002). In housing terms, this theoretical frame reveals how uninhabited buildings become paradoxical sites: simultaneously uninhabitable ruins and inhabited homes, simultaneously excluded from formal urban planning and actively constituting heterogeneous sensibility dwelling practices.

The heterogeneous sensible reveals how the very act of inhabiting uninhabitable spaces challenges dominant definitions of what constitutes proper inhabitation. When displaced communities occupy uninhabited multi-storey structures, they expose the contingency of professional standards that render certain spaces illegible as

housing. The heterogeneous sensible helps theorise how informal dwelling exists in perpetual tension between autonomy (self-organised dwelling practices independent of state or humanitarian control) and heteronomy (dependence on existing structures, urban infrastructure, and spatial configurations not designed for habitation).

This theoretical approach departs from conventional displacement housing studies that typically frame informal occupation either as a humanitarian crisis requiring external intervention or as a resilient adaptation to be celebrated. Instead, understanding vertical settlements through the heterogeneous sensible reveals them as sites where the very boundaries of housing, between inhabitable and uninhabitable, between home and ruin, become permeable and contestable. These settlements embody practices that redistribute places and forms of participation in a common world by making visible those previously excluded from legitimate habitation (Rancière, 2013, p. 85).

2.2. Heterogeneous Sensibility of Housing

This paper investigates informal occupation and modification of uninhabited buildings as heterogeneous housing—spatial practices that emerge from challenging dominant assumptions about legitimate habitation. This housing operates through what Rancière describes as the disruption of the distribution of the sensible: the established order that determines what can be seen, said, and done within a given spatial and social configuration. When Syrian migrants occupy the Wizarat Al Iqtissad building in Beirut's Hamra district, they fundamentally challenge the political order that designated this space as abandoned, uninhabitable, and outside the realm of legitimate housing.

This challenge involves vertical informal camps—multi-storey buildings spontaneously occupied by displaced populations and regulated through informal governance rather than humanitarian agencies or governmental housing oversight (Samhan & Boano, 2025). The Wizarat Al Iqtissad exemplify heterogeneous sensibility: the transformation of spaces designated as ruins into what Jordan and Minca (2023) call makeshift homes and what Bakonyi and Chonka (2023) identify as permanent community places. These territories constitute multiple incremental and transformative acts with the ultimate purpose to hold and resist marginalisation from formal housing systems (Boano & Astolfo, 2020, p. 555).

The connection between heterogeneous sensibility and informal inhibition reveals an inherently political nature. Vertical informalities are housing precisely because they challenge what housing is understood to be. They embody both autonomy (communities self-organising dwelling without external authorisation) and heteronomy (dependence on uninhabited structures, urban infrastructure, and the very exclusion that makes occupation necessary). These conditions generate what Simone (2023, p. 3) describes as a plethora of registers, apertures, potentialities and an ontology of indeterminacy that functions as a locus of continuous rebellion against exclusion from formal urban planning.

2.3. Forced Displacement and Housing Exclusion in Lebanon

Forced displacement has reached unprecedented levels, with 60.9 million people forcibly displaced in 2022—a 60% increase from the previous year—exposing fundamental housing unpreparedness across urban systems (Nagle Alverio et al., 2025; IDMC, 2023). Forced displacement occurs when individuals are compelled to relocate from their places of usual residence due to disasters, be they natural or human-made (Cuadrado et al., 2023).

Lebanon's experience hosting over 1.5 million forcibly displaced Syrians since 2011 provides a critical context for examining how exclusion from affordable housing generates sensibility politics (Kikano et al., 2021). The scale of this displacement—creating the highest refugee per capita concentration worldwide (Brun and Maalouf, 2022)—has exposed fundamental limitations in both humanitarian responses and housing provision systems. With 75% of Syrian displaced households living in extreme poverty and inhabiting Beirut's informal housing areas and uninhabited buildings (UN Inter-Agency Coordination Lebanon, 2024), conventional approaches to migrant housing have proven inadequate.

Syrian migrants face systemic exclusion from affordable housing through legal restrictions, including prohibitions on formal employment, and restrictions on property ownership (Fouad et al, 2021). Brown et al. (2015) identify how these exclusions create informal land acquisition, conflict-driven resettlement, housing rights advocacy, insecure tenure, and gender discrimination. Crawford (2013) argues that such insecure tenure represents a pervasive manifestation of urban inequality, yet conventional responses have focused on informal neighbourhood expansions rather than understanding the adaptive spatial strategies employed by displaced populations themselves.

This exclusion occurs within a context of significant housing stock underutilisation. Pietrostefani (2022) documents an incomparable quantity of unlet and unsold housing units in Beirut, whilst Mazzetto et al. (2024) indicate that up to 20% of built accommodation units across all neighbourhoods remain uninhabited. Stanganelli et al. (2023) define uninhabited structures as buildings halted before completion, forsaken due to prohibitive maintenance costs, or evacuated during armed conflicts, but there is insufficient documentation of how these structures are transformed through migrants' occupation. This paradox—simultaneous housing crisis and abundance of unused housing—suggests that displacement inhibition difficulties are not primarily about scarcity but about systems of exclusion that prevent them from inhabiting available urban units.

2.4. Informal Vertical Housing

Recent scholarship has moved beyond viewing informal housing as merely a response to dwelling shortages, instead examining how displaced populations actively reshape urban environments through inhabitation practices. Feng and Zhu (2022) observe that displacement frequently creates opportunities for occupying abandoned buildings and spaces that involve active housing modification rather than passive accommodation. This perspective challenges conventional framings of displaced populations as passive recipients of humanitarian assistance.

The concept of heterogeneous sensibility offers a more nuanced understanding of these habitation practices. Rather than a temporary occupation, this sensibility involves what Boano and Astolfo (2020, p. 555) describe as multiple incremental and transformative acts with the ultimate purpose of holding and resisting marginalisation. This process encompasses social transformation, as displaced communities create not merely shelter but sites of community formation and political resistance. Stoetzer argues that communities develop in marginal spaces and depend on edge effects and the juxtaposition of contrasting environments in one ecosystem (2018, p. 297). Applied to housing contexts, this concept illuminates how uninhabited buildings function as collective inhabitation.

This paper addresses the collective inhabitation by examining Syrian migrants' occupation of the Wizarat Al Iqtissad building in Beirut through Rancière's concept of heterogeneous sensibility. Rather than prescribing solutions for forced displacement, we investigate how socio-spatial invisible dwelling strategies emerge because of the systematic exclusion of displaced populations. By focusing on a single building as a site of collective adaptation, the paper offers insights into the micro-politics of informality and the dwelling strategies that emerge under conditions of marginality.

The paper contributes to scholarship on migrant housing by documenting how displaced populations actively reshape built environments whilst negotiating uncertain legal status. We challenge humanitarian housing's emphasis on purpose-built solutions by revealing the housing innovations already occurring within displaced communities, thereby suggesting alternation of existing housing practices rather than replacing them with new developments.

The works of the past can be considered as forms for new content or raw materials for new formations. They can be re-viewed, re-framed, re-read, re-made.(Rancière, 2011, p.143)

3. Methodology

The research was conducted in the Wizarat Al Iqtissad building in Beirut's Hamra district, which has been informally inhabited by Syrian migrant families since 2014. Participants were selected using purposive sampling to ensure representation across different periods of residence and household compositions. The sample included 14 participants representing households with varying lengths of residence, from four months to approximately ten years, comprising both family units and single migrant workers. Sample size was determined through theoretical saturation principles, with data collection ceasing when no new themes emerged regarding housing adaptation practices across different household types and residence durations (Guest et al., 2006).

Data collection occurred between August 2024 and January 2025 using multiple qualitative methods. Semi-structured interviews explored participants' experiences of housing modification, community relationships, and daily life within the building. Photo-elicitation sessions involved participants photographing significant housing spaces within their apartments and common areas, followed by discussions about dwelling meanings. Questionnaires gathered demographic information and housing histories.

Participant observation followed systematic protocols (Salmona & Kaczynski, 2024) involving twice-weekly visits over six months, with each visit lasting 1-2 hours during different times of day to capture varying housing

uses. Observations were documented through detailed fieldnotes focusing on housing arrangements, modifications, social interactions, and daily routines. A structured observation template recorded dwelling configurations, material modifications, and social activities, ensuring consistent data collection across visits.

3.1. Researcher Positionality and Reflexivity

As an international researcher with privileged legal status and economic position, I acknowledge significant power imbalances with participants experiencing legal precarity and economic hardship. My position as an outsider to both Lebanese society and the Syrian migrants experience required sensitivity to avoid extractive research practices (Hilaire, 2023). Regular reflection sessions with Arabic-speaking research assistants helped identify potential biases, cultural misinterpretations, and navigate complex cultural dynamics. Reliance on research assistants for linguistic mediation created additional layers of interpretation that required careful consideration. Class, nationality, and legal status differences remained significant factors requiring ongoing reflexive attention throughout data collection and analysis.

Ethical approval by the Ethical Board of the American University of Beirut was obtained with particular attention to vulnerability guidelines. All participants provided informed consent in Arabic, with emphasis on voluntary participation and withdrawal rights. The sampling strategy prioritised households with longer residence periods initially, then included recently arrived families to examine temporal dimensions of housing adaptation.

Data analysis employed Braun and Clarke's (2025) reflexive thematic analysis, with initial coding focused on dwelling practices, community relationships, and adaptation strategies. All interviews were conducted in Arabic, recorded with permission, and transcribed by bilingual research assistants with translation accuracy verified through back-translation of selected excerpts. The analysis recognises that housing concepts may carry different cultural meanings, requiring careful interpretation across linguistic contexts.

The research also occurred during a specific period of Lebanon's economic crisis and the 2024 Israeli bombing of Beirut, which may have intensified both housing constraints and adaptive strategies in ways that might not reflect practices under different conditions. Additionally, the focus on housing modifications meant that other dimensions of community formation, such as economic networks, educational arrangements, or healthcare strategies, received limited attention, potentially overlooking important aspects of how displaced populations create liveable communities.

By making what is ordinary extraordinary, it makes what is extraordinary ordinary, too. For this contradiction, it makes a kind of politics – or metapolitics- of its own. (Rancière, 2011, p.145)

4. The Occupation of Highrise

The Wizarat Al Iqtissad building, constructed in the late 1950s during Lebanon's development boom, emerged as a desirable housing location as the Hamra neighbourhood became the new business centre. Since the Lebanese Civil War (1975-1999), property records show contested ownership, with a Syrian retiree serving as caretaker, known among families as the de facto building owner (August 2024, interview). Whilst few occupants are his relatives, most households secured housing through word of mouth. They all paid a monthly rent of 300 US$ to the building gatekeeper and reported fears of forceful eviction. Two building managers verbally dictated rental terms to tenants, including duration of stay, regardless of housing conditions. The caretaker lets the underground car park to local employees and leases space behind the building to an informal electricity supplier's three large generators, whose noise residents have to tolerate. Occupants object to the supplier selling energy to the entire block, including 2.5 Amps/apartment.

The original housing design featured studios and one-bedroom apartments on the first five floors, with larger two- to three-bedroom units above. Current migrant modifications include first- and second-floor workers' dormitories housing six men per room. Upper floors contain two-bedroom apartments with increasing tenant density; observations reveal multiple families sharing units to split rent, averaging five to seven occupants per room (Figure 1). Most apartments contain only mattresses and lack proper kitchens or bathrooms, compelling households to create makeshift facilities in hallways or room corners. Households modified and deteriorated walls and floors using recycled foil, wallpaper, and paint layers. Most units lack formal furniture; thus, occupants utilise recycled pieces covered with cloth for hygiene. Bedrooms typically contain floor-placed mattresses or stored rollaway blankets for daily activities. Following the building's abandonment and complete interior dismantling, including all doors, windows, flooring, and kitchen/bathroom facilities, families invested in the toilet function and improvised a kitchen in its original location.

The engineer-designer wants to create objects whose form fits their use and advertisements which offer exact information about them, without commercial embellishment. (Rancière, 2011, p.140)

5. Toward Heterogeneous Sensibility

5.1 Housing Adaptations as Manifestations of the Heterogeneous Sensible

The findings from the Wizarat Al Iqtissad building reveal how Syrian migrant households transform uninhabited apartments into residential spaces through systematic housing modifications. Whilst acknowledging the precarious conditions faced by Syrian migrants in Lebanon, including periodic raids by Lebanese General Security Forces that result in temporary detention of male residents, this analysis concentrates on the housing strategies employed within the building itself. Participants reported dismantling internal partitions to create flexible living spaces that serve multiple purposes throughout the day. Balconies were frequently converted into cooking areas whilst original kitchen spaces were repurposed for food storage, reflecting adaptations to limited infrastructure constraints (Figure 1). These modifications address practical needs such as child safety, accommodating extended families, and creating functional flexibility within the constraints of housing design originally intended for different purposes. These spatial adaptations demonstrate what is understood as incremental place-making practices that transform the building's intended function. Rather than passively occupying existing abandoned apartments, households actively reshape their environments to better suit their needs and circumstances. This process involves both individual household modifications and collective negotiations over shared spaces and resources, embodying the heterogeneous sensible through the simultaneous existence of the building as uninhabited ruin and inhabited home. The transformation of designated uninhabitable space into dwelling places illustrates Rancière's concept of heterogeneous sensibility. Each modification challenges building code standards that render such adaptations illegible. These practices make visible the sophisticated spatial intelligence embedded in occupying intelligence.

5.2. Interior Adaptation and Housing Negotiations

The research reveals sophisticated strategies that transform uninhabited apartments into functional dwelling spaces. Households systematically reconfigure interior layouts through partition removal, material recycling, and incremental modifications that address both immediate needs and long-term habitability. Participants reported dismantling non-structural walls to create multipurpose spaces, converting balconies into cooking areas with improvised ventilation systems, and establishing makeshift bathroom facilities in corners of rooms or hallways where plumbing infrastructure remains accessible (Figure 2).

Material adaptations demonstrate resourcefulness under severe constraints. Households employ recycled materials—foil, wallpaper remnants, salvaged timber, and fabric—to repair deteriorated surfaces and create functional divisions within spaces. These modifications serve multiple purposes: improving thermal comfort, establishing visual privacy between families sharing apartments, and creating storage solutions where built-in furniture has been stripped away. Participants described coordinating material procurement through informal networks, with households sharing tools and expertise for repairs.



Figure 1. Housing modification by migrant households. Source: Author, 2025.

Interior adaptations extend beyond individual apartments to encompass collective modifications of shared spaces. Households negotiated the transformation of stairwells into communal storage areas, established informal water collection points on landings where supply remains intermittent, and created makeshift electricity distribution systems connecting apartments to the building's limited power supply. These collective interventions required ongoing negotiation between households regarding access, maintenance responsibilities, and resource allocation.

The interior adaptation patterns also reveal informal governance structures that emerge to manage resource allocation and conflict resolution. Whilst these structures operate outside formal institutional frameworks, they enable collective inhabitation and community formation within the building. We observed households' shared use of common areas, coordinated infrastructure improvements, and mediated disputes without external intervention. These governance practices constitute what Simone (2023, p. 3) identifies as a locus of continuous rebellion against exclusion from the city, demonstrating both the autonomy of self-organised dwelling and the heteronomy of dependence on inadequate infrastructure.

The sophistication of these interior adaptations challenges assumptions that informal housing represents merely makeshift or temporary occupation. Rather, the documented modifications reveal systematic spatial intelligence: households understand structural limitations, coordinate collective improvements, and continuously refine living arrangements to accommodate changing needs. This adaptive capacity operates within severe constraints—legal precarity, economic hardship, infrastructure deterioration—yet generates dwelling solutions that formal housing provision has failed to provide.

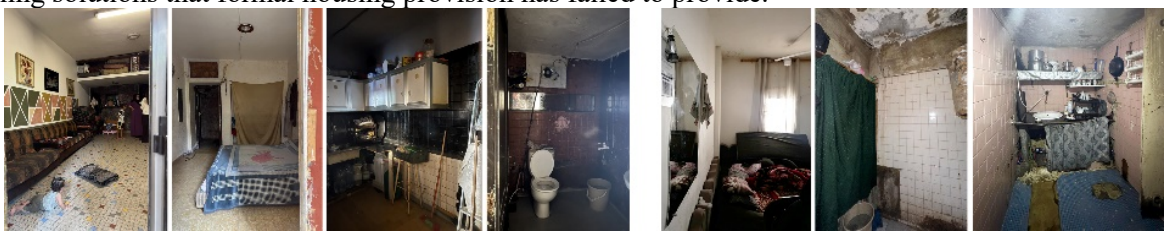


Figure 2. Interior modification by migrant households. Source: Author, 2025.

5.3. Heterogeneous Housing Strategies

The findings demonstrate that occupied buildings should be considered as sites for heterogeneous sensibility that allow the other non-housing-dwelling population to identify affordable possibilities within a hostile housing market (Grange and Gunder, 2018, p. 389). Rather than designing new objects for housing people, architectural practice should engage with the incremental transformation of already existing unit stock through occupation tactics, which require professional support rather than rehousing.

The documented adaptation strategies within the Wizarat Al Iqtissad building challenge conventional dwelling provision through the heterogeneous sensible by revealing the contingency of building code standards. These strategies expose the political dimensions of housing: the determination of what constitutes inhabitable space, who possesses the authority to make such determinations, and the processes by which certain populations become excluded from housing discourse entirely.

Recognition of these housing innovations does not romanticise the precarious conditions under which they emerge. Rather, it acknowledges the structural violence that makes such housing necessary whilst simultaneously recognising the architectural knowledge embedded within these adaptive practices. This dual recognition enables more responsive interventions that learn from heterogeneous housing strategies rather than imposing external solutions that reinforce existing exclusions.

The vertical settlement exemplifies the productive tension between autonomy and heteronomy that characterises all housing under conditions of displacement. It is neither purely emancipatory nor entirely determined by structural violence but exists in the ambiguous space that makes political transformation thinkable. By documenting these dwelling practices, we make visible communities and strategies previously excluded from housing discourse, thereby redistributing architectural legitimacy and challenging the boundaries between inhabitable and uninhabitable, between home and ruin.

The 'spirit of forms' becomes the inverted image of the aesthetic revolution.(Rancière, 2011, p.141)

6. Conclusion

This ethnographic investigation of Syrian migrants' occupation of the Wizarat Al-Iqtissad building in Beirut contributes to scholarship on displacement and housing informality by demonstrating that dwelling practices function as political interventions that challenge dominant housing orders. We advance understanding of informal housing beyond survival strategies, revealing how displaced populations exercise housing agency through what this study terms 'heterogeneous housing'—dwelling practices that make visible alternative possibilities for habitation.

The application of heterogeneous sensitivity to housing analysis yields three significant theoretical insights. First, the framework reveals the ways seemingly mundane housing modifications constitute political acts that disrupt established hierarchies of housing belonging. When households systematically reconfigure uninhabited apartments, dismantling partitions to create multipurpose spaces or converting balconies into cooking areas, they engage in the heterogeneous sensibilities that introduce new subjects and housing possibilities into Beirut's dwelling commons. These modifications expose the contingency of professional standards that render certain spaces illegible as legitimate housing, demonstrating that the boundaries between inhabitable and uninhabitable remain fundamentally unstable and politically charged.

Second, the sophisticated interior adaptation strategies observed within the building—including material recycling, collective infrastructure improvements, and systematic spatial reconfigurations—challenge static conceptualisations of informal housing. Rather than representing merely makeshift or temporary occupation, the documented modifications reveal systematic spatial intelligence through which households understand structural limitations, coordinate collective improvements, and continuously refine living arrangements to accommodate changing needs. These practices embody the productive tension between autonomy (self-organised dwelling independent of state or humanitarian control) and heteronomy (dependence on existing structures, deteriorated infrastructure, and the very exclusion that makes occupation necessary).

Third, the emergence of informal governance structures operating parallel to the formal housing market illustrates how dwelling practices generate alternative forms of community organisation that remain largely invisible to authorities. The negotiation of shared spaces, coordination of infrastructure improvements, and mediation of disputes without external intervention constitute what Simone (2023, p. 3) identifies as 'a locus of continuous rebellion' against exclusion from the rest of the city. These governance mechanisms enable collective inhabitation whilst simultaneously revealing the structural violence that makes such self-organisation necessary.

These findings extend Boano and Astolfo's (2020) conceptualisation of inhabitation by documenting specific mechanisms through which 'incremental and transformative acts' occur in vertical housing settlements. Whilst previous scholarship on informal housing has focused predominantly on horizontal expansion in peripheral areas, this research reveals the ways vertical uninhabited structures enable different dwelling practices that maximise limited footprints through intensive modification and collective adaptation. The study also complicates Stoetzer's (2018) notion of communal spaces by showing how buildings function not merely as marginal environments but as sites of sophisticated community formation that challenge conventional boundaries between formal and informal housing.

However, this investigation reveals tensions within informal housing practices that require critical examination. Whilst household modifications demonstrate adaptive capacity, they occur within conditions of extreme precarity—legal restrictions, economic hardship, and infrastructure deterioration—that raise questions about the sustainability of intensive dwelling modification without professional support. The very sophistication of adaptive strategies should not obscure the structural violence that makes such adaptation necessary, nor should documentation of spatial intelligence romanticise the inadequate living conditions households endure.

Furthermore, the informal governance structures, whilst enabling collective inhabitation, operate through mechanisms that reflect broader patterns of housing marginalisation. Access to apartments and resources depends partially on social networks, economic capacity, and negotiating power, creating internal dynamics that complicate idealistic framings of informal housing as inherently egalitarian. These contradictions highlight the need for a nuanced analysis that recognises both the innovative capacity embedded in dwelling practices and the structural constraints that circumscribe them.

Several methodological limitations affect the interpretation and transferability of these findings. The focus on a single building over six months may not capture longer-term housing adaptations or responses to changing external conditions. The researcher's position as an international scholar with privileged legal status, despite efforts to build rapport through Arabic-speaking assistants, inevitably shaped participants' narratives and potentially limited access to more sensitive aspects of community dynamics or conflicts. Additionally, the research occurred during Lebanon's acute economic crisis and the 2024 Israeli bombing of Beirut, which may have intensified both housing constraints and adaptive strategies in ways that might not reflect practices under different conditions.

This study opens several productive avenues for future investigation. Comparative research examining vertical informal housing settlements across different contexts could reveal the ways building typologies, legal frameworks, and local governance structures shape dwelling adaptation strategies. Longitudinal studies tracking modifications and community formation over extended periods would provide insights into the sustainability and evolution of informal housing practices, particularly regarding the balance between adaptive capacity and structural deterioration.

Additionally, research examining the perspectives of property owners, local authorities, and humanitarian organisations could illuminate the broader housing politics within which informal dwelling practices operate. Investigation of the ways informal housing practices connect to wider urban networks—including labour markets, educational systems, and healthcare provision—would provide a more comprehensive understanding of the means by which displaced populations create liveable communities within conditions of legal precarity. Finally, studies exploring the potential for architects and planners to support rather than replace informal housing innovations could develop practical frameworks for more responsive humanitarian interventions.

The findings demonstrate that informal housing practices constitute sophisticated forms of spatial knowledge that challenge conventional approaches to understanding both displacement and housing development. Rather than viewing such practices as temporary solutions awaiting formal intervention, this paper suggests they represent alternative approaches to housing provision that warrant serious consideration within architectural and planning discourse. The heterogeneous sensibility provides a theoretical framework for understanding these practices beyond binary categories of formal/informal, adequate/inadequate, or authorised/unauthorised, revealing instead the simultaneous contestation of and dependence upon dominant housing orders.

Supporting such practices requires acknowledging both their innovative capacity and their structural limitations, whilst working towards policy frameworks that recognise displaced populations' housing agency without romanticising the conditions of precarity within which such agency emerges. This approach enables excluded and invisible communities to step beyond stigmatisation through the very act of making their adaptive housing strategies visible—not only as resilient adaptation, but as evidence of housing's fundamental instability as a category and the political possibilities embedded in that instability. By documenting these dwelling

practices, architectural research can contribute to redistributing housing legitimacy and challenging the boundaries that determine who can legitimately inhabit which spaces, where, and under what conditions.

7. Acknowledgement & Conflict of Interest
I appreciated the households' kindness and engagement during the fieldwork. The author declares that there are no conflicts of interest.

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TÜRKIYE'S PROTECTED AREA STRATEGY AND MANAGEMENT

Hüccet Vural[113], Ayşe Karahan[114]

Abstract
Protected areas constitute one of the core components of contemporary environmental policies due to their critical role in biodiversity conservation, sustainability of ecosystem services, and balancing human–nature interactions. Defined within the framework of the International Union for Conservation of Nature (IUCN) and the Convention on Biological Diversity, protected areas encompass not only the conservation of species and habitats but also multidimensional functions such as climate change mitigation, disaster risk reduction, conservation of water and soil resources, and enhancement of human well-being.
This study examines the role of protected areas in the context of ecosystem services at both global and national scales, evaluating their historical development, international legal frameworks, and the current legal and institutional structure in Türkiye. Within the scope of the presentation and paper, the functions of protected areas are analysed through supporting, provisioning, regulating, and cultural ecosystem services, emphasizing their contributions to climate regulation, carbon sequestration, biodiversity continuity, disaster prevention, and public health.
The assessment focusing on Türkiye reveals major challenges related to the proportion of protected areas within national territory, diversity of protection statuses, governance fragmentation, and management effectiveness. Findings indicate that the existing protected area network remains below international targets in both quantitative and qualitative terms, particularly regarding representativeness, ecological integrity, and effective governance. Furthermore, fragmented institutional responsibilities, legal inconsistencies, and short-term economic pressures are identified as key factors weakening conservation objectives.
The study argues that, in line with the European Union's targets of protecting 30% of natural areas and restoring 30% of degraded ecosystems, Türkiye should adopt integrated institutional structures, area-based management models, and ecosystem-based planning approaches to enhance the effectiveness of protected areas. In this context, protected areas are conceptualized not merely as conservation instruments but as fundamental components of sustainable development, climate adaptation, and societal well-being.
Keywords: Protected Areas, Ecosystem Services, Biodiversity, Sustainability, Türkiye

1. Introduction

Protected areas constitute one of the principal instruments of contemporary environmental policy with respect to the conservation of biological diversity, the continuity of ecosystem services, and the balancing of human and natural relationships. At the global scale, the accelerating pace of land use change, habitat fragmentation, climate change, and biodiversity loss necessitates a fundamental reappraisal of protected areas. They can no longer be regarded merely as spaces designated for the protection of particular species or landscapes of high aesthetic value. Instead, they must be understood as strategic spatial components that secure the life support systems of the planet as a whole (Dudley, 2008; Watson et al., 2014). The global spatial distribution of protected areas is illustrated in Figure 1. Within this framework, protected areas have evolved beyond the boundaries of nature conservation policy alone and have become integral to broader objectives encompassing sustainable development, climate adaptation, disaster risk reduction, and societal well-being.

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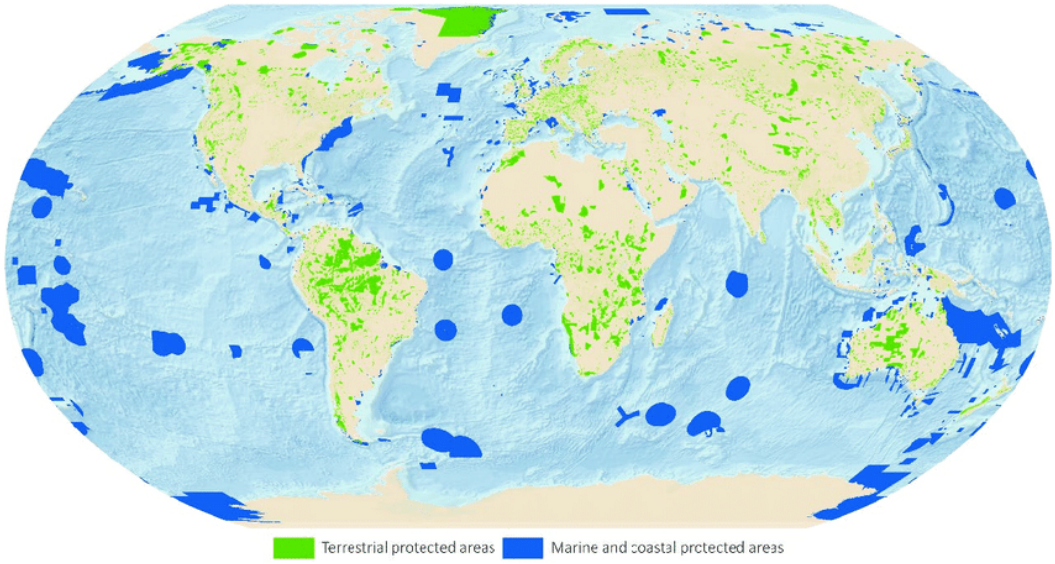


Figure 1. Global distribution of terrestrial and marine protected areas. (Source: World Database on Protected Areas (WDPA), UNEP-WCMC and IUCN (latest available dataset).

In the international literature, protected areas are defined as spatial networks that maintain the continuity of supporting, provisioning, regulating, and cultural ecosystem services by safeguarding the structural and functional integrity of ecosystems (Millennium Ecosystem Assessment MEA, 2005). These services encompass a wide range of interconnected functions, including carbon sequestration and climate regulation, the stabilization of hydrological cycles, the reduction of soil erosion, the conservation of biological diversity, and indirect benefits for human health and well-being. Recent studies in particular demonstrate that effectively managed protected areas play a critical role in both climate change mitigation and adaptation, highlighting their growing strategic importance in global environmental governance (United Nations Environment Programme World Conservation Monitoring Centre and International Union for Conservation of Nature, 2021).

Despite the quantitative expansion of protected areas worldwide, a substantial body of research emphasizes persistent limitations related to ecological representativeness, spatial coherence, and management effectiveness. Although approximately sixteen to seventeen percent of the global terrestrial surface is currently designated as protected, a significant proportion of ecosystems with the highest levels of biodiversity remain outside this network. Moreover, many protected areas fail to fully achieve their intended conservation objectives due to inadequate management practices, insufficient financial resources, and fragmented institutional frameworks (Watson et al., 2016; United Nations Environment Programme World Conservation Monitoring Centre, 2020). This situation underscores the need to reconsider protected area policies beyond approaches focused solely on area designation, and to adopt ecosystem-based, site specific, and integrated management models.

Türkiye ranks among the countries with considerable global biodiversity potential, owing to its biogeographical position, climatic diversity, and high levels of endemism. Located at the intersection of the Euro Siberian, Mediterranean, and Iran Turan biogeographical regions, the country hosts a wide array of ecosystem types and numerous rare species (Eken et al., 2005). Nevertheless, the proportion of protected areas relative to national territory remains below internationally endorsed targets, and the existing conservation network exhibits structural deficiencies in terms of ecosystem representativeness and spatial continuity. In addition, the multilayered nature of legal regulations and the fragmentation of institutional authority concerning protected areas complicate the implementation of effective and integrated management practices (Güneş, 2011).

In recent years, international policy frameworks have increasingly highlighted the targets of thirty percent protection and thirty percent restoration, thereby shifting attention not only toward the quantitative expansion of protected areas but also toward improvements in management quality and the restoration of degraded ecosystems to functional conditions (European Commission, 2020). For Türkiye, these targets necessitate a critical assessment of the current status of protected areas and a stronger alignment of conservation strategies with ecosystem services, climate policy objectives, and sustainable development goals.

Against this background, the present study aims to evaluate the role of protected areas in the context of ecosystem services at both global and national scales, and to assess Türkiye's protected area strategy and governance structure within a holistic analytical framework. The study comparatively examines international conservation approaches alongside the legal and institutional arrangements in Türkiye, and discusses existing challenges through the lens of ecosystem-based planning and site-oriented management. In doing so, it seeks to contribute to the repositioning of protected areas in Türkiye not merely as instruments of nature conservation, but as fundamental components of climate adaptation, societal well-being, and sustainable development.

2. Theoretical Framework: Protected Areas and Ecosystem Services

In the literature on modern environmental governance, protected areas are conceptualised not merely as spatial arrangements aimed at the conservation of biological diversity, but as strategic territories that secure the continuity of the multidimensional services provided by ecosystems. The International Union for Conservation of Nature defines protected areas as clearly delineated geographical spaces that are recognised, dedicated, and managed through legal or other effective means in order to ensure the long term conservation of nature together with associated ecosystem services and cultural values (Dudley, 2008). This definition highlights that protected areas encompass not only biological components, but also functions directly related to human well-being and broader societal benefits.

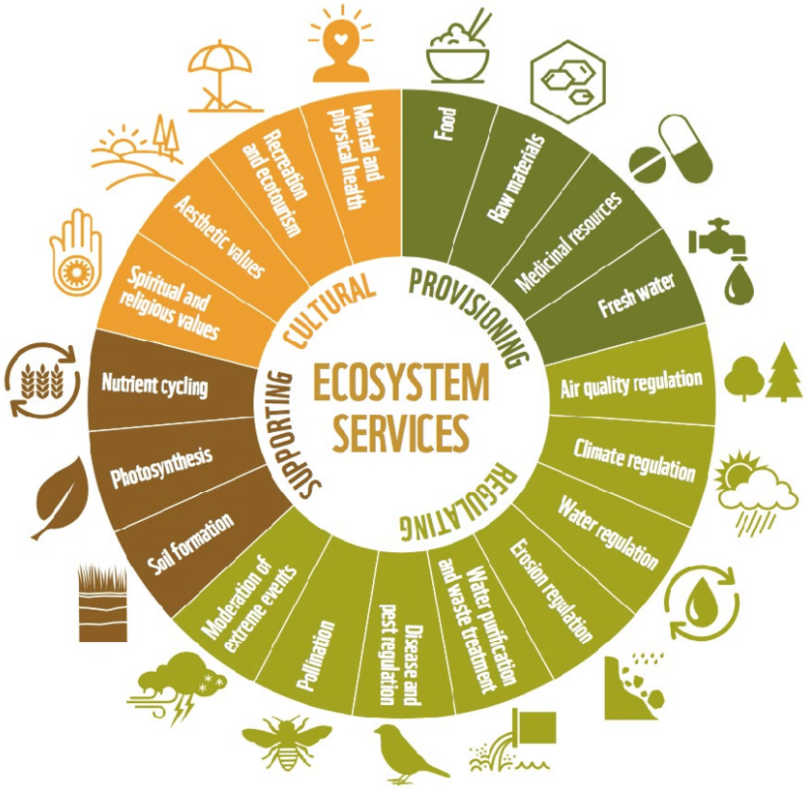


Figure 2. Classification of ecosystem services based on the Millennium Ecosystem Assessment framework. (Source: Adapted from WWF-Turkey (2018), LPR Full Report.)

The concept of ecosystem services constitutes one of the core theoretical frameworks for explaining the mutual dependence between human societies and nature. In the Millennium Ecosystem Assessment report, ecosystem services are defined as all direct and indirect benefits that people obtain from ecosystems, and are classified into four principal categories, namely supporting, provisioning, regulating, and cultural services (Millennium Ecosystem Assessment, 2005), as schematically presented in Figure 2. This classification provides a holistic perspective that enables the integrated evaluation of the ecological, economic, and socio cultural values of protected areas.

Supporting ecosystem services encompass the fundamental ecological processes upon which all other services depend. Processes such as soil formation, nutrient cycling, photosynthesis, and habitat provision sustain ecosystem functioning and ensure the persistence of biological diversity (Millennium Ecosystem Assessment, 2005). Protected areas enhance the long term resilience of ecosystems by allowing these essential processes to

continue under conditions that are relatively free from intensive human pressure. In particular, it is widely emphasized that unfragmented and well managed protected areas play a critical role in conserving the genetic diversity of species populations and in preventing the transgression of ecological thresholds (Watson et al., 2014).

Provisioning ecosystem services include natural resources that are directly utilised for human livelihoods. These services encompass food, fresh water, timber and non timber forest products, as well as medicinal and aromatic plants. Protected areas contribute to safeguarding long term productivity by limiting the uncontrolled and unsustainable exploitation of these resources. In the context of Türkiye, wetlands, forest ecosystems, and rangelands are of vital importance for water supply, livestock production, and rural livelihoods. However, the sustainability of these services depends less on the mere existence of protected area status than on the implementation of effective management and monitoring mechanisms (Güneş, 2011).

Regulating ecosystem services comprise processes such as climate regulation, carbon sequestration, flood and erosion control, and the improvement of water and air quality. Recent research demonstrates that the role of natural ecosystems in addressing climate change further increases the strategic significance of protected areas. Forests, wetlands, grasslands, rangelands, and marine ecosystems store a substantial proportion of atmospheric carbon, thereby limiting the accumulation of greenhouse gases (United Nations Environment Programme World Conservation Monitoring Centre and International Union for Conservation of Nature, 2021). From this perspective, protected areas are increasingly regarded as essential spatial instruments that contribute not only to the conservation of biodiversity, but also to the stability of the global climate system.

Cultural ecosystem services refer to the aesthetic, recreational, educational, and spiritual influences of nature on human well-being. By providing opportunities for recreation and nature-based tourism, protected areas support physical and psychological health, while also functioning as important outdoor laboratories for scientific research and environmental education (Daniel et al., 2012). In Türkiye, national parks and nature parks represent some of the most visible settings in which these services are experienced. Nevertheless, growing visitor pressure necessitates the management of cultural services in a manner that remains compatible with ecological carrying capacity.

Another issue that has received increasing attention in the theoretical literature concerns the integration of the ecosystem services approach into protected area management. This perspective suggests that conservation decisions should be informed not only by biological criteria, but also by a balanced consideration of social benefits and costs (Haines Young and Potschin, 2012). Within this framework, protected areas are redefined as spatial planning instruments that render visible the reciprocal relationship between humans and nature and that are aligned with the objectives of sustainable development.

In Türkiye, however, the incorporation of the ecosystem services approach into protected area planning and management remains limited. Existing practices predominantly focus on status based protection, while the quantitative and qualitative assessment of ecosystem services occupies a secondary position in decision making processes. Yet, making visible the contributions that protected areas can offer in fields such as climate adaptation, disaster risk reduction, and rural development would significantly strengthen societal and institutional support for these areas.

This theoretical framework elucidates the multidimensional functions of protected areas in the context of ecosystem services and demonstrates that conservation strategies in Türkiye should be reconsidered not solely on the basis of protection status, but through an ecosystem-based, site-oriented, and integrated management approach. Such a perspective provides the conceptual foundation for the evaluation of global and national protected area policies addressed in the following section.

3. The Evolution of Protected Area Policies Worldwide

The global development of protected area policies represents a significant indicator of the historical transformation of conservation thinking and of paradigm shifts in human nature relationships. Early conservation initiatives emerged largely from aesthetic, recreational, or hunting oriented elite motivations and were shaped within a framework dominated by strict protection approaches in which nature was separated from human activities. One of the most prominent examples of this perspective is Yellowstone National Park, designated in 1872, which played a pioneering role in the institutionalisation of the modern national park concept (Runte, 1997).

Until the mid twentieth century, protected areas were largely framed around the notion of nature without people, and the historical and cultural relationships between local communities and these areas were frequently overlooked. However, the rapid acceleration of industrialisation, urbanisation, and natural resource

consumption in the aftermath of the Second World War rendered nature loss increasingly visible at the global scale. This shift brought to the fore the need to address protected areas not solely on aesthetic or recreational grounds, but on the basis of ecological necessity (Adams, 2013).

The 1970s represent a major turning point in international conservation policy. International agreements adopted during this period, including the Ramsar Convention of nineteen seventy one, the Convention Concerning the Protection of the World Cultural and Natural Heritage of nineteen seventy two, and the Bern Convention of nineteen seventy nine, paved the way for an understanding of protected areas as elements of a global conservation network. In the same period, the Man and the Biosphere Programme developed under the auspices of UNESCO introduced the concept of biosphere reserves, promoting a more integrated approach that combined conservation, sustainable use, and scientific research within a single framework (UNESCO, 2017).

The nineteen nineties are widely regarded as the period in which protected area policies began to shift toward an ecosystem-based perspective. The Convention on Biological Diversity, adopted at the 1992 Rio Earth Summit, identified protected areas as key instruments for the conservation and sustainable use of biological diversity, and imposed obligations on Parties to establish and effectively manage national protected area systems (Convention on Biological Diversity, 1992). As a result, protected areas increasingly came to be assessed not merely in terms of designation, but according to criteria such as representativeness, ecological integrity, and management effectiveness.

From the early two thousands onwards, governance, participation, and social dimensions have assumed growing importance in protected area policy. The protected area management categories and governance types developed by the International Union for Conservation of Nature have encouraged multi-actor models that extend beyond state centred approaches to include local communities, civil society organisations, and the private sector (Dudley, 2008). This shift has aimed to enhance social acceptance of protected areas and to reduce tensions between conservation objectives and local development needs.

In recent years, climate change and the global ecological crisis have become central to protected area policy debates. Reports published by the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services and the United Nations Environment Programme World Conservation Monitoring Centre indicate that existing protected area networks remain insufficient to halt ecosystem loss. These assessments emphasise that, in the face of climate change, protected areas must be strengthened qualitatively as well as expanded quantitatively in order to ensure ecological resilience (IPBES, 2019; United Nations Environment Programme World Conservation Monitoring Centre, 2020). Within this context, the target of thirty percent protection and thirty percent restoration adopted under the European Union Biodiversity Strategy for 2030 has emerged as one of the most comprehensive policy frameworks shaping the future of protected areas (European Commission, 2020).

Contemporary approaches increasingly view protected areas not simply as spaces for nature preservation, but as multifunctional spatial systems that contribute to climate adaptation, carbon sequestration, disaster risk reduction, and human health. Concepts such as ecosystem-based management, green infrastructure networks, and nature based solutions have therefore become integral theoretical and practical tools within protected area policy (International Union for Conservation of Nature, 2020). Through this lens, protected areas are positioned at the core of multi scale and interdisciplinary planning approaches that are directly aligned with sustainable development objectives.

This global evolution offers important lessons for countries such as Türkiye, which possess high levels of biological diversity yet face structural challenges in protected area management. In the following section, the historical development, legal framework, and current status of protected areas in Türkiye are examined in detail in light of these international policy shifts and conceptual transformations.

4. The Legal and Institutional Framework of Protected Areas in Türkiye

The legal and institutional framework governing protected areas in Türkiye has been constructed upon a wide range of laws, regulations, and administrative arrangements adopted over different periods. While this structure has expanded the diversity and scope of protection statuses, it has simultaneously generated significant challenges with respect to the distribution of authority, inter institutional coordination, and management effectiveness. An examination of the historical development of regulations related to protected areas reveals that the approach to nature conservation in Türkiye has largely evolved within a sector oriented and fragmented framework (Güneş, 2011). The spatial distribution and limited overlap between key biodiversity areas and legally protected areas in Türkiye is illustrated in Figure 3, based on the WWF-Türkiye analysis of 2016 biodiversity data.

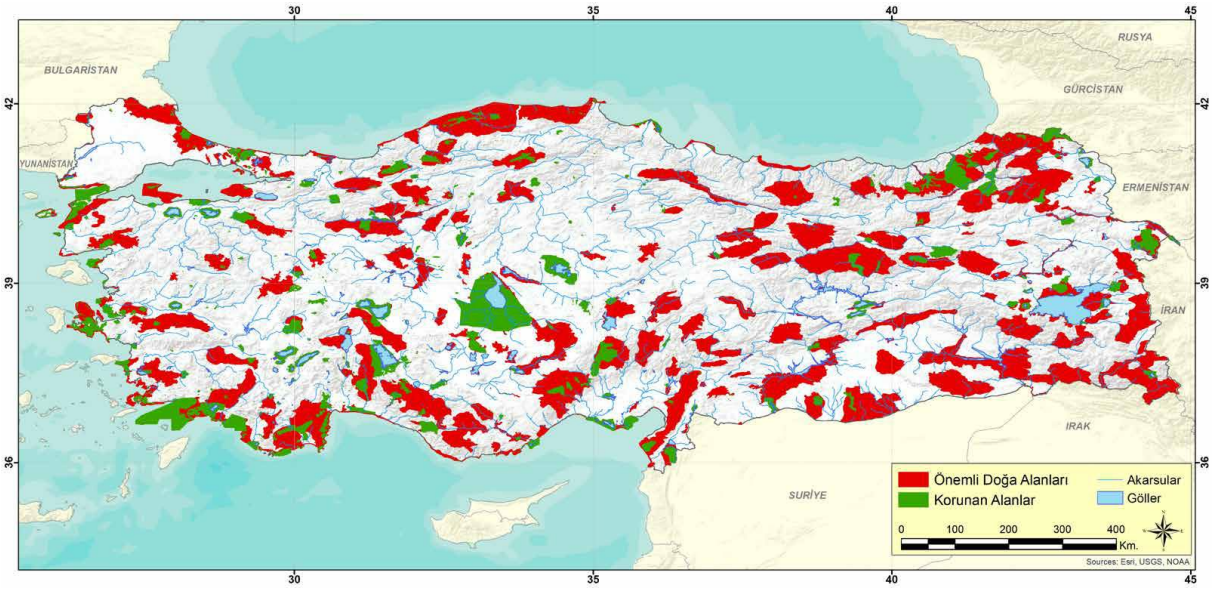


Figure 3. Spatial distribution of key biodiversity areas and protected areas in Türkiye. (Source: Adapted from WWF-Turkey (2022)

Modern legal arrangements concerning protected areas in Türkiye began in the early years of the Republic with initiatives aimed at the conservation of forest resources. The inclusion of the concept of conservation forest in Law Number five hundred and four of nineteen twenty four is regarded as one of the first systematic steps toward the protection of natural resources. This approach was later consolidated through the Forest Law Number six thousand eight hundred and thirty one enacted in 1956, which provided a more comprehensive legal framework and placed the conservation and sustainable management of forest ecosystems under statutory protection (Forest Law, 1956).

One of the most fundamental legal instruments governing protected areas in Türkiye is the National Parks Law Number two thousand eight hundred and seventy three, which entered into force in nineteen eighty three. This law introduced different protection categories, including national parks, nature parks, natural monuments, and nature conservation areas, and established the basic principles governing their protection, use, and management. Although the National Parks Law formally adopts the principle of balancing conservation and use, its practical implementation largely reflects an approach focused primarily on the protection of biophysical values (National Parks Law, 1983).

In addition, the Law on the Protection of Cultural and Natural Assets Number two thousand eight hundred and sixty three provides a separate legal framework for the conservation of natural sites and natural assets. Natural sites designated under this law encompass areas requiring protection due to their geological, geomorphological, and ecological characteristics. However, the management of these areas is often not addressed in an integrated manner with spatial planning and protected area management processes(Law on the Protection of Cultural and Natural Assets, 1983). As a result, areas with similar ecological attributes may be managed under different protection statuses by different institutions.

The institutional structure of protected area governance in Türkiye is primarily shaped around two main ministries. The Ministry of Agriculture and Forestry, through the General Directorate of Nature Conservation and National Parks, is responsible for national parks, nature parks, wildlife development areas, and a significant proportion of wetlands. The Ministry of Environment, Urbanisation, and Climate Change, on the other hand, holds authority over natural sites, special environmental protection zones, and areas designated as strictly protected sensitive areas. While this dual structure increases institutional diversity in protected area management, it also gives rise to problems such as overlapping mandates and insufficient coordination in practice(Güneş, 2011; Organisation for Economic Co-operation and Development, 2019).

International conventions also play a significant role in shaping the legal framework of protected area policies in Türkiye. The Convention on Biological Diversity, to which Türkiye became a Party in nineteen ninety six, calls for the development of national protected area systems and the adoption of ecosystem-based approaches (Convention on Biological Diversity, 1992). Wetlands designated under the Ramsar Convention are of critical importance for migratory birds and water dependent ecosystems. Nevertheless, international obligations are not always fully translated into national legislation and practice, and deficiencies in institutional capacity

persist, particularly with regard to the preparation and implementation of management plans (United Nations Environment Programme World Conservation Monitoring Centre, 2020).

One of the central challenges associated with the legal and institutional structure of protected areas in Türkiye is the dominance of a status oriented conservation approach. While considerable emphasis is placed on the designation of areas, issues such as ecological representativeness, spatial coherence, and long term management effectiveness often remain secondary. Furthermore, the inability to harmonise plans and strategies prepared by different institutions within an integrated framework complicates the alignment of protected areas with climate adaptation, disaster risk reduction, and sustainable development objectives (Organisation for Economic Co-operation and Development, 2019).

In conclusion, the legal and institutional framework governing protected areas in Türkiye presents a comprehensive yet fragmented structure. Although this framework offers advantages in terms of the diversity of protection statuses, it also entails significant structural limitations with respect to effective management and integrated planning. This situation highlights the need to address protected areas not solely through legal designation, but through an ecosystem-based, site-oriented, and institutionally integrated management model. The following section examines the practical implications of this framework and provides a detailed assessment of the principal challenges facing protected areas in Türkiye.

5. Major Challenges Related to Protected Areas in Türkiye

Despite the comprehensive nature of the legal and institutional framework governing protected areas in Türkiye, these areas frequently fail to fulfil their ecological, managerial, and spatial functions effectively in practice. This situation demonstrates that quantitative expansion alone is insufficient and that qualitative dimensions such as management quality, representativeness, and integrated planning are decisive. In the Turkish context, the most prominent challenges may be grouped under the headings of ecosystem representativeness, governance structure, management capacity, and spatial integrity.

One of the primary challenges concerns inadequate ecosystem representativeness and inclusiveness. Although Türkiye is exceptionally rich in terms of biological diversity, the existing protected area network falls short of representing this diversity in a balanced manner. Historically, protection decisions have largely concentrated on forest ecosystems, mountainous regions, and landscapes with high aesthetic value, while steppes, grasslands, agricultural landscapes, and marine areas have remained comparatively underrepresented (Eken et al., 2005; Güneş, 2011). This imbalance results in a substantial proportion of biodiversity remaining outside the scope of effective protection.

A second major challenge relates to legal complexity and institutional fragmentation. Protected areas in Türkiye are designated under multiple laws and regulations, and their management falls within the authority of more than one institution. The division of responsibilities between the Ministry of Agriculture and Forestry and the Ministry of Environment, Urbanisation, and Climate Change often lacks a clear and coherent governance model. The assignment of multiple protection statuses to the same geographical area gives rise to overlaps in planning processes and uncertainty in implementation (Organisation for Economic Co-operation and Development, 2019). This fragmentation complicates the development of a shared vision and a long term strategic approach to protected area management.

A third critical issue concerns management capacity and shortcomings in implementation. In a large proportion of protected areas, management plans are either absent or not effectively implemented. Insufficient staffing, limited financial resources, and deficiencies in technical infrastructure constrain the translation of conservation objectives into practice on the ground. International assessments indicate that a significant number of protected areas in Türkiye function primarily as paper parks, highlighting a clear gap between formal designation and effective conservation outcomes (United Nations Environment Programme World Conservation Monitoring Centre, 2020; Watson et al., 2014).

Another structural problem is the weakness of spatial integrity and ecological connectivity. The current protected area network largely consists of isolated and fragmented sites. The lack of ecological corridors and buffer zones negatively affects species migration and dispersal processes and limits ecosystem adaptive capacity in the face of climate change. Contemporary conservation literature, by contrast, emphasises that protected areas should be conceived not as isolated units but as interconnected networks operating at the landscape scale (Bennett, 2003; International Union for Conservation of Nature, 2020).

Short term economic pressures also represent a significant challenge for protected areas in Türkiye. Activities such as mining, energy production, tourism development, and large scale infrastructure projects exert considerable pressure on protected areas and their surroundings. The treatment of such activities as exceptional

cases justified by public interest weakens the effectiveness of protection statuses and threatens ecological integrity (Organisation for Economic Co-operation and Development, 2019). This tendency indicates that the balance between conservation and use is frequently tilted in favour of development rather than protection.
Finally, the limited integration of the ecosystem services approach into decision making processes constitutes a major shortcoming in protected area management in Türkiye. The benefits provided by protected areas in areas such as climate regulation, disaster risk reduction, water security, and human health are often insufficiently recognised in planning and investment decisions. As a result, the societal and economic value of protected areas remains poorly understood, and public and institutional support for conservation policies remains constrained (Millennium Ecosystem Assessment, 2005; Haines Young and Potschin, 2012).
Taken together, these challenges indicate that the central issue facing protected areas in Türkiye is not merely the number or total area of designated sites, but rather deficiencies in management quality, ecological representativeness, and integrated governance. In the following section, potential new approaches and policy responses to these structural challenges are discussed in light of international best practice examples.

6. Conclusions and Recommendations

This study has examined the role of protected areas in the context of ecosystem services at both global and national scales and has evaluated Türkiye's conservation strategy and governance structure through a review based approach (Figure 4). International literature and policy documents clearly demonstrate that protected areas are not merely spatial instruments for the conservation of biological diversity, but perform a wide range of interconnected functions, including the mitigation of climate change, the reduction of disaster risks, the protection of water and soil resources, and the support of human well-being (Millennium Ecosystem Assessment, 2005; Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services, 2019; United Nations Environment Programme World Conservation Monitoring Centre and International Union for Conservation of Nature, 2021).

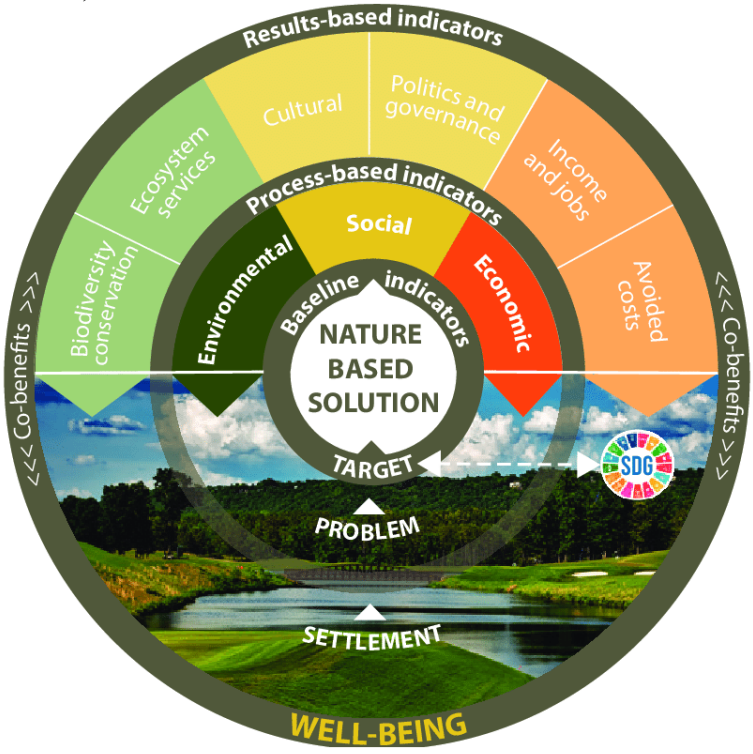


Figure 4. A proposed holistic and ecosystem-based management framework for protected areas in Türkiye. (Source: Adapted from IUCN, 2020, Global Standard for Nature-based Solutions.)
The assessments undertaken within the scope of this study indicate that, despite the comprehensive nature of the legal and institutional framework governing protected areas in Türkiye, significant structural limitations persist in practice. Although the proportion of protected areas within the national territory and the diversity of protection statuses point to quantitative progress, the existing system remains below internationally recognised targets in terms of ecosystem representativeness, spatial integrity, and management effectiveness. In particular, the insufficient representation of steppes, grasslands, agricultural landscapes, and marine ecosystems within the conservation network results in a substantial share of biological diversity remaining outside the scope of

effective protection (Güçlü and Karahan, 2004; Eken et al., 2005; Organisation for Economic Co-operation and Development, 2019).

One of the central challenges in Türkiye concerns the dominance of a status oriented approach to protected area management. Legal designation is often not supported by effective conservation measures and sustainable management practices. Deficiencies in management planning, limited financial and human resources, and problems of institutional coordination hinder the translation of conservation objectives into tangible outcomes on the ground. This situation contributes to the emergence of areas commonly described in the international literature as paper protected areas and undermines the ecological functions of protected areas (Watson et al., 2014; United Nations Environment Programme World Conservation Monitoring Centre, 2020).

The findings of this review further demonstrate that protected areas in Türkiye are not sufficiently integrated with climate adaptation, disaster risk reduction, and sustainable development policies. However, the targets emphasised in the European Union Biodiversity Strategy for 2030, namely thirty percent protection and thirty percent restoration, require not only the expansion of protected areas but also their qualitative strengthening and the restoration of degraded ecosystems to functional conditions (European Commission, 2020). For Türkiye, these targets underline the necessity of re evaluating protected areas through an ecosystem-based planning perspective and a site-oriented management approach.

Within this context, several recommendations can be derived from the findings of the study. First, the legal and institutional framework governing protected areas should be restructured within a more integrated governance model. Clarifying the distribution of responsibilities, strengthening inter institutional coordination, and establishing a shared national vision for protected area management represent essential steps toward improving management effectiveness.

Second, the systematic integration of the ecosystem services approach into protected area planning and management processes is of critical importance. By making visible the ecological, economic, and social benefits provided by protected areas, this approach can enhance societal and political support for conservation policies (Haines Young and Potschin, 2012). In particular, incorporating services such as climate regulation, water security, and disaster risk reduction into decision making processes would reinforce the strategic significance of protected areas.

Third, the existing protected area network should be strengthened in terms of ecological connectivity and spatial integrity. The development of ecological corridors, buffer zones, and landscape scale planning approaches would enhance species adaptive capacity under climate change and reduce the isolation effects associated with fragmented protected areas (Bennett, 2003; International Union for Conservation of Nature, 2020).

With regard to future research, there is a need to expand studies focusing on the quantitative assessment of ecosystem services provided by protected areas in Türkiye. Site specific ecosystem service mapping, economic valuation studies, and climate adaptation scenarios would render the role of protected areas in planning and policy processes more concrete and measurable. In addition, interdisciplinary research addressing local community participation and social dimensions of protected area management would contribute to establishing a more sustainable balance between conservation and use.

In conclusion, this review demonstrates that protected areas in Türkiye should be reconsidered not merely as instruments of nature conservation, but as fundamental components of sustainable development, climate adaptation, and societal well-being. The adoption of such an approach would strengthen Türkiye’s alignment with international biodiversity targets and enhance the long term effectiveness of protected areas.

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EXAMINING THE HUMAN–BIRD MOTIF IN THE OTTOMAN TRADITION:AN ICONOGRAPHIC STUDY OF A MINIATURE FROM TĀRĪKH-I HIND-I GHARBĪ

Parvin Pourzeynal

Abstract
This study examines the representation of the human–bird motif in Ottoman visual culture, focusing on its symbolic, mythological, and narrative dimensions. The combination of human and avian features is among the most enduring hybrid forms in the visual and mythological traditions of various cultures, often functioning as a mediator between the human realm and the transcendent world. In Islamic art, and particularly within the Ottoman context, such hybrid beings frequently appear in texts and images concerned with wonders ʿajāʾib, marvelous lands, and extraordinary creatures.
The present research centers on a specific miniature from Tārīkh-i Hind-i Gharbī, a sixteenth-century Ottoman work produced in response to the discovery of the New World. Rather than relying on direct geographical experience, Ottoman perceptions of the Americas were largely shaped through textual and visual sources, including European travel accounts, marvel literature, and earlier Islamic narrative traditions. Within this framework, the depiction of the man–bird beneath the Waqwaq tree constitutes a particularly meaningful visual synthesis, bringing together motifs of speech, birth, warning, and liminality.
Methodologically, this study adopts a qualitative and descriptive–analytical approach. Data have been collected through visual analysis of the miniature, examination of historical and mythological texts, and comparative interpretation of related narratives, especially those associated with the Alexander Romance and the myth of speaking birds. The primary research questions address the symbolic position of the man–bird in Ottoman visual culture, the influence of the Waqwaq tree and speaking-bird traditions on this imagery, and the broader meanings these representations convey regarding knowledge, power, and the relationship between humanity, nature, and the sacred.
The findings suggest that the human–bird in Ottoman miniatures is not merely a fantastic or decorative creature, but a liminal figure embodying awareness, divine warning, and the boundary between the known and the unknown. Its association with the Waqwaq tree and Alexander narratives indicates a conscious engagement with a multilayered network of mythological and intertextual sources. By analyzing this imagery, the study contributes to a deeper understanding of how Ottoman artists visualized the New World through established symbolic languages, transforming unfamiliar geographies into comprehensible and meaningful visual narratives.

Statement of the Problem

Composite or hybrid beings—particularly human–animal combinations—are among the oldest and most enduring elements in the mythological, religious, and visual traditions of the world. These beings are not merely reflections of the human imagination confronting the unknown; they often perform conceptual and epistemological functions, serving as instruments for articulating the boundaries of existence, the limits of humanness, and the relationship between humanity and the sacred. Among such combinations, the human–bird figure occupies a privileged position in the narratives and images of diverse civilizations, owing to its simultaneous association with earth and sky, matter and meaning, and body and soul.
Despite the antiquity and wide circulation of this motif, the representation of the human–bird in the Ottoman visual tradition—particularly within the context of encounters with the New World in the sixteenth century—has not yet been examined in a systematic and analytical manner. Studies related to the Tārīkh-i Hind-i Gharbī have generally approached the work either from the perspective of historiography and the transmission of geographical information or within the broader framework of Islamic marvel literature (ʿajāʾib-nāma). In this process, the image of the human–bird beneath the Wāq-Wāq tree, one of the most complex and multilayered images of the work, has often been overlooked or treated merely as a fantastic and wondrous illustration.
The central question of this research concerns how this image was formed and through what network of mythological, marvel-based, and intertextual narratives, and what position the human–bird occupies within the semantic system of the Ottoman imagination. Is this figure merely a reflection of the influence of European sources and reports concerning the New World, or should it instead be understood in relation to older Islamic traditions, particularly the Alexandrian narratives of journeys to the ends of the world? Moreover, what is the relationship between the juxtaposition of the human–bird and the Wāq-Wāq tree and concepts such as liminality, birth, warning, and the demarcation of the boundaries of the human?

By posing these questions, the present study seeks to demonstrate that the image under consideration is neither a simple imitation of earlier models nor a raw representation of the unknown. Rather, it constitutes a conscious and meaningful synthesis of multiple narrative traditions. On this basis, the human–bird beneath the Wāq-Wāq tree is analyzed as a liminal being situated at the threshold between humanity, nature, and the sacred, playing a key role in rendering the New World intelligible within the Ottoman imagination. Addressing this problem may contribute to a deeper understanding of the function of hybrid beings in Ottoman painting and of the role of images in structuring cultural encounters with the unknown.

Review of the Literature

Research related to the subject of this article can be categorized into several main strands:

First are studies that address the Tārīkh-i Hind-i Gharbī and the conditions of its formation within the context of Ottoman encounters with the New World. In this regard, the works of scholars such as Abbas Hamdani and Gilles Veinstein have paid particular attention to Ottoman sources of information, networks of geographical knowledge transmission, and the relationship of this work to Spanish and Portuguese explorations.

For example, in the article "Some Considerations on the Study of Ottoman Geographical Writing," Gottfried Hagen adopts a critical approach to rethinking the methods used to study and interpret Ottoman geographical texts, demonstrating that these texts should not be evaluated solely according to the criteria of modern geography or empirical cartographic science. Hagen also emphasizes the close interconnection of geography with historiography, politics, and theology in the Ottoman world. Unlike the modern geographer, the Ottoman geographer does not conceive of himself as a neutral observer of nature; rather, he operates within a network of religious, dynastic, and cosmological values. Consequently, representations of distant lands—including India, China, or the New World—are often articulated through the familiar and established language of marvels, wonders, and divine signs.

Another body of scholarship consists of mythological and comparative studies on the Wāq-Wāq tree and beliefs concerning the birth of humans from trees. Among these is the article "The Sacred Tree, the Speaking Tree, and the Process of the Formation of the Wāq Motif" by Alireza Taheri, published in Bāgh-e Nazar (vol. 8, no. 19). This study examines the symbolic relationship between tree and human in myths, beliefs, and art, showing that in many societies the tree is not merely a natural phenomenon but a sacred symbol associated with life, birth, and creation. Taheri seeks to elucidate the shared and meaningful relationships among the sacred tree, the tree of life, the speaking tree, and the Wāq motifs, arguing that one of the reasons for the emergence of the Wāq motif in Iranian and Islamic art lies precisely in this ancient and enduring bond between humans and trees in popular beliefs and mythological texts.

On this basis, it can be argued that although each of the elements addressed in this study—the Tārīkh-i Hind-i Gharbī, the Wāq-Wāq tree, the human–bird, and the Alexandrian tradition—has been examined individually in previous scholarship, a simultaneous and intertextual analysis of their interrelationship within a specific image from the Ottoman tradition constitutes a clear research gap. The present article seeks to fill this gap by focusing on the image of the human–bird beneath the Wāq-Wāq tree and to demonstrate how the Ottoman painter, through the conscious juxtaposition of narratives and traditions, reconstructs a complex concept of threshold, boundary, and humanness in visual form.

Introduction

The presence of plants, animals, and other natural elements in myths, ancient narratives, and early cultures is neither accidental nor merely decorative; rather, it reflects the ways in which early human societies understood, organized, and endowed meaning to the world around them. By employing the simplest and most accessible elements of the natural environment, early humans transcended their ordinary functions and transformed them into carriers of symbolic, ritual, and epistemological meanings. Among these elements, birds due to their ability to fly and their access to a realm beyond the reach of terrestrial humans, namely the sky occupied a privileged position in human imagination and appeared as mediators between the earthly and the celestial realms within mythological and visual systems.

In visual analyses of early artistic traditions, composite or hybrid beings are among the motifs that have consistently drawn scholarly attention. Animal representations constitute some of the earliest visual forms through which prehistoric humans sought to communicate with their environment and express their fears, beliefs, and perceptions. In the continuation of this process, the combination of human and animal forms particularly in liminal or threshold figures enabled the articulation of concepts that extended beyond ordinary lived experience, often associated with the sacred, death, creation, and the boundaries of human existence.

The motif of a bird with a human head represents one of the earliest examples of such hybrid formations, with a history dating back at least to the third millennium BCE. Its persistence into the modern era attests to the enduring symbolic and conceptual significance of this figure. Across various traditions, such beings are not depicted as monstrous entities, but rather as signs of the diversity of creation, the scope of divine power, and the limitations of humanity in the face of cosmic order. Accordingly, the human–bird may be understood as a liminal being situated at the intersection of humanity, animality, and transcendence.

Within the Islamic world and particularly in the Ottoman tradition hybrid beings occupy a distinctive place in texts and images related to marvel literature (ʿajāʾib-nāmeh), imaginative geography, and illustrated historiography. The Ottoman encounter with the New World in the sixteenth century, which was shaped more through texts and images than through direct geographical experience, created new conditions for the reproduction of such wondrous figures. Works such as Tārīkh-i Hind-i Gharbī sought to render the unknown lands beyond the Atlantic intelligible to an Ottoman audience not solely through empirical data, but through a familiar and deeply rooted visual language of marvels, wonders, and hybrid creatures.

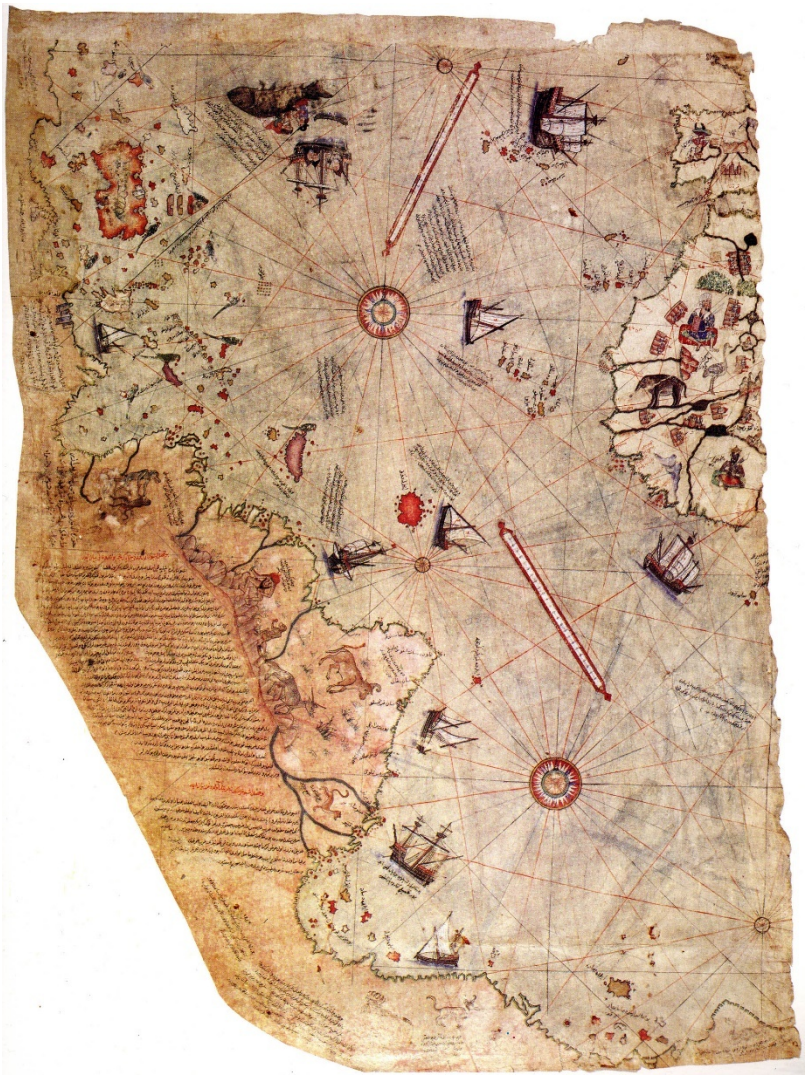
Within this context, the depiction of the human–bird beneath the Wāq-Wāq tree—one of the most well-known myths of birth and wonder in the Islamic tradition—acquires particular significance. Focusing on this miniature in Tārīkh-i Hind-i Gharbī, the present study argues that the Ottoman illustrator did not merely replicate earlier visual conventions, but rather, with awareness of a network of mythological, marvel-literature, and especially Alexander Romance narratives concerning journeys to the ends of the world, created a multilayered and meaningful visual composition. The aim of this article is to analyze the narrative, mythological, and intertextual origins of this imagery and to elucidate the role of the human–bird as a liminal figure within the semantic structure of Ottoman imagination.

The New World in Ottoman Imagination: From Political Geography to Visual Marvel Literature

In the early decades of the sixteenth century, the Ottomans were among the first non-European powers to become aware of the discovery of the New World and to reinterpret it within their own political and geographical frameworks. Research by Abbas Hamdani demonstrates that Ottoman knowledge of Spanish and Portuguese explorations was formed not solely through European sources, but also through information networks such as the Moriscos of al-Andalus and navigational documents obtained from Spanish ships.

One of the most important contexts for understanding the miniatures of Tārīkh-i Hind-i Gharbī al-musammā bi-Ḥadīth-i Naw is the examination of Ottoman visual culture in its encounter with the New World an encounter most clearly embodied in the famous map of Piri Reis (919 AH / 1513 CE). Although the map was influenced by cartographic traditions associated with Christopher Columbus, it cannot be definitively stated that it was directly copied from his original map. Nevertheless, its representation of the New World is clearly framed within Ottoman visual language and the Islamic tradition of marvel literature. The prominent depiction of unknown islands, tropical birds, parrots, and unusual creatures is not merely decorative; rather, these elements signify new, fertile, and potentially conquerable lands territories still positioned at the threshold between knowledge and wonder (hamdani, 1981, pp. 323-330).

The same visual logic can be observed in the miniatures of Tārīkh-i Hind-i Gharbī. The image of the human–bird beneath the Wāq-Wāq tree may be understood as an extension of the visual strategy established in the Piri Reis map: a strategy based on recombining Western sources concerning the New World with the Islamic tradition of marvels and wondrous beings. In this context, the Wāq-Wāq tree one of the most familiar motifs of Islamic marvel literature plays a crucial role in rendering the unfamiliar comprehensible. The New World is thus represented not through entirely foreign concepts, but through signs familiar to the Ottoman viewer, such as the Wāq-Wāq tree and hybrid creatures.



Imagae1: Map of the world by Ottoman admiral Piri Reis, Library of Topkapi Palace Museum, No. H 1824

Furthermore, the Ottomans' inability to gain direct access to the Atlantic coast and cross it meant that their engagement with the New World occurred primarily on the levels of text, image, and imagination rather than through direct geographical experience. The empire's focus on multiple fronts in the Mediterranean, Central Europe, and the Islamic world, combined with the political barrier posed by Morocco, prevented physical Ottoman presence in the Americas. This limitation, however, did not indicate a lack of interest; instead, it redirected that interest into the realm of representation.

Within this framework, Tārīkh-i Hind-i Gharbī may be regarded as a textual and visual substitute for direct presence in the New World. Figures such as the human–bird, as liminal beings, represent a form of symbolic presence in a land that remained physically inaccessible. These figures simultaneously signify wonder, curiosity, and the integration of the unknown into the Ottoman semantic and visual system a system through which the New World was reconstructed not as an absolute "Other," but as a space open to imagination and interpretation. In such a context, hybrid beings became effective visual tools for understanding and symbolically appropriating the New World.

This remarkable book is fundamentally concerned with strange beings and distant wonders. For the Ottoman imagination, America was as unfamiliar as it was for many Europeans of the same period. The emergence of a new continent undoubtedly provoked curiosity, and this work sought to respond to that curiosity—but not in the "scientific" manner expected by modern standards. Just as Europeans entertained various fantasies about the New World, Ottomans likewise viewed this newly discovered land as a place not fundamentally different from mythical territories of the Far East, such as the island of Wāq-Wāq.

Thus, rather than reflecting what the Ottomans knew or did not know about the New World, Ḥadīth-i Naw with its abundant imagery opens a window onto the Ottoman world of imagination. The work is indeed about America, but an America that was imagined more than observed. The Americas provided an ideal setting for such creative imagination precisely because of their remoteness, which stimulated Ottoman curiosity about wonders. (Tezcan, 2012, p. 9)

Manuscript Tradition of Tārīkh-i Hind-i Gharbī and the Position of the Examined Version

1. The Royal Presentation Manuscript (1583/84)

The earliest dated version of this work is an illustrated manuscript prepared in 991 AH / 1583–1584 CE for Sultan Murad III.

This manuscript, currently preserved in the Beyazıt State Library in Istanbul under a specific catalogue number, occupies a distinguished position in terms of its pictorial richness and visual program and is rightly identified as a courtly presentation copy.

The present study focuses primarily on this manuscript, since its illustrations including the depiction of the human–bird figure beneath the Wāq-Wāq tree contain distinctive symbolic and political layers that were either omitted or significantly simplified in later versions.



Imagae2: The WaqWaq Tree in India. Tarīẖ-i Hind-i Ġarbī, TPL R. 1488, ca, 1580-1590, fol. 18a.

2. The Widely Circulated Ottoman Manuscript (Late 16th Century / ca. 1600)

Between the royal presentation manuscript and the printed editions, there exists an Ottoman manuscript that enjoyed broader circulation and is commonly referred to in modern scholarship as Tārīkh-i Hind-i Gharbī, a title that gradually became the standard name of the work.

The most important representative of this group is the manuscript preserved at the Newberry Library, Chicago (Ayer MS 612), dated to approximately 1600. This version served as the principal basis for Thomas Goodrich's translation and critical analysis and, in both textual and visual terms, shows closer affinities with Spanish sources.

The digital version introduced through the provided link (CARLI / Newberry) corresponds to this manuscript.

3. The Persian Version

In addition to the Ottoman Turkish manuscripts, at least one Persian translation of the work is also known.
This version demonstrates that interest in narratives concerning the New World was not confined to the Ottoman court but circulated within a broader cultural context across the Islamic world.
Nevertheless, in terms of visual program and symbolic complexity, the Persian version is not comparable to the 1583 royal presentation manuscript and therefore plays only a marginal role in the present study.

4. The Printed Edition of İbrahim Müteferrika (18th Century)

The fourth major form of this work is the printed edition published by İbrahim Müteferrika, the founder of printing in the Ottoman Empire, which appeared in Istanbul around 1142 AH / 1730 CE.
This edition represents the first transfer of Tārīkh-i Hind-i Gharbī from the tradition of courtly manuscript production to the medium of print. The illustrations in this edition were either removed or drastically simplified, indicating a shift in audience, function, and interpretive horizon in the later period.
This edition constitutes one of the earliest printed versions of Tārīkh-i Hind-i Gharbī as an illustrated book in the Ottoman world. Copies are preserved in several major libraries worldwide, including:

- New York Public Library
- John Carter Brown Library (Brown University)
- Clements Library (University of Michigan)
- British Library
- Leiden University



Imagae3: Tarih ül-Hind il-garbi el-müsemmâ bi-Hadis-i nev, McGill University Library, 78-1-77096-050-3

The significance of this edition lies in its transformation of sixteenth-century marvel literature into a printed format and its recontextualization within the visual culture of the late Ottoman period.
The illustration examined in this article depicting the human–bird figure beneath the Wāq-Wāq tree—is analyzed on the basis of the Müteferrika printed edition. This choice is motivated by the fact that it demonstrates how narratives and images related to the New World were preserved and reinterpreted within Ottoman visual memory more than a century later.

5. Later Eighteenth- and Nineteenth-Century Printings

Finally, other later printings appeared in the eighteenth and nineteenth centuries, which generally lack visual significance and are primarily situated within the framework of general historiography or descriptive geography (Tezcan, 2012, pp. 10 -11)These versions are not examined in the present study.

Table 1. Manuscript Tradition of Tārīkh-i Hind-i Gharbī and the Position of the Examined Version

No.	Type of Version	Place of Preservation / Publication	Main Characteristics	Date / Period	Role in the Present Study
1	Royal presentation manuscript	Beyazıt State Library, Istanbul	Earliest dated manuscript; illustrated; rich visual program; courtly copy prepared for Sultan Murad III	991 AH / 1583–1584 CE	Core manuscript of the study due to its symbolic richness and complete depiction of the human–bird beneath the Wāq-Wāq tree
2	Widely circulated Ottoman manuscript	Newberry Library, Chicago (Ayer MS 612)	Broader circulation; closer to Spanish sources; basis of Goodrich's translation and analysis	Late 16th c. / ca. 1600	Comparative use; examination of textual and visual differences
3	Persian version	Exact location unknown	Persian translation; evidence of wider circulation in the Islamic world; lacks complex visual program	Uncertain (probably 17th c.)	Marginal role; no visual relevance to the human–bird motif
4	Müteferrika printed edition	Istanbul; copies in major world libraries	First printed edition; images omitted or simplified; transition to print culture	1142 AH / ca. 1730 CE	Primary version for image analysis; evidence of continuity in visual memory
5	Later printings	Various libraries	Mostly non-illustrated; historiographical or geographical focus	18th–19th c.	Excluded from the scope of the study

As demonstrated in the table, this research primarily focuses on the royal presentation manuscript (1583/84) and, for the analysis of the illustration, on the Müteferrika printed edition, since these two versions together allow for a simultaneous examination of both the initial formation and the long-term visual continuity of the human–bird motif within the Ottoman tradition.

The Wāqwāq Tree: A Myth of Birth, Voice, and the Threshold of the World

The relationship between humans and trees, and the sanctification of this relationship, developed in such a way that human birth was sometimes imagined as originating from trees. This belief influenced certain magical, ritual, and artistic practices among various communities. Du Boucor likewise maintains that some early peoples occasionally regarded trees as generators of humankind, an idea that became embedded in ancient myths and legends. For example, according to the ancient Yakut tribe, human beings are the fruit of a seven-branched tree and are nourished by a woman whose body emerges from the bark of the tree itself (Monique, 1373/1994, p. 19). Within narrative and visual traditions, however, the Wāqwāq tree is not merely a wondrous or anthropogenic tree; rather, it functions as a liminal structure positioned at the intersection of nature and humanity, sound and silence, life and death, and the visible and invisible worlds. The birth of humans from trees, the speech of fruits, and the placement of this tree on remote islands or at the ends of the world all signal its symbolic role as a point of contact between the natural order and the sacred order.

such as Wāq-Wāq or Wāq—in different cultural sources. Lexicographical works describe it as an imaginary and legendary tree that blooms in the spring dawn and the autumn dusk, whose fruits appear in the form of human beings or other animals and are capable of speech (Khalaf Tabrizi, 1063 AH). In Dehkhodā's dictionary, wāq or wāk is also identified as the name of a bird, and the croaking sound of frogs is likewise described by the term wāq (Dehkhodā, 1373/1994, p. 20412).

The notion that a tree could give birth to human beings was, in some cultures, accompanied by images of humans hanging from trees or positioned among branches like fruit. This imagery found expression in folklore, narrative literature, and the visual arts, ultimately crystallizing in the figure of the Wāqwāq tree. In Western narrative literature and religious traditions as well, trees that generate humans and animals appear frequently.

In this context, the role of Western travelers and explorers to the East—who reported wonders and marvels encountered in distant lands—was highly significant in the dissemination and acceptance of such beliefs. Marco Polo, for instance, was among those who transmitted accounts of the marvels of the East, particularly China and India, to the West. In a text by Tikkanen, an image of paradise appears as a grove of flowers bearing human heads; this imagery and worldview were likely transmitted through Muslim stories and legends about trees that produce living heads, developing from as early as the eighth century CE (Baltrušaitis, 1981).

In the geographical treatise Ḥudūd al-ʿĀlam min al-Maghrib ilā al-Mashriq, written by an anonymous author in 372 AH, the Wāqwāq is described as a Chinese tree resembling an almond or cucumber vine, whose fruits bear human-like faces. When the fruits ripen, a sound resembling "wāq wāq" can be heard several times. These legends exist in multiple versions. According to one account, this strange tree—whose branches carry the heads of the sons of Adam is located on a remote island; at sunrise and sunset, the heads cry out "wāq wāq" and chant ritual hymns to the Creator. In some versions, trees bearing fruits with fully formed female bodies and emitting the sound "wāq wāq" are considered ominous signs.

One of the central elements of the Wāqwāq tree myth is the element of sound. Fruits that speak, cry out, or sing transform the tree from a natural phenomenon into a conscious being. In these narratives, sound functions as a marker of life, awareness, and at times warning qualities that, in many mythological traditions, are characteristic of liminal beings and guardians of the boundaries of the world. From this perspective, the Wāqwāq tree is not only generative but also "speaking" and "revealing."

The story of this tree is elaborated in Indian books of marvels, yet its earliest recorded mention is attributed to a Chinese author named Tong Tiang of Tui-ro, written in 751 CE. According to this account, the king of Tāche dispatched envoys by ship, carrying various kinds of living beings and garments. Early in the eighth year of their voyage, they encountered a square-shaped rock upon which stood a tree with red branches and green leaves. Numerous human children, measuring six to seven inches in height, grew upon this tree. When they saw humans, they did not speak, but all were capable of laughter. Their hands, feet, and heads were attached to the branches, and when they were detached and held in the hands, they immediately dried up and turned black. The envoys returned with a branch of this tree, which was then kept in the residence of the king of Tāche (Taheri, 1390/2011, p. 48).

Overall, the Wāqwāq tree in various traditions is not merely a natural curiosity but a narrative structure through which the boundaries between humanity, nature, and the sacred are articulated.

The association between the Wāqwāq tree and composite beings particularly the human–bird figure is rooted in this very liminal function. If the Wāqwāq tree is the site of the birth and speech of beings who are not yet fully human, the human–bird is likewise a creature that is not, or no longer, entirely human. Both occupy a threshold between nature and meaning: the tree gives birth to humans as "fruit," while the human–bird redefines humanity as a flying, observing being. Consequently, the juxtaposition of the human–bird with the Wāqwāq tree in Ottoman imagery is not accidental, but rather the result of an overlap between two symbolic traditions concerned with the thresholds of the world and the limits of the human condition.

Within the Ottoman tradition which absorbed both the legacy of Islamic marvel literature and reports of unknown lands the Wāqwāq tree provided a suitable framework for representing the New World. Like the human–bird, it became a visual device for expressing the "distant Other": an Other that is neither fully real nor purely imaginary, but situated within a realm of wonder open to interpretation.

Narrative Connection of Human–Bird and the Waq-Waq Tree in the Alexandrian Tradition

The narrative of the Waq-Waq tree in Islamic and Iranian texts is not a singular or merely imaginative phenomenon; rather, it results from the convergence and continuity of layers of ancient narratives concerning journeys to the ends of the world, encounters with the marvels of creation, and the delineation of human potential. One of the most important origins of this narrative tradition lies in the Alexander romances and accounts attributed to Alexander the Great's journeys to distant lands, particularly the southern and eastern regions of the known world. In these narratives, Alexander appears not only as a historical figure but also as a seeker of knowledge and a witness to the hidden order of creation.

In the Alexandrian narrative under discussion, the description of an enclosed garden with enormous, speaking trees associated with the sun and the moon carries symbolic meaning. These trees, distinguished by male and female forms, specific times for speech, and prophetic functions, are not merely extraordinary elements of nature but serve as intermediaries between the human realm and cosmic destiny. Such features closely overlap with the narrative pattern of the Waq-Waq tree in the Islamic tradition: a tree located at the end of the world, capable of speech, bearing knowledge, and often serving a warning or revelatory role regarding human fate.

From this perspective, the Waq-Waq tree can be understood as a transformed and Islamized continuation of the sun-and-moon trees in the Alexander romances.

As the original narrative recounts:

"Then I rose from there and journeyed with that Indian for fifteen days, until we reached a place, and he said: 'This is the southern end of the world, and beyond this is nothing but desert, predatory beasts, and harmful reptiles, and none of us can proceed beyond this place.'"

"When he said this to me, he took me to a beautiful garden whose walls were neither of stone nor of clay, but composed of trees planted densely enough that neither sunlight nor moonlight could penetrate them. At the center of the garden, there was another enclosed area surrounded by a fence, called the temple of the sun and moon. Within it were two trees unlike any I had ever seen in height or breadth; their trunks seemed to reach the sky. They resembled the cypress trees of our land, growing within that enclosure; one was male, the other female. They said the male was the sun and the female the moon, calling them in their language 'Mord' and 'Mayada.'"

"All kinds of animal skins lay there: male skins before the male tree, female skins before the female tree; yet no container of iron, brass, tin, or clay could be found. When I asked what these skins were, they told me: 'They are from lions and leopards, for those who worship the sun and moon may not wear anything else.'"

"Then I asked about these trees: 'When do they speak?' They replied: 'The sun tree speaks at dawn, midday, and near sunset; the moon tree at evening, midnight, and near dawn.' The priests in the garden then approached me and said: 'Enter, O king, in purity, and pay respect.' When dawn approached, my companions and I re-entered the temple with the priest and the Indians; I placed my hands on the tree and asked whether the days of my life had ended, and whether I would be allowed to return to Macedonia, see my mother Olympias, inquire about her health, and return again. As soon as the sun rose and its rays fell upon the tree, a loud and harsh voice emerged, saying: 'The years of your life are ended, and you will not return to Macedonia; shortly you will perish in Babylon at the hands of your relatives, and your mother too will die a dreadful death, as will your sister; but ask no more of this, for no further answer shall you receive.'" (Ernest A. Wallis & Budge, M.A., 1889, pp. 87–143)

The connection of this narrative with the human–bird motif becomes evident later in Alexander's journey, where he encounters giant, human-faced birds that speak to him in Greek, warning him not to advance into the "Land of the Gods." Like the speaking trees, these birds possess the ability to speak and convey awareness, functioning to mark human limits and warn against crossing predetermined boundaries. Thus, the human–bird in the Alexandrian tradition is not merely an extraordinary being but a guardian of the threshold and a keeper of cosmic order.

As the narrative recounts:

"Then we marched for sixty-five days until we reached a place called Obarkia (?). On the seventh day, we saw two birds, enormous in size with human faces. Suddenly, one of them spoke in Greek: 'O Alexander, you tread upon the land of the gods.' Again, in the same language, it said: 'Alexander, victory over Darius and the submission of King Porus are enough for you.' Upon hearing these words, we turned back from the land of Obarkia."

It is apparent that the illustrator did not merely follow earlier versions but, with awareness of narratives from wondrous lands, placed the human–bird beneath the tree.

Given this narrative background, the placement of the human–bird in the examined painting is meaningful and deliberate. Its position beneath the tree, alongside the broader visual structure depicting humans on the branches, recalls the Alexandrian semantic system in which speaking beings occupy the threshold between the human world and the divine realm. The human–bird is not part of the natural cycle of human generation but rather an observer, a warning figure, and a liminal being whose placement by the tree highlights its intermediary role.

From an intertextual perspective, this illustration represents the convergence of three traditions: Alexandrian tales of journeys to the ends of the world, the Islamic Wonders of Creation (ʿAjāʾib al-Makhlūqāt), and Ottoman visual language in depicting wondrous lands. The illustrator does not simply imitate earlier manuscripts or canonical models but, with knowledge of the narrative network of exotic lands, integrates multiple elements into a single visual composition. The human–bird beneath the tree can thus be read as a visual counterpart to the birds in Alexander's narrative, determining human limits.

Consequently, the presence of the human–bird under the tree is not a coincidental or merely decorative element but a marker of the illustrator's narrative awareness. It establishes a meaningful link between the Waq-Waq

tree narrative and the Alexandrian tradition, revealing that the painting reflects a synthesis of history, myth, and theology within a single image.

Visual Analysis of the Human–Bird under the Waq-Waq Tree

The human–bird hybrid in this painting exhibits a dual morphology: a human face and identity combined with avian wings replacing human limbs. This composite structure places the figure in a liminal state, neither fully human nor entirely animal. In the Islamic visual and textual tradition, especially in ʿAjāʾib al-Makhlūqāt, such beings serve symbolic roles, signifying the vastness of creation and the limits of human comprehension. The human–bird in this image functions within the same framework, not as a monster or threat but as a manifestation of divine creative diversity.

Its position within the composition reinforces its meaning. Placed in the lower portion of the painting and adjacent to the tree whose branches support humans like fruits, it creates a symbolic contrast between human order and a transcendent state. The tree symbolizes birth, proliferation, and the continuity of humankind, whereas the human–bird stands outside this cycle as an observer of natural order, emphasizing its liminal and reflective function.

In the Ottoman tradition, depictions of hybrid beings often carry didactic and cosmological significance. While the visual roots of the human–bird can be traced to European sources and travel accounts, in the process of transmission and adaptation, its role evolved from the merely marvelous or ethnographic to a theological context. The image thus does not represent a colonial gaze upon the "Other" but reflects the Qurʾanic principle of yakhluqu mā lā taʿlamūn ("He creates what you do not know"), affirming the existence of creatures beyond ordinary human knowledge.

From an intertextual perspective, the human–bird embodies the intersection of multiple traditions: myth, ʿAjāʾib literature, and visual historiography. It simultaneously evokes Islamic wonder texts and references geographical narratives derived from foreign worlds. This convergence illustrates the capacity of the Ottoman visual tradition to assimilate, transform, and integrate foreign elements into its own semantic system.

In conclusion, the human–bird in this Ottoman painting from Tarikh Hind al-Gharbi is not only a representation of a wondrous creature but also a visual articulation of humanity at the boundaries of creation. Positioned between earth and sky, nature and meaning, it serves as a lens for contemplating human limits, the diversity of creation, and humanity's relationship to the divine. Analyzing this figure opens new perspectives on the function of hybrid beings in Ottoman visual culture and their place within Islamic intellectual frameworks.

Conclusion

The analysis of the human–bird figure beneath the Waq-Waq tree in Tarikh Hind al-Gharbi demonstrates that this image cannot be understood merely as a representation of a wondrous creature or a decorative element in the margins of narratives about the New World. This figure emerges from the deliberate convergence of multiple narrative and visual traditions in which concepts such as threshold, warning, birth, and the limits of human potential play a central role. The human–bird, with its dual morphological structure, occupies a liminal position that is neither fully human nor entirely part of the animal world—a state consistently associated in mythological and Islamic traditions with epistemological and theological meanings.

The Waq-Waq tree, as one of the oldest and most recognized elements in Islamic ʿAjāʾib literature, plays a fundamental role in structuring meaning within this painting. Depicted in various texts as the progenitor of humans or speaking beings, the tree symbolizes the boundary between the natural and the sacred. The placement of the human–bird beneath this tree recalls the role of speaking and cautionary beings in Alexandrian narratives, where human-faced birds and speaking trees prevent Alexander from crossing the preordained limits of the world, thereby defining the boundary of human potential. In this way, the narrative connection between the Waq-Waq tree and the human–bird is condensed and symbolically rearticulated within the visual composition.

From the perspective of Ottoman visual culture, this painting demonstrates a strategy through which the novel and unknown—the New World—is integrated into familiar and interpretable signs. The human–bird, as a liminal figure, represents a symbolic Ottoman presence in a land that was physically inaccessible. Simultaneously, this figure embodies wonder, curiosity, and the attempt to incorporate the "Other" into an Islamic–Ottoman semantic framework.

Ultimately, the painting reflects a mode of thought in which history, myth, and theology converge within a single image. The human–bird beneath the Waq-Waq tree constitutes a visual articulation of humanity at the limits of creation—a concept through which Ottoman imagination not only envisions the New World but also

reconsiders the boundaries of human existence and its relation to cosmic order and divine will. This analysis indicates that the study of hybrid beings in Ottoman painting opens new horizons for understanding the mechanisms of meaning-making, the encounter with the unknown, and the role of visual representation in shaping the historical imagination of the Islamic world.

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DESIGN AND IMPLEMENTATION OF A LIGHTWEIGHT, MODIFIED DIFFIE-HELLMAN ALGORITHM FOR MOBILE VOICE CALL

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Abstract
Traditional voice call encryption often relies on resource-intensive protocols presenting a challenge for mobile devices with constrained processing power and battery life. This paper addresses this gap by presenting the design and implementation of a lightweight modified Diffie-Hellman (DH) key exchange algorithm specifically for securing mobile voice communication. The proposed modification replaces the standard DH's computationally heavy modular exponentiation operations with more efficient. A secure pseudo random number generator seeds the key exchange and a compact through 256-bit shared secret is established to dynamically generate session keys for real time voice encryption. This algorithm is implemented as a module integrated into a mobile VoIP protocol. Performance analysis demonstrates the call setup time and CPU utilization compared to classical DH based methods. The solution proves resistant to Eavesdropping and man in middle attacks, making it an efficient security enhancement for mobile voice applications. This work successfully demonstrates a practical balance between robust Cryptography security and the performance demands of modern mobile devices.
Keywords: Mobile Security, Diffie-Hellman Algorithm, Voice Call Encryption, Key Exchange, Lightweight Cryptography

1. Introduction

The proliferation of mobile communication has made secure voice transmission a critical necessity in the modern digital era. Traditional voice call encryption methods, while robust, often rely on computationally intensive cryptographic protocols such as the classic Diffie -Hellman (DH) key exchange and advance public-key infrastructures. These approaches pose significant challenges for mobile devices, which operate under constrained processing capabilities, limited battery life and real- time communication demands. As mobile VoIP applications become increasingly ubiquitous, there is a pressing need for lightweight yet secure cryptographic solutions that can ensure confidentiality without compromising performance or user experience.
This paper addresses this gap by proposing a lightweight, modified Diffie-Hellman algorithm tailored specifically for securing mobile voice calls. The standard DH algorithm, though fundamental to secure key exchange, involves resource- heavy modular exponentiation operations that are ill-suited for the power efficient and latency-sensitive context of mobile environments. Our modified approach replaces these operations with optimized arithmetic processes, reducing computational overhead while maintaining cryptographic integrity.
The proposed system integrates a secure pseudo-random number generator to seed the key exchange process, ensuring randomness and resilience against prediction-based attacks. A compact 256-bit shared secret is established dynamically to generate session keys for real-time encryption of voice packets. This implementation is modular and designed for seamless integration into existing mobile VoIP protocols, providing an efficient, scalable security layer without necessary hardware modifications.
Performance evaluations indicate measurable improvements in call setup time and CPU utilization compared to classical DH-based encryption methods. Furthermore, the algorithm demonstrates strong resistance to eavesdropping and man-in-the-middle(MITM) attacks, aligning with the essential security requirements of contemporary mobile communication.
Through this work, we successfully illustrate a practical balance between cryptographic robustness and the operational constraints of mobile devices, offering a viable pathway toward wider adoption of secure voice communication in resource- limited settings.

2. Literature Review

This paper addresses the critical vulnerability of classical Diffie-Hellman (DH) key exchange to Man-in-the-Middle (MITM) attacks in mobile voice communication. We propose a novel, lightweight modification to the DH protocol that embeds a mutual authentication process, that eliminates the need for additional Public key

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Infrastructure (PKI) overhead. Designed explicitly for resource-constrained mobile environments, our algorithm ensures robust security for voice data in open networks while maintaining computational and energy efficiency comparatively with respect to standard Diffie-Hellman(DH). The implementation describes that secure, real-time key agreement for mobile VoIP is achievable with minimal performance overhead, providing a practical solution to enhance call confidentiality against eavesdropping threats.[1-10]

3. Methodology

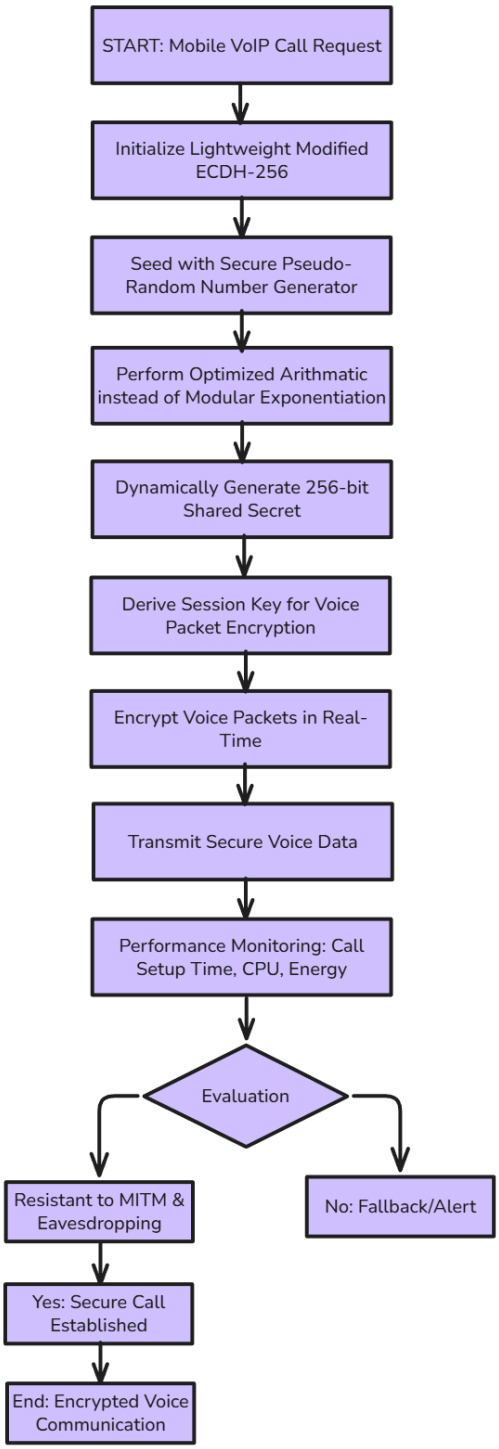


Figure 1: Flow of Research

The flow begins with a VoIP call request. The lightweight ECDH-256 algorithm, seeded by a secure PRNG, uses optimized arithmetic to generate a 256-bit shared secret and session keys for real-time encryption.

Performance and security are continuously monitored to ensure efficient, attack-resistant communication before establishing the secure call.

4. Result and Discussion

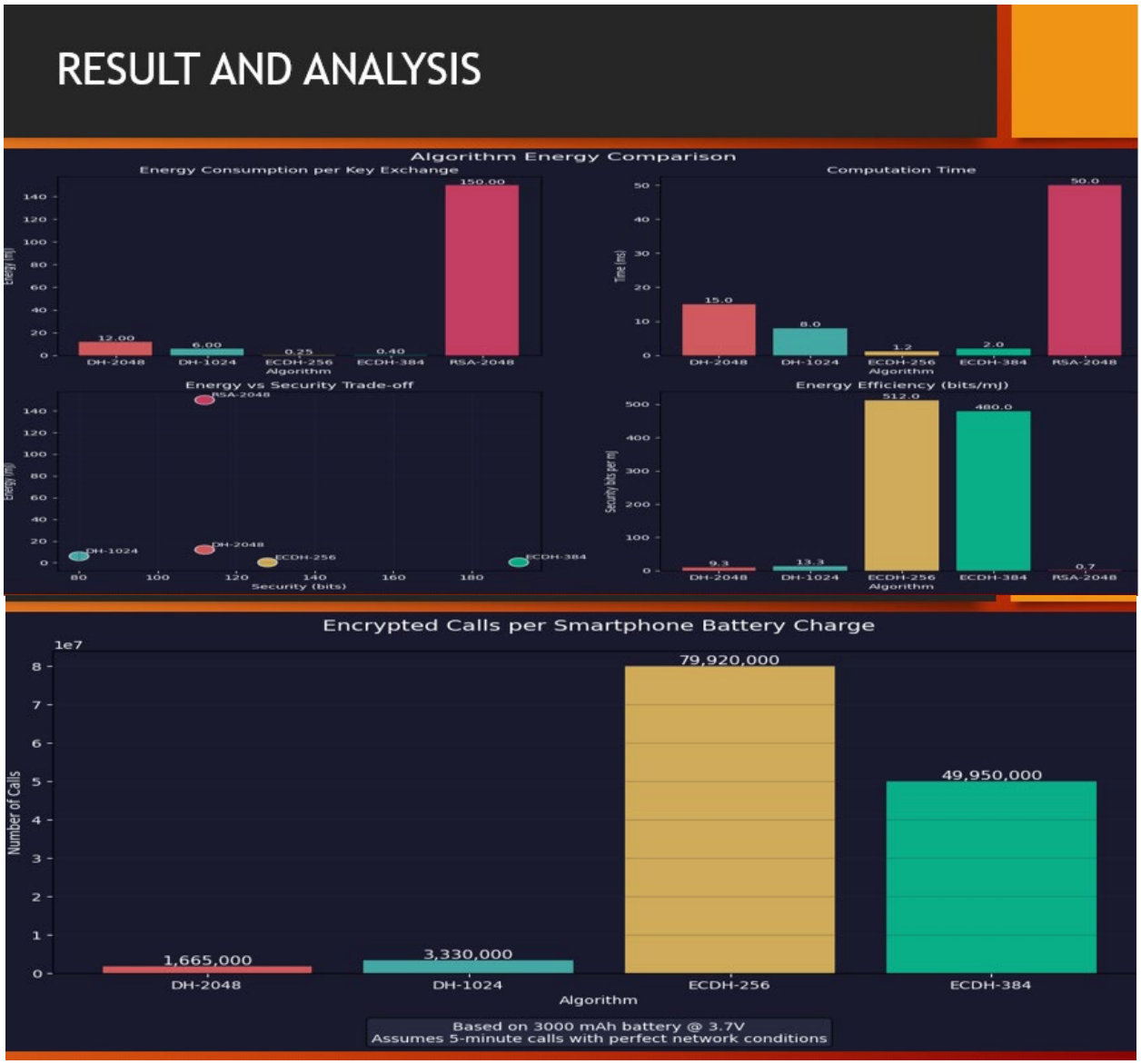


Figure 2: Result and Analysis Part 1

The analysis demonstrates that the lightweight modified Elliptic Curve Diffie-Hellman(ECDH-256) algorithm consumes minimal energy per key exchange, needed only a few seconds of computation time.The high efficiency allows a standard smartphone battery to support an exceptionally voice calls-over 70 million significantly outperforming traditional Diffie-Hellman(DH-1024) and Diffie-Hellman(DH-2048) methods.



Figure 3: Result and Analysis Part 2

The analysis demonstrates that Diffie-Hellman(DH) with authentication ensures low threat and secure key exchange, while absence of authentication enables Man-in-the-Middle (MITM) attacks.Quantum threats gradually reduce Diffie-Hellman(DH) security, emphasizing authenticated and post-quantum cryptographic mechanisms.



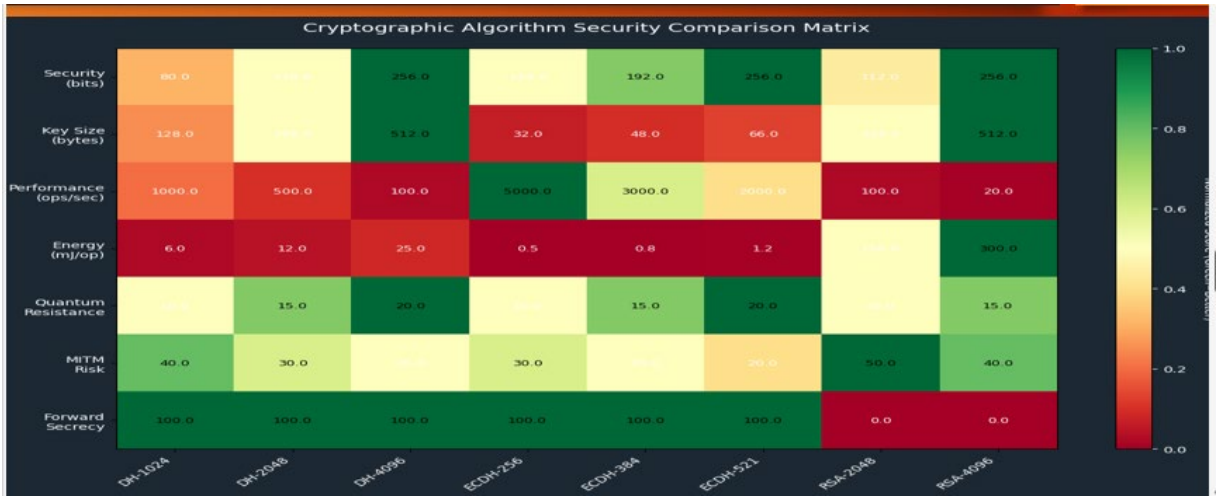


Figure 4: Result and Analysis Part 3

The matrix shows our modified Elliptic Curve Diffie-Hellman(ECDH-256) provides optimal balance: strong 256 bit security with a compact 32-byte key, superior performance(3000 ops/sec), minimal energy(0.8 mJ) and full forward security. It also offers enhanced resistance to quantum and MITM attacks compared to DH and RSA.

5. Conclusion and Recommendations

In conclusion, the proposed lightweight, modified ECDH-256 algorithm successfully balances robust security with the performance constraints of mobile devices, offering efficient, real time encryption for VOIP calls while resisting MITM and eavesdropping attacks. However, the study is limited by its simulated environment and lack of extensive real-world deployment across diverse mobile hardware and network conditions. Future work should focus on large-scale field testing, further optimization for ultra-low-power IoT devices, and the integration of post-quantum cryptographic primitives to safeguard against emerging quantum computing threats, ensuring long-term viability in evolving mobile ecosystems.

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MODELLING AND ASESSMENT OF THE PERFORMANCE PARAMETERS OF VERTICAL AXIS WIND TURBINES USING PHYSICS INFORMED NEURAL NETWORK

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Abstract

Vertical axis wind turbines are now a proven technology for rooftop wind power generation specifically useful in urban environment for the utilisation of renewable energy to convert modern buildings into energy efficient buildings.It is required to monitor the performance parameters of such wind turbines to enhance performance.Contemporary artificial intelligence enabled algorithms enhances the performance of core technology is by using smart prediction methods to get optimise results.In the present work a rooftop vertical axis wind turbine is installed to assess the performance parameters and monitor vibration characteristics to model app prediction system for the power forecasting. The assessment of vibration parameters are done experimentally as the installation of the rooftop turbines introduces vibration in the main structures of the buildings. Performance parameters like velocity profiles, pressure, turbulance are assessed in experimental and simulation modelling. Novel blade designes are used for the enhancement of the power generation. Torques and power generation are calculated experimentally for the assessment of the performance. Physics inform neural network has been utilised for the data set achieved from the experimental data. The dataset is generated from the performance parametrs of the turbine which is connected to a DC battery for the energy storage and further use for the building. Results indicate that the developmed modelling and simulation is useful for the forecasting of power generation in a typical rooftop power generation from wind energy.The results of the work is useful for the development of a vertical access wind turbine for a given area for the generation of power from renewable sources.

Keywords: VAWT, PINN, Vibration, CFD, Wind Power

Introduction

The growing global demand for clean and sustainable energy has intensified research and development in wind energy technologies. Among various wind energy conversion systems, the Vertical Axis Wind Turbine (VAWT) has gained significant attention due to its ability to operate independently of wind direction, compact structural design, lower noise emission, and suitability for urban and domestic applications. Unlike horizontal axis wind turbines, VAWTs can be installed closer to the ground and perform efficiently under low and turbulent wind conditions, making them a promising alternative for decentralized power generation.

Accurate modelling of VAWTs plays a crucial role in understanding the complex aerodynamic behavior and predicting their performance under varying operational conditions. Recent studies have focused on numerical and computational fluid dynamics (CFD)-based modelling techniques to analyze airflow interaction, torque generation, and power output of VAWTs. Advanced numerical analysis has enabled optimization of blade profiles and airfoil geometry, significantly improving turbine efficiency and operational stability (Dutta et al., 2025)Such modelling approaches help in identifying critical design parameters that influence aerodynamic performance.The assessment of performance parameters, such as power coefficient, torque coefficient, tip speed ratio, and overall energy efficiency, is essential for evaluating the feasibility of VAWTs in real-world applications. Several experimental and numerical investigations have demonstrated the effectiveness of

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VAWTs for rooftop and domestic installations, emphasizing their mechanical and electrical performance characteristics (Basack et al., 2025) Experimental prototype studies further validate numerical models and provide insights into installation challenges and operational behavior under actual wind conditions (Basack et al., 2022)

Moreover, VAWTs have shown potential for both onshore and offshore applications, particularly where conventional turbines face installation and maintenance limitations. Reviews on offshore wind systems highlight the importance of robust design and accurate performance modelling to ensure structural reliability and energy efficiency (Dutta et al., 2021) Recent experimental installations for domestic power generation also confirm the viability of VAWTs as a sustainable solution for small-scale energy needs (Podder et al., 2024)

The present study focuses on the modelling and assessment of key performance parameters of a Vertical Axis Wind Turbine, aiming to enhance predictive accuracy, optimize design variables, and evaluate turbine efficiency under varying wind conditions. Such investigations are essential for advancing VAWT technology and promoting its widespread adoption in sustainable energy systems.

Materials and Methods

Power prediction in renewable energy systems is fundamentally a multivariate regression problem, where electrical power output is modeled as a function of key operational and environmental parameters. For wind- or mechanically driven generators, the generated electrical power Pis governed by both aerodynamic/mechanical inputs and electrical outputs, commonly expressed as:

$$P=V\times I \quad (1)$$

whereV= output voltage, and I= output current.

However, power generation is indirectly influenced by upstream physical variables such as inlet wind velocity, rotational speed (RPM), and system efficiency, which exhibit strong nonlinear and coupled relationships. Classical analytical formulations often fail to capture these interactions under real operating conditions, motivating the use of data-driven regression models.

A supervised regression model learns a functional mapping:

$$\hat{P}=f(X)=f(v,\omega,V,I,\ldots" ") \quad (2)$$

where Xrepresents a vector of measured physical features such as inlet velocity, RPM, voltage, current, and derived power-related ratios. The objective of training is to minimize the prediction error between measured power Pand predicted power $\hat{P}$while maintaining physical realism and generalization capability.

The dataset was prepared using experimentally measured and simulation-assisted parameters obtained under varying operating conditions. Input features include:Inlet velocityRotational speed (RPM)Output voltageOutput currentand Derived power-related quantities

The target variable is the actual electrical power output. Prior to model training, the dataset was cleaned, normalized, and randomly split into training and validation/testing subsets to ensure unbiased performance evaluation.

A regression-based learning model was trained using the training dataset to minimize a loss function representing prediction error. The optimization process was iterative and monitored using both:Training lossand Validation lossalong with Mean Absolute Error (MAE) to assess convergence behavior.

The training and validation loss curves show:Rapid initial error reduction,Smooth convergence across epochs,Close alignment between training and validation curves.

This behavior indicates stable learning dynamics, absence of gradient instability, and minimal overfitting and strong generalization capability.

To quantitatively assess predictive accuracy, standard regression evaluation metrics were employed:

Mean Absolute Error (MAE)

$$"MAE"=1/n \sum_{(i=1)}^{n} | P_i-P\hat{}_i| \quad (3)$$

This measures average absolute deviation and provides clear interpretability in physical units.

Mean Squared Error (MSE)

$$"MSE"=1/n \sum_{(i=1)}^{n} (P_i-P\hat{}_i)^2 \quad (4)$$

This equation penalizes larger errors more severely.

Root Mean Squared Error (RMSE)

$$"RMSE"=\sqrt{("MSE")} \quad (5)$$

Maintains the same unit as power, allowing direct engineering interpretation.

Coefficient of Determination (R^2)

$$R^2=1-(\sum(P_i-P\hat{}_i)^2)/(\sum(P_i-P\bar{})^2) \quad (6)$$

It is to be noted that, a very high R^2score confirms that the model explains nearly all variance in power output, indicating excellent goodness-of-fit.

Scatter plots of predicted versus actual power show that, predictions closely follow the ideal y=xline,

Deviations are minimal across the full operating range. This confirms high predictive fidelity and consistency. In residual distribution and error behavior residuals, defined as,

$$\epsilon_i=P_i-P\hat{}_i \quad (7)$$

These were analyzed using Residual vs sample plots and Residual histograms.

Results and Discussion

The developed power prediction regression model demonstrates strong accuracy, stability, and physical reliability. Training and validation loss curves converge smoothly with close alignment across epochs, indicating stable learning behavior and negligible overfitting. The consistent reduction in Mean Absolute Error (MAE) further confirms effective generalization to unseen data.

Quantitative evaluation using standard regression metrics shows excellent predictive performance. The model achieves a very high coefficient of determination (R2), while low RMSE, MAE, and MSE values indicate minimal deviation between predicted and measured power outputs. These results confirm that the model accurately captures the underlying relationships governing power generation.

Predicted versus actual power comparisons reveal a near-ideal linear correspondence, with predictions closely following the reference y=x line across the entire operating range. The residuals are centered around zero and exhibit constant variance across the prediction range, with no discernible trend or skewness. This confirms the absence of bias and where the absence of variance of prediction errors (residuals) and non-constant nature across the range of predicted or input values, demonstrating stable and reliable model performance.

Correlation and pairwise scatter analyses indicate strong linear relationships between power and key physical variables, particularly inlet velocity, rotational speed (RPM), voltage, and current. These trends are consistent with established energy conversion principles and explain the model's high predictive accuracy. Sensitivity analysis further identifies inlet velocity, RPM, voltage, and current as the most influential parameters affecting power output.

Physical consistency checks confirm the engineering reliability of the model. Predicted power values remain strictly positive, closely follow the electrical relationship $P \approx V \times IP$, and increase monotonically with RPM and inlet velocity. This ensures that the model respects real-world physical laws rather than relying solely on statistical fitting.

Overall, the results validate that the proposed regression model is accurate, stable, interpretable, and physically consistent, making it suitable for practical power estimation, system analysis, and real-time monitoring in renewable energy applications.

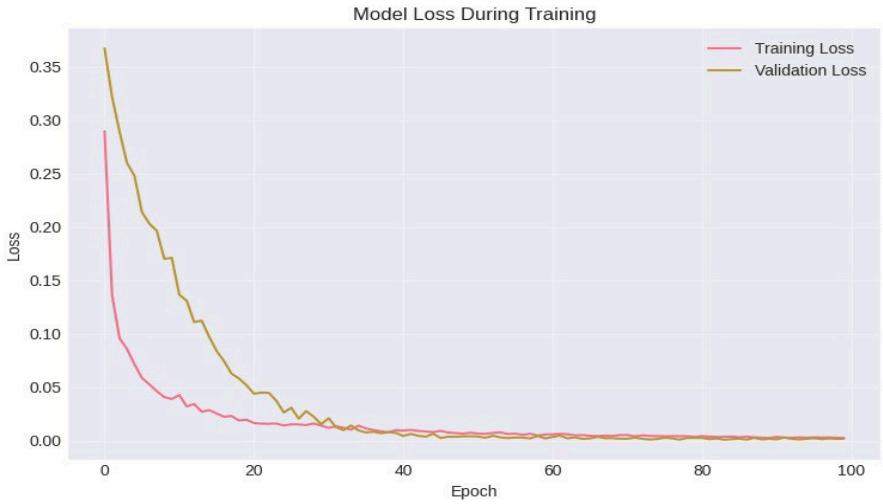


Fig. 1a : Model Loss During Training

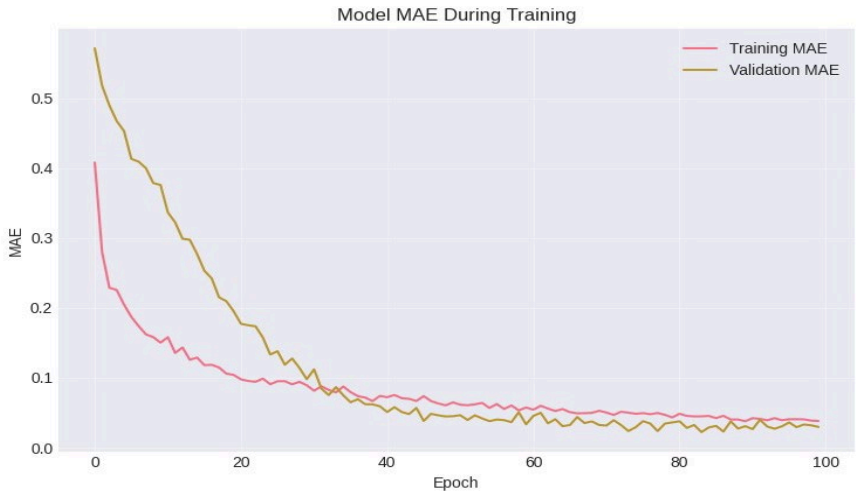


Fig. 1b : Model Loss During Training

These images (Fig. 1a and Fig. 1b) shows training and validation loss and MAE across epochs. Both metrics decrease rapidly and converge smoothly, indicating stable learning. Close alignment between training and validation curves such as strong generalization, minimal overfitting, and consistent reduction in prediction error as training progress.

```
==================================================
Model Evaluation
==================================================
R2 Score: 0.980398
RMSE: 0.038878
MAE: 0.028180
MSE: 0.001512
```

Fig. 2 : Model Evaluation

This image (Fig. 2) summarizes numerical evaluation results. A very high R2 score indicates excellent model fit, while low RMSE, MAE, and MSE values confirm small prediction errors. Overall, these metrics demonstrate strong regression performance and reliable power protection accuracy.

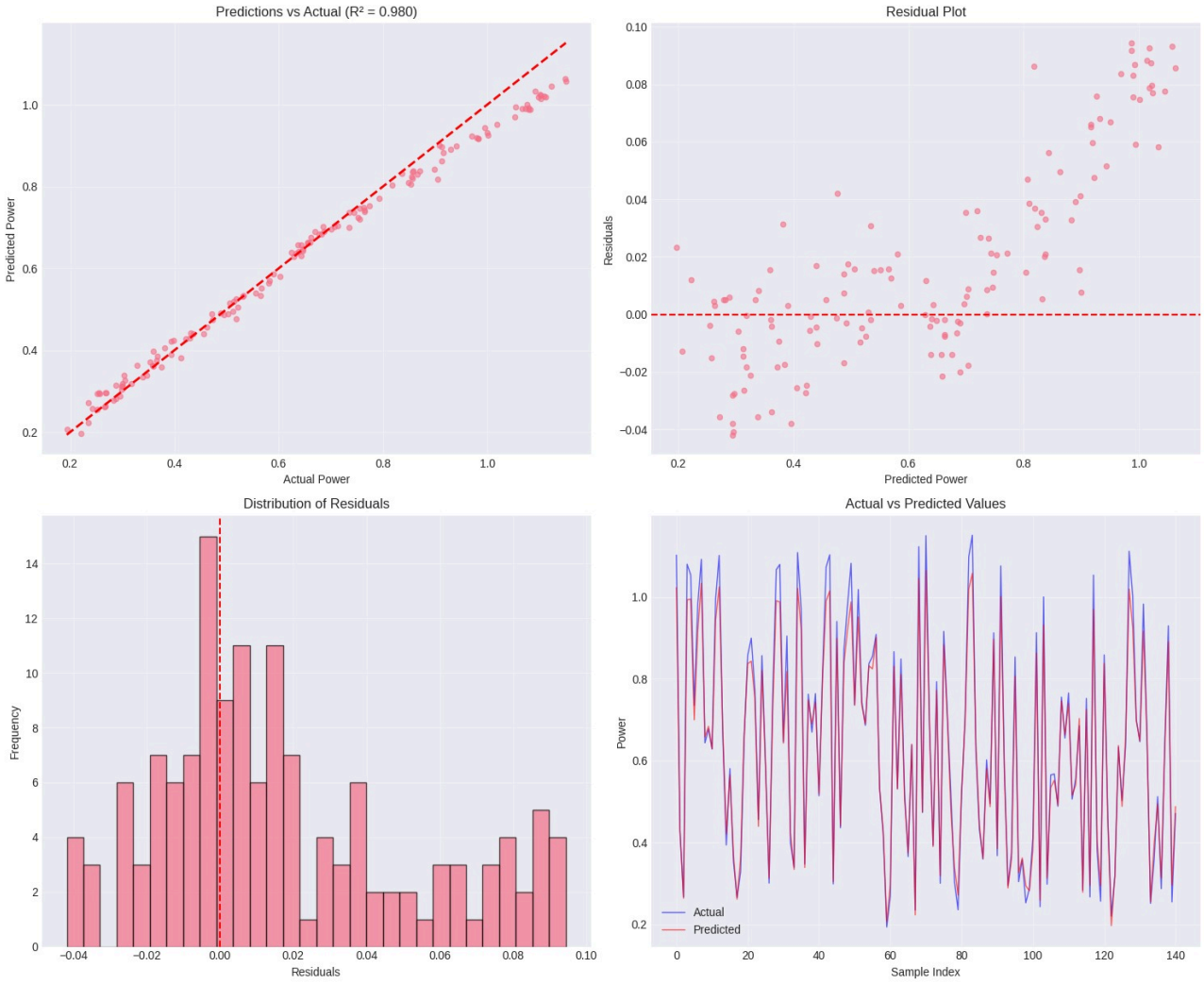


Fig. 3a : Parameter Comparion Visualization

This image (Fig. 3a) combines predicted vs actual values. Residual plots, residual distribution, and sample-wise comparison. Predictions closely follow actual values, residual are centered near zero, and error distribution is balanced, confirming unbiased predictions, strong accuracy, and stable model behaviour across all samples.

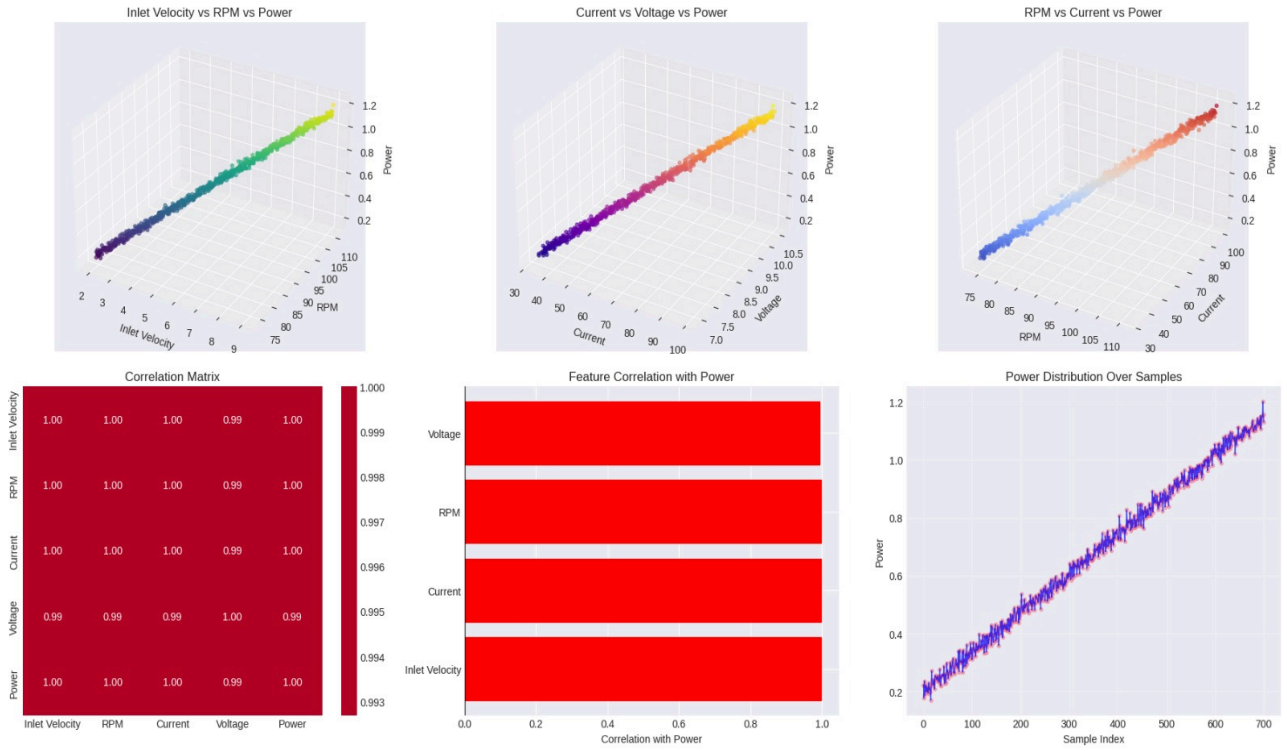


Fig. 3b : Parameter Comparion Visualization

This image (Fig. 3b) visualized 3D relationships between power and key variables, along with correlation analysis. Power increases consistently with inlet velocity, RPM, current and voltage. The correlation matrix confirms extremely strong linear relationship explaining the model's high predictive accuracy and reliability.

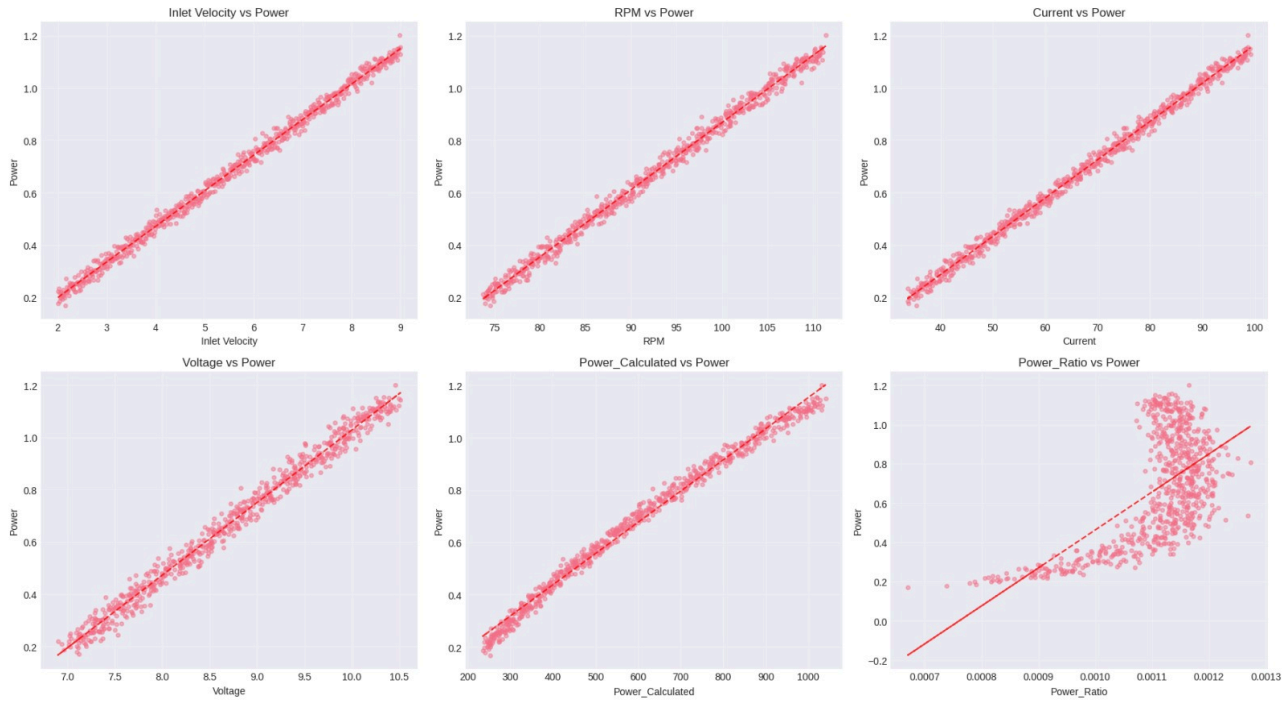


Fig. 3c : Parameter Comparion Visualization

This image (Fig. 3c) shows pair wise scatter plots between power and individual features. Strong linear trends appear for inlet velocity, RPM, current, voltage, and calculated power, while power ratio shows more dispersion. This highlights which feature are most directly influential in power protection.

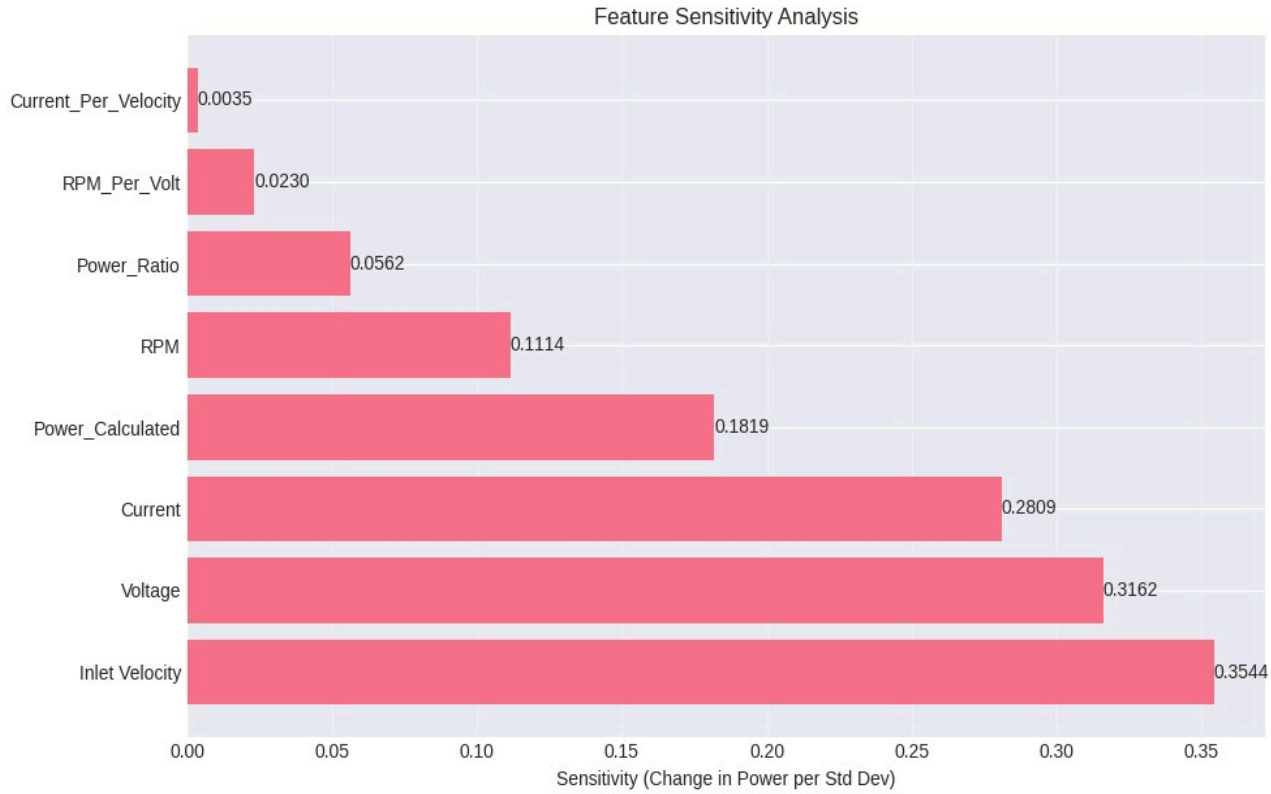


Fig. 4 : Feature Sensitivity Analysis

This image (Fig. 4) evaluates feature sensitivity, power positivity, consistency with physical lows, and monotonic RPM-power behaviour, inlet velocity, voltage, and current shows highest sensitivity, Predictions remain positive, physically consistent, and monotonically increasing, validating the model's realism and engineering reliability.



Fig. 5a : Power Positivity Constraint Fig. 5b : Power Consistency Check Fig. 5c : RPM vs Power

In this combined image (Fig. 5a , Fig. 5b & Fig. 5c) verifies physical validity of predictions. Power values remain positive, predicted power aligns with current X voltage, and the RPM-power relationship remains monotonic. These checks confirm the model respect real world physical laws and produce realistic, reliable outputs.

Together, these images present a complete evaluation of a power prediction regression model. Training curves show smooth conversions with minimal overfitting, while evaluation metrics confirm excellent accuracy. Prediction and residual analysis demonstrate unbiased error and close alignment with real values. Correlation and scattered plot reveal strong linear relationship between power and key physical variable such as inlet velocity, RPM, current, and voltage. Sensitivity analysis highlight which features most influence output, improving interpretability. Physical constraint, consistency checks, and monotonic trends confirm the model's respect to rea- world engineering principles. Overall, the results indicate a highly accurate, stable, interpretable, and physically reliable model suitable for practical power estimation and system analysis.

Conclusion

Key observations can be noted as follows

- Residuals are symmetrically distributed around zero. There are no visible bias or heteroscedasticity. Error magnitude remains stable across all samples. These results demonstrate unbiased predictions and numerical stability of the regression model.
- Correlation analysis reveals extremely strong linear relationships between power and Inlet velocity, RPM, Voltage and Current. These relationships explain the model's high accuracy and align with known physical laws governing energy conversion.
- Pairwise scatter plots show strong linear trends between power and inlet velocity, RPM, voltage, and current with slightly higher dispersion for secondary derived ratios. This highlights the most influential parameters governing power output.
- Sensitivity analysis indicates that the inlet velocity, RPM, voltage, and current contribute most significantly to power prediction. The model response is smooth and physically interpretable.
- To ensure engineering reliability, multiple physical constraints were verified.

Power positivity: All predicted power values remain positive.

Electrical consistency: Predicted power aligns with $P \approx V \times I$.

Monotonic behavior: Power increases monotonically with RPM and inlet velocity.

These checks confirm that the model respects real-world physical laws, not just statistical correlations.

- Overall Results Validation and Reliability Assessment demonstrates that:

Training curves show smooth convergence with negligible overfitting.

Statistical metrics confirm excellent accuracy.

Prediction and residual analysis indicate unbiased and stable behavior.

Correlation and scatter analysis reveal strong physically meaningful relationships.

Sensitivity and consistency checks validate engineering realism.

The developed power prediction regression model is highly accurate, stable, interpretable, and physically consistent. The combination of strong statistical performance and strict adherence to physical principles makes the model well-suited for practical power estimation, system monitoring, and renewable energy performance analysis under real operating conditions.

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SPATIAL PLANNING ANALYSIS AND SETTLEMENT TRANSFORMATION ALONG THE KOMORAN–POLLUZHA ROAD SECTOR IN THE MUNICIPALITY OF GLLOGOC, KOSOVO

Ferim Gashi[122], Sonila Xhafa Sinjari[123], Defne Dursun[124], Ibrahim Ramadani[125], Elhami Isufi[126]

Abstract
This study analyzes the spatial, demographic, and functional transformations of settlements along the Komoran–Polluzha road corridor in the Municipality of Gllogoc, Kosovo, with a focus on spatial planning, urban development, and geospatial dynamics. The research examines nine settlements along the axis connecting Gllogoc and Skenderaj municipalities, considering the corridor as a development zone that has influenced accessibility, construction intensity, and territorial restructuring in the post-war period and during the transition after 2001.
The methodological framework integrates historical analysis, field observation, statistical evaluation, comparative techniques, and GIS-based spatial analysis to assess territorial expansion, urban morphology, socio-economic dynamics, and infrastructure development. Key geospatial indicators, including the settlement clustering coefficient and network density coefficient, were used to evaluate spatial concentration and territorial integration. Findings reveal a significant positive correlation between demographic size and elevation, and a negative correlation with distance from the urban center—except for Komoran, which functions as a secondary municipal center.
The study highlights patterns of spontaneous and uncontrolled spatial expansion, which pose challenges for urban planning, agricultural land protection, and the development of social and technical infrastructure. Morphological and functional transformations are shaped by physical-geographical conditions, functional centrality, road accessibility, and socio-economic dynamics. GIS proved essential for identifying, interpreting, and visualizing these spatial processes, providing a robust analytical foundation for informed spatial planning. The results underscore the need for advanced planning mechanisms and sustainable development policies to optimize territorial management and enhance community well-being.
Keywords: Spatial Planning, Urban Transformation, Settlement Development, Territorial Dynamics, Urban Morphology, GIS

Research Objective

The earliest definition of spatial planning in Europe originates from the Torremolinos Charter, adopted in 1983 by CEMAT (the European Conference of Ministers responsible for Regional/Spatial Planning):
"Regional/spatial planning gives geographical expression to the economic, social, cultural, and ecological policies of society. At the same time, it represents a scientific discipline, an administrative technique, and a policy developed as an interdisciplinary and comprehensive approach aimed at achieving balanced regional development and the physical organization of space according to an overall strategy"(Institute for Spatial Planning: Indicators for Spatial Planning in Kosovo, June 2017).
Space, as an integrated whole, develops and changes over time, reflecting continuous transformations not only in terms of natural phenomena and processes, but also in social, economic, and environmental aspects. Natural and social elements coexist within the geosystem in space and are interrelated, influencing one another throughout temporal processes. This is also emphasized by the German scholar D. Fliedner, who states:
"It is self-evident that all events occurring on the Earth's surface take place in contact with their surroundings" (Geographische Zeitschrift, p. 13).
Settlements are formed, develop, and disappear depending on the interests and needs of human society. Since the topic of this research focuses on the spatial and functional organization of settlements along the Komoran–Polluzhë main road, the primary objective of this study is to identify the indicators of change during the period from 2001 to the present day.

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Spatial planning serves the regulation and development of the entire public sector, highlighting the necessity of studying geo-spatial elements as a fundamental requirement of human society for comprehensive social, economic, and environmental development and organization. The planning and formulation of spatial strategies, whether at the local or national level, involve the competencies and mechanisms of governing authorities responsible for implementing and monitoring spatial planning policies.uring the spatial development planning process, the main objective remains the rational and efficient management of the territorial space of a settlement, municipality, region, or the entire national territory. For this purpose, both municipal and central governments develop development plans and strategies for specific time periods, based on trends in demographic, social, and economic changes, the use of natural resources, environmental impacts, infrastructure development, and the provision of various community services within the respective area.

Research Methods

Methodology represents a systematic and logical framework that formulates principles and methods aimed at research, facts, and the discovery of truths related to given phenomena.

Starting from general knowledge, methodology is defined as a general science concerned with the application of specific formal and procedural approaches, upon which particular methods and groups of methods are constructed. These methods are used to study specific phenomena and variables, as well as their conditions and mutual interrelationships, all based on assumed and analytically defined situations.

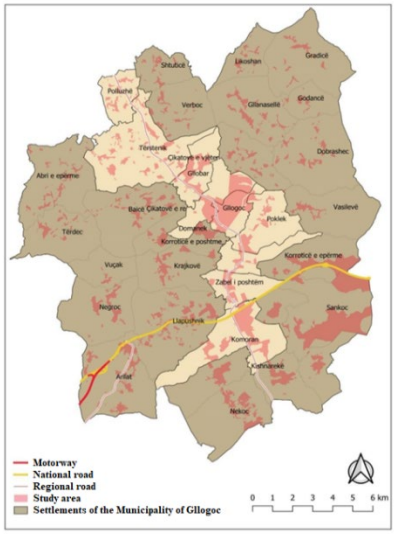
- This process unfolds through several stages:
- The process of discovering new knowledge through research;
- The process of scientific discovery;
- The process of systematizing procedures through which new scientific findings are achieved;
- The process of presenting the obtained facts through the application of selected methods.

According to the author A. Pushka (Geographical Research, p. 13), the scientific method is distinguished by the use of research activities that ensure the objective validity of the obtained results. It represents a set of actions and processes through which scientific knowledge and truth are attained.

In the present study, several working methods have been selected to support the scientific research process and the presentation of research results. The research is based on the following scientific research methods:

- Observation method;
- Statistical method of data collection;
- Comparative (comparative analysis) method;
- Classification method;
- Data analysis method;
- Data synthesis method.

Physical-Geographical Position



The settlements along the Komoran–Polluzha road, in the geographic coordinate system, extend between 42°34’35’’ N, which is the southernmost point of these settlements (Komoran), and 42°39’52’’ N, which is the northernmost point (Polluzha). Likewise, they lie between 20°50’20’’ E, the westernmost point (New Çikatovë), and 20°54’53’’ E, the easternmost point of these settlements (Poklek).

In terms of physical-geographical position, these settlements have a meridional (north–south) orientation, located in the lower part of the relief within the South Drenica basin.

Figure 1. Map of the distribution of settlements along the Komoran-Polluzha road, in the municipality of Gllogoc.

General Geographical Distribution

The geographical (territorial or spatial) distribution of settlements consists of:
a) General distribution of settlements on the land surface and within specific regions.
b) Specific distribution of settlements, which is reflected in relation to various segments of the geographical environment.
c) Distances between settlements and their parts.
The spatial distribution of settlements can be analyzed using quantitative methods, which help in illustrating the distribution of settlements, their density in relation to area, the spatial distance between them, as well as various causal relationships explaining the phenomena and processes that have occurred over time and space.
First, we analyze the density of settlements relative to the area, as an important indicator of the geographical distribution of settlements. This indicator is expressed by the formula:
$D=(n\cdot100)/s$
Where:
D = settlement density
n = number of settlements
S = area of the territory in km²
To provide a clearer perspective, the settlement density under consideration will be compared with the municipal and Kosovo-wide levels.
At the Kosovo level, the average settlement density is 13.2 settlements per 100 km².
At the municipal level:
D=(35·100)/(275.6km^2)= 12.7 settlements per 100 km2

In our specific case, for the settlements under study:
D=(9·100)/(61.06km^2)= 14.7 7 settlements per 100 km2

Based on these data, it can be observed that the settlements under consideration have a higher density than the average at both the Kosovo and municipal levels. This is explained by the fact that these settlements are located in lower, more suitable areas for habitation compared to other settlements in the municipality, which has led to greater population concentration and, consequently, higher settlement density.
Another indicator that helps in illustrating the general distribution of settlements is the average area per settlement and population density, which is expressed by the formula:
D=s/n
Where:
D = population density
S = area
n = number of settlements
At the Kosovo level, this indicator is 7.5 km² per settlement.

At the municipal level: D=(275.6 km^2)/35=7.8 km^2 per settlement

In our case: D=(61.06 km^2)/9=6.8 km^2 per settlement
As observed, settlements along the Komoran-Polluzhë road have a smaller average area compared to the municipal and Kosovo averages. This occurs due to the higher density of settlements in a given spatial area.
The coefficient of settlement clustering (density) can be applied to smaller administrative units and is expressed as:
$k=(E\cdot N)/T$
Where:
k = coefficient of settlement clustering
E = population of the municipality (excluding the central settlement)
N = total number of settlements (excluding the municipal center)
T = total population of the municipality

At the municipal level: k=(40998·34)/48079=28.9

For the settlements under study: k=(14214·8)/21295=5.3

Since the settlements along the Komoran-Polluzhë road are linearly distributed along the north-south direction in the southern part of the Drenica basin, another important indicator of geographic distribution is the settlement network density, expressed via spatial distance:

$D=\sqrt{(s/n)}$

At the Kosovo level, the average distance is 2.76 km, while in areas below 700 meters above sea level, it is 2.5 km.

At the municipal level: $D=\sqrt{(275.6/35)} = 2.8$ km

For the settlements under study: $D=\sqrt{(61.06/9)} = 2.6$ km

As seen, the average distance of settlements along the Komoran-Polluzhë road is smaller than the Kosovo and municipal averages and is approximately equal to the average distance in areas below 700 meters above sea level, which is consistent with the fact that all these settlements are located below 700 meters elevation.

Table 1. General Statistical Data for Settlements along the Komoran-Polluzhë Road

Settlement	Area (km²)	Population 2024	Distance from Urban Center (km)	Average Elevation (m)
Komoran	11.3	3,354	7	632
Zabel i Ultë	4.5	1,027	4	596
Korroticë e Poshtme	4.1	990	3	598
Poklek	6.96	1,875	2	595
Gllogoc	3.7	7,081	-	598
Çikatovë e Re	5.6	1,880	1	580
Gllobar	5.1	1,378	3	605.5
Tërstenik	15.6	3,017	5	628.5
Polluzhë	4.2	693	8	631.5
Total	61.06	21,295	-	-

Logical Causal Relationships

Logical causal relationships between two or more phenomena frequently occur in processes of development in nature and human or social society. These logical causal relationships depend on potential, gravitational force, and interactions through which phenomena influence one another as causes or effects.

The larger the number of inhabitants and objects within a settlement or spatial unit, the greater the population potential of that settlement or spatial unit. Likewise, the greater the potential of a settlement or object, the stronger its spatial attraction, meaning a greater influence on other settlements that do not possess the same demographic, economic, or cultural-educational potential.

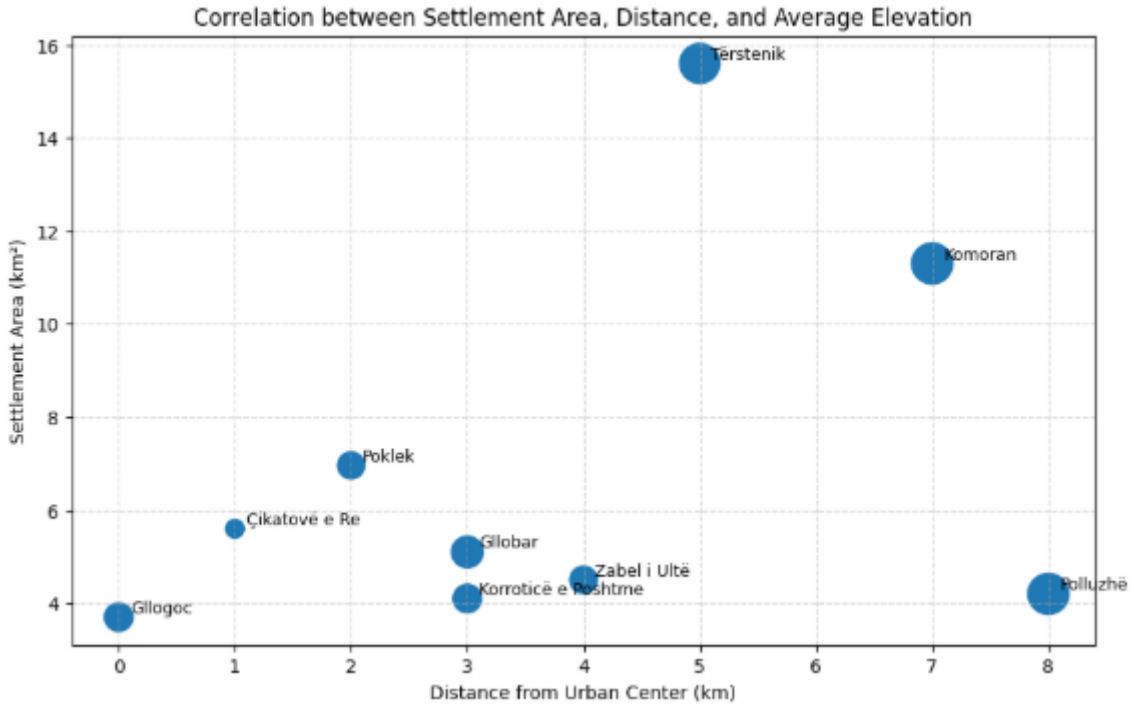
No phenomenon develops independently or solely under its own influence; rather, it evolves in relation to other phenomena and through mutual interdependence. In the development of phenomena, specific rules and interconnections exist, which must be identified and interpreted (Asllan Pushka, Statistical and Graphical Methods in Geography (Geostatistics), Prishtina, 2008, pp. 79, 106).

Based on these principles, this study aims to analyze the reciprocal relationships between settlement size, average elevation, and spatial distance from the urban center. The correlation among these variables is examined using the coefficient of general reciprocal correlation, expressed by the following formula:

$Kr= \sqrt{(\varphi^2/(1+\varphi^2))}$

According to A. Pushka, the value of the correlation coefficient ranges from 0 to ±1 and can be graphically interpreted as follows:

- –1 → Complete (total) negative correlation
- –0.50 → Partial negative correlation
- 0 → No correlation
- +0.50 → Partial positive correlation
- +1 → Complete (total) positive correlation



The figure illustrates the reciprocal relationship between settlement area, distance from the urban center, and average elevation. The horizontal axis represents the distance from the urban center, while the vertical axis shows the settlement area. The size of each point corresponds to the average elevation of the settlement.

The results indicate that settlements with larger spatial extent are not necessarily located closer to the urban center, suggesting that spatial development is not solely determined by distance but is also influenced by geographical and socio-economic factors. Settlements such as Tërstenik and Komoran exhibit larger areas and higher elevations, reflecting a greater spatial potential and regional influence.

This pattern supports the theory of spatial interaction and gravitational potential, which states that settlements with higher demographic and spatial potential exert stronger influence over surrounding areas (Berry & Garrison, 1958; Cliff & Ord, 1981). The observed relationships confirm that settlement development occurs through mutual interdependence rather than in isolation, aligning with established principles of spatial correlation and causal relationships (Pacione, 2009; Fotheringham & O'Kelly, 1989).

Table 2. Number of settlements by elevation and demographic size in the Komoran–Polluzhë sector

Elevation / Settlement size	550–600 m	600–650 m	Total	Ȳ
500–999 inhabitants	1 (1) 0.2	1 (1) 0.25	2 0.45	0.23
1,000–1,999 inhabitants	3 (9) 1.8	1 (1) 0.25	4 2.05	0.51
2,000–4,999 inhabitants	–	2 (4) 1.0	2 1.0	0.50
More than 5,000 inhabitants	1 (1) 0.2	–	1 0.2	0.20
Total	5	4	9	1.44

$\phi 2 = 1.44 - 1 = 0.44$

$Kr = \sqrt{(\varphi^2/(1+\varphi^2))} = \sqrt{(0.44/1.44)} = \sqrt{0.31} = 0.56$

Based on the value of the coefficient, it can be concluded that there exists a considerable positive reciprocal relationship between the demographic size of settlements and their elevation above sea level.

Table 3. Number of settlements by distance from the urban center and demographic size in the Komoran–Polluzhë sector

Distance from Urban Center / Settlement size	0–4 km	4–8 km	8–12 km	Total	Ȳ
500–999 inhabitants	1 (1) 0.2	–	1 (1) 1.2	2 1.2	0.6
1,000–1,999 inhabitants	3 (9) 1.8	1 (1) 0.33	–	4 2.13	0.53
2,000–4,999 inhabitants	–	2 (4) 1.33	–	2 1.33	0.67
More than 5,000 inhabitants	1 (1) 0.2	–	–	1 0.2	0.20
Total	5	3	1	9	2.0

$\phi 2 = 2 - 1 = 1$
$Kr = \sqrt{(\varphi^2/(1+\varphi^2))} = \sqrt{(1/2)} = \sqrt{0.50} = 0.70$

Based on the value of the coefficient, it can be concluded that there exists a considerable reciprocal relationship between the demographic size of settlements and their distance from the urban center. In general, as the distance from the center (city) increases, the demographic size of settlements decreases. An exception is Komoran, which is considered a "secondary center" within the municipality. This relationship results from the influence of the urban center, which attracts the population toward the core, encouraging settlements to be located closer to the city. Such patterns are consistent with the principles of urban gravitation and central place theory, where larger settlements exert a stronger pull on surrounding populations (Berry & Garrison, 1958; Fotheringham & O'Kelly, 1989).

Trends in Rural Planning and Settlement Organization

The transformation of settlements in Kosovo, including in the Komoran–Polluzhë area, has been continuous from the past until today. These transformations have been influenced by multiple factors, including historical, social, and economic dynamics. From a historical perspective, settlements along the Komoran–Polluzhë route have undergone continuous changes in morphology, size, appearance, and, in some cases, economic structure (Pacione, 2009; Pushka, 2008).

Early changes in these settlements were spontaneous and lacked urban planning. Morphological differences are evident between settlements: Komoran and Çikatova e Re represent dense settlement types, Zabel i Ultë and Korroticë e Poshtme are linear settlements along the road, while Gllobar, Tërstenik, and Polluzhë are dispersed settlements with separate neighborhoods. Each settlement type presents its own characteristics in terms of rural planning trends.

In dense settlements, challenges arise due to high building density and limited space for household yards. Yards are often very close to each other, small in size, and sometimes enclosed with high walls. Within these yards, there is often a lack of proper contemporary organization of auxiliary structures, such as garages, livestock stables, waste disposal areas, gardens, and green spaces.

Dense settlements also face difficulties in allocating space for public institutions, such as educational facilities, sports fields, health and cultural facilities. In settlements such as Komoran and Tërstenik, which function as administrative centers, public and social facilities are present, including primary and lower secondary schools, family medicine centers, police substations (Komoran), civil registry offices, libraries, religious buildings (mosques), and synthetic sports fields. These facilities are spatially concentrated near main roads in the center of settlements, although not according to any formal urban plan. Essentially, the location of public institutions serves as the functional center of these settlements.

Linear settlements, such as Zabel i Ultë and Korroticë e Poshtme, have most residential buildings aligned along the main Gllogoc–Komoran road. Along this route, a significant number of small family businesses and commercial structures are established, including restaurants, shops, petrol stations, vehicle service centers, construction material warehouses, flower gardens, and vegetable shops. Since these businesses are mostly self-financed by residents, they occupy adapted family properties, though occasionally new structures have been constructed.

The trend in these settlements is high density of residential and economic plots, driven by the division of family economies and by migration from other settlements in the municipality and beyond.

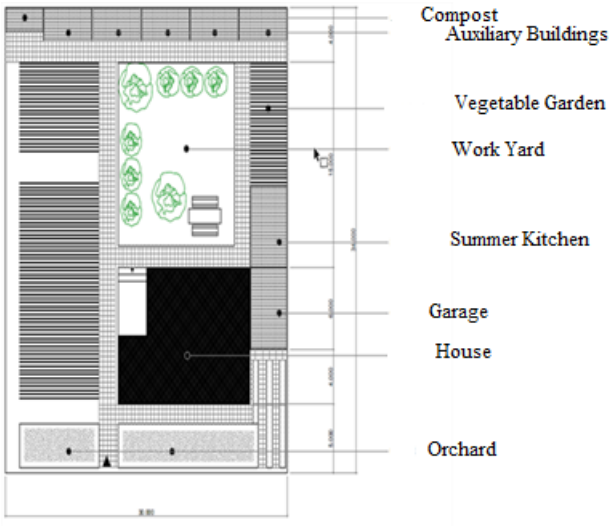
Dispersed settlements, such as Gllobar, Tërstenik, and Polluzhë, are characterized by separate neighborhoods established spontaneously without urban planning. Neighborhoods are often organized based on family or kinship ties, resulting in scattered development throughout the settlement. In Tërstenik, as a sub-center of four localities, public and social facilities are more numerous, including municipal offices, two primary and lower secondary schools, a family medicine center, and a library (temporarily located in municipal offices due to lack of a dedicated building).

Future challenges for municipal governments in rural spatial planning remain significant. Key issues include: protecting agricultural land from unauthorized construction, creating public and green spaces (including pedestrian, jogging, and cycling paths), providing sports and recreational facilities, improving emergency services in remote villages, ensuring local administrative functioning, reorganizing central areas such as Komoran, managing uncontrolled construction along regional roads, addressing informal settlements in Gllogoc and Komoran, and defining development zones for both rural and urban areas. The Zonal Map of Gllogoc Municipality (2022–2030) clearly identifies construction areas for all settlements.

Recent years show a trend toward modern organization and parcel arrangement within settlements. Increasingly, residential buildings are constructed according to contemporary standards: two- to three-story houses with durable materials, modern architecture, adequate lighting and ventilation, and carefully organized yards. Residential yards are often divided into three zones: (1) front yard near the street for the main building, garage, and garden (approx. 40% of the plot), (2) central area for greenery, vegetable gardens, and outdoor living (approx. 40%), and (3) rear area for auxiliary structures, livestock, waste management, and orchards (approx. 20%) (Miller & Shaw, 2001; Fotheringham & O'Kelly, 1989).

Two main parcel models are observed:

- Model 1 (Dense Settlements): Small plots with high building and yard density, usually in dense settlements. Space allocation prioritizes residential buildings and front gardens, with auxiliary and economic spaces compactly arranged.
- Model 2 (Dispersed Settlements): Larger plots (up to 20 ares) in dispersed settlements allow greater flexibility for residential, economic, and green spaces. The front portion near the street is allocated for the residence, garage, and garden; the middle portion is used for greenery, outdoor leisure, and vegetable gardens; and the rear portion is for auxiliary structures, livestock, waste management, and orchards.



These trends demonstrate a gradual shift toward structured and sustainable rural planning, while still reflecting local traditions and settlement morphology.

Conclusion and Recommendations

By analyzing and reviewing the facts, various data sources, and diverse literature, this study has examined settlements as units and as a system, exploring the meaning and classification of settlements, the importance and influence of geographical elements and factors on their territorial distribution, as well as the relationships, interdependence, and functional spatial connections among them. In this regard, we conclude that these settlements have undergone various transformations, both in terms of population and economic function, as well as in their spatial organizational structure.

The continuous transformations occurring in our settlements are influenced by physical-geographical characteristics (relief, geographical location, natural resources, etc.), historical development or origin, centrality relative to other settlements, social and economic connections, and communication links. These factors have impacted the overall geographical distribution, particularly affecting settlement density, spatial expansion by reducing distances between them, continuous morphological transformation, gravitational influence, and interactions that affect each other as cause or effect.

In this scientific study, we have attempted to demonstrate the correlation between elevation and the distance of settlements from urban centers, as a factor affecting their morphology and socio-economic impacts. Moreover, what stands out is the spatial expansion of these settlements in a largely spontaneous manner. To date, their uncontrolled growth has caused multiple challenges, such as issues in spatial planning, difficulties in developing technical infrastructure, protection and preservation of agricultural land, and the creation of an adequate living environment.

In Chapter Two, we examined the spatial regulation and organization of settlements along the Komoran-Polluzhë road. From this analysis, we conclude that competent municipal authorities, when drafting their future Local Spatial Plans (PZHK), will need to establish better spatial organization for these settlements. This, in turn, will result in the development of capacities and various types of social and public facilities. This conclusion arises from the fact that some of these settlements have highly favorable geographical positions and significant centrality relative to other settlements, which influences the development of new capacities for spatial-functional planning and rural environment management.

For example, two settlements currently considered sub-centers of the Gllogoc municipality—Komoran and Tërstenik—are continuously growing, particularly Komoran, which is planned to have a new organization as a municipal center in the future. Similarly, the settlements near the urban area, Çikatovë e Re and Poklek i Ri, are undergoing continuous transformation. Considered as suburban neighborhoods, it is expected that these two settlements will merge with the urban area and become part of it.

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APPLYING LINGUISTIC OPTIMAL THEORY IN THE FIELDS OF ARCHITECTURE AND URBAN PLANNING

Mohammad Tagi Pirbabaei[127], Zahra Shahihagh[128]

Abstract
Given the interdisciplinary nature of the field of architecture, in order to resolve the complexity of the relationships between patterns and achieve the language of the pattern, it can be understood and interpreted in various ways by linking it to other fields of knowledge. One of these connections is the link that is established between architecture and language. Prince and Smolensky's optimality theory is the most prominent theories in linguistics. Considering the use of linguistic theories in architecture and urban planning, alongside other fields, especially theories regarding common linguistic features, similarities, and differences, this theory can significantly influence the field due to its focus on common linguistic limitations. For this reason, this research seeks to find its counterpart in architecture and urban planning, as well as the application of theory in these areas. This article uses a qualitative approach and a descriptive-analytical method.
The findings show that there are no rules in this theory, and it only discusses general limitations: In the field of architecture and urban planning, public norms and general preferences form a system of dos and don'ts of society, and they are all accompanied by a kind of general restriction that includes four types of norms; legal, procedural, moral and religious and social. Furthermore, although all restrictions in this theory are general, different languages prioritize these restrictions differently; Therefore, types of architecture depending on the location (geographical) and time have different prioritizations of norms and restrictions, which leads to differences in them. Also, any language can violate a restriction, so in the architecture of a work, the restrictions can be transgressible or intransgressible, with intransgressible constraints having a higher rank in the arrangement of constraints in that architecture.
Keywords: Optimality theory; linguistics; architecture and urban planning; Alan Prince; Paul Smolensky

1. Introduction

Comparing a building or a city to a text involves imagining it as a language that expresses concepts and meanings. This perspective suggests that when we analyze the characteristics of a building or city, we should consider how its elements combine and convey specific meanings. To do this effectively, we need to apply methods similar to those used in the field of linguistics; that is, we must understand the grammar that governs the combination of components of the design language and its characteristics. Then, using existing theories in the field of linguistics, we will examine how its grammar is formed (Ahari, 2014). Since the 1960s, linguistic theories in architecture and urban planning have begun in parallel with other fields of thought, such as literature, philosophy, anthropology, and sociology. As Keith Nesbeit says, within the framework of linguistic analogies, architects have addressed how meaning is transferred in architecture and urban planning (Nesbeit, 1996: 32).

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Current linguistic theories assume that languages are fundamentally similar because people have a genetic predisposition to acquire language. Linguists are trying to create a model of this universal abstract grammar that captures the basic commonalities between different languages while still making room for all the subtle differences that occur naturally in human speech. Among these theories are generative phonology, which represents rule-based models of universal grammar, and optimality theory, which represents constraint-based models (Abdulrazzaq, 2023). Thus, one of the most influential linguistic theories in the tradition of generative grammar in the field of architecture and urban planning has been Chomsky's theory, which has been addressed by various people and states that, apart from the visible structure that shapes urban spaces, buildings and urban spaces also have an internal and deep structure, which is the basis for the formation of various types of urban spaces and the meanings associated with them. This internal structure includes abstract concepts that refer to various aspects of human life and thought, and the internal structure or deep structure acquires spatial-locative characteristics through a series of identical rules and becomes the surface structure or real urban space (Ahari, 2014: 236). Following generative grammars and years after Chomsky, Prince and Smolensky proposed optimality theory, which used breakable constraints instead of rules as the main tool for analyzing the phonetic system of languages (Bijan Khan, 2005). This theory has become a popular trend in linguistics since its introduction in 1993 (Safari & Goldost, 2016). It can be very influential in architecture and urban planning.Therefore, the ideas and knowledge of prominent and famous researchers such as Alan Prince and Paul Smolensky, due to their background and expertise, can, like Chomsky's theories, provide the possibility for architectural and urban planning theorists to choose, in an analogical manner, the collision framework of generative grammar to describe and analyze what is called the language of architecture and urban planning. So, the main question of the present study is: How is the usage of optimality theory in the field of architecture and urban planning?

2. Methodology

This paper is a basic developmental research and seeks to assess the feasibility of applying Prince and Smolensky's optimality theory in the foundations of architecture and urban planning. It looks at linguistic concepts from a relativist analytical perspective and, based on information and theories derived from analyses, seeks to benefit from linguistic theory in the field of architecture and urban planning. Therefore, in this article, first, the concepts related to the theory of optimality have been studied using a descriptive method, and then, using an analytical and comparative approach, the relationship between this theory and the field of architecture and urban planning has been established. Finally, the structure and characteristics of this theory and its usage in architecture have been identified.

3. Research background

Language and architecture both involve regular methods of giving meaning to the environment. Both use rules to create unlimited possibilities with limited resources (Juhasz, 1981: 241). Alexander envisions a structure similar to the structure of language for patterns and believes that architectural patterns, like the words and grammatical rules of a language, among people they are imperceptibly common (Alexander, 1979: 127). Since the 1950s and 1960s, when seeing architecture as a language became common in architectural theories, the use of the term architectural language has also become popular (Johnson, 1994: 15). Among the first linguistic theories used in the field of architecture is Saussure 's theory, which discusses semiotics in language: Saussure considers linguistic signs to have two aspects: signifier and signified. Signifier and signified are two fundamental components in semiotics, which is considered a turning point in the science of linguistics (Pour Mehdi Ghayem Maghami, 2017). Among the architects and theorists who have attempted to determine the signifier and signified in architecture or urban planning based on this theory are Maria Luisa Scalvini and Renate De Fusco (De Fusco & Scalvini: 1970), Jeffrey Broadbent (Broadbent, 1996), Charles Jencks (Jencks 1980:27), Claire and Michel Duplay (Duplay et Duplay 1985:263), Roland Barthes (Barthes, 1997:169).

Another of the most influential linguistic theories in the field of architecture and urban planning has been Chomsky's theory. While this theory accepts the existence of structural relations, it rejects the structuralist method, which limits its study only to the objective aspects of language and behavioral studies. Chomsky's theory of language, known as Generative-Transformative grammar, is based on the premise that sentences usually have more than one level of structure. Apart from the visible structure that exists at the surface in the form of speech (the Surface Structure), there is also an abstract underlying structure (the deep structure) that can be fundamentally different from the upper level (Trask, 1999: 320). Among the architects and theorists who have attempted to determine the deep structure, surface structure, and transformative Architectural or urbanization based on Chomsky's theories are Peter Eisenman (Gandelsonas & Morton 1980: 265), Michael Graves (Graves, 1996), Jeffrey Broadbent (Broadbent, 1996: 132), Pierre Boudon (Boudon, 1986: 305), Stefano Bianca (Bianca, 2000), Zahra Ahari (Ahari, 2014), and others, some of whom rely on the syntactic aspect and some on the semantic aspect. In this theoretical framework, deep structures require transformations to become surface structures, which generally have a geometric or, in other words, spatial characteristic.
In the tradition of generative grammar, there are two turning points in the study of the phonetic system of languages: the first turning point is Chomsky's theory (1968), in which rules, as well as phonological principles and parameters, are the main tools for analyzing the phonetic system of languages. The second turning point is the theory of Prince and Smolensky (1993), in which phonological breachable constraints are the main tool for analyzing the phonetic system of languages (Bijan Khan, 2005:1). Optimality theory is a theory in language that has become a popular trend in linguistics since its introduction in 1993 (Gilbert and Hope, 1998, quoted by Dabir Mogaddam, ibid., 645) And it is now widely used in linguistic analysis (Mustafa, 2023). Considering the above-mentioned issues, the theories and perspectives of Saussure and Chomsky, as important theories in the field of linguistics, are among the theories that have been utilized in the field of architecture and urban planning, and architects and theorists have conducted studies in this field. Therefore, considering the importance of optimality theory and its connection with these theories, it seems that the usage of this theory in the field of architecture and urban planning has been neglected in the studies conducted.

4. Theoretical foundations

Rules that distinguish between correct and incorrect forms are defined as language rules or grammar (Larsen-Freeman & DeCarrico, 2019). The languages in the world are structurally different, but despite their differences, they also have commonalities. Linguists have compiled these commonalities into theories called general theories of language. General theories of language claim that its principles are consistent across all languages in the world and can be used by all languages. In fact, all languages in the world have many similarities with each other (Noroozali, 2022: 316; Afshari, 2014: 59). One of these theories is optimality theory.

4.1. Prince and Smolensky's Optimality Theory

Optimality theory (OT) is a constraint-based theory that originated from generative linguistics (Dabir Moghaddam, 2010: 644). This theory aims to use a set of generalities in phonology, morphology, and syntax to describe and explain similarities, differences, and changes between languages (Eftekhary Far et al, 2024). In optimality theory, all languages share a common set of universal constraints (Prince and Smolensky, McCarthy and Prince, 1993). In general, it can be said that optimality theory is the determination of conflicts that lead to the selection of the optimal output (Eftekhary Far et al, 2024). This theory does not have any rules; instead of having rules, there are constraints. These constraints are universal. The differences seen among languages are rooted in the existence of differences in the ranking of constraints (Yoshimoto, 2002: 19).

4.1.1. Limitations in Optimality Theory and Its Model

Optimal phonology consists of several violable global constraints that are imposed on the output (infrastructure) to produce the optimal output that has the fewest violations of these constraints. The higher constraint is preferred over the lower constraint in determining the optimal output. The order of constraints varies from language to language. All constraints exist in all languages, although many of these constraints typically have little or no effect on determining the output, because they are at a lower level in the order of constraints. The final output is the result of applying a hierarchy of constraints to the various options that could potentially be outputs. The optimal output will be the option that has the fewest violations of the hierarchy of constraints (Hadian and Ali-Nejad, 2013: 4).

4.1.2. Mechanism and model of optimality theory

Optimal phonetics is one of the constraint-based phonologies that, like rule- and parameter-based phonology, has an input-output mechanism (Eftekhary Far et al. 2024). According to this idea, the generator has generated a large number of options from a received input. Then, several constraints are applied to these options, and finally, one option is selected as the optimal output by the evaluator (Firuziyan pour Esfahani et al. 2014: 69). As seen in the concept of optimality theory, one of the words of the language is input into the generator. The generator produces many options based on universal phonological principles. Then the phonetic structure of each option is examined in terms of 'n' global constraints. During the elimination process, the evaluator eliminates options that are less consistent with the conditions defined in the constraints until it reaches a point where it introduces only one output candidate that is most consistent with the constraints as the optimal output (Hashemi, 2012: 70 and Sukri et al., 2024: 15). McCarthy presents the box diagram of optimal phonology as follows.

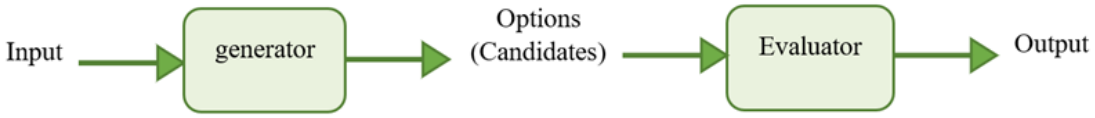


Fig. 1. Box diagram of optimality theory (McCarthy 2002: 10)

According to the constraints diagram, they are universal, but their order to extract the optimal output varies from language to language (Bijan Khan, 2005: 37-38). The important role of the Evaluator is to assess the "coordination" of the outputs concerning a given ranking of constraints (Kager, 2004: 21).

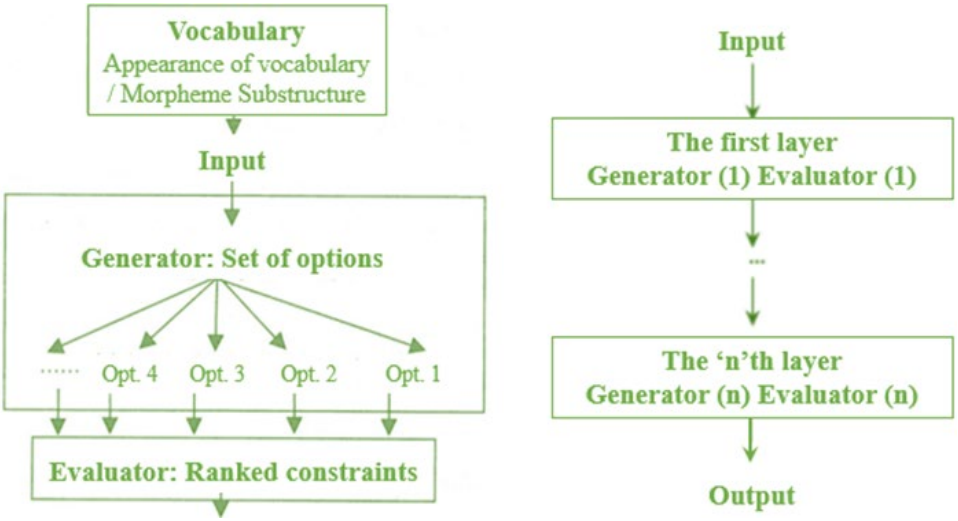


Fig. 2. Optimality theory model, (Kager, 1999: 382, Dabir Moghaddam, 2010)

In optimality theory, any language can violate a constraint. The ranking of these constraints in a language also means which constraints in that language are inviolable and which are transmissible, with inviolable constraints having a higher order in the arrangement of constraints in that language. Whenever a constraint in language that is inviolable is violated, the resulting chain will be incorrect and non-grammatical. Also, in each layer, there is a generator and an evaluator, and the output of each layer acts as an input for the next layer, and finally, the final output is produced (Mahdavi and Alinejad, 2020).

4.2. Optimality Theory in Architecture

An architecture on a global scale, whose components have different owners and architects, will have a general order when the norms that shape and limit its independent components are common (Siavashpour, 2012). In architecture and urban planning, norms, ideals, interactions, and social positions are sets that are components of the social system (Chalabi, 2015: 36). The set of common norms includes legal norms, procedural norms (implementation technology), moral and belief norms, and social norms (Hosseini, 2011: 35). Norms, general prefers, and the system of dos and don'ts form a society, and they are all accompanied by some kind of limitation. At the same time, the basis of social systems varies in content, depending on the preference of each of these norms over the other.

4.2.1. Norms and constraints in architecture

Legal norms have the greatest impact in limiting and shaping the order of the community of units. Architectural and urbanism rules, master projects (comprehensive and detailed projects), and regulations and bylaws fall into this category. In addition, procedural norms - as professional and technical dos and don'ts - have a very decisive influence on the formation of architecture and the community of buildings in their vicinity. These limitations arise from the technical capabilities of the time, available materials, and local capabilities that limit the implementation procedures. Religion is one of the factors that has a direct and indirect impact on architecture. Religion and religious instructions affect the way of life, customs, and attitudes of humans, both architect and user of architecture, on the one hand, and living spaces (Gharibpour and Totunchi Moghaddam, 2022: 147). Therefore, some laws are formulated based on values, beliefs, and convictions. These laws lead to issuing architectural rulings and restrictions without entering the realm of evidence. For example, the necessity of paying attention to mosques in the orientations of new cities design, which are stated in the approvals of the Supreme Urban Planning Council, basically relies on the beliefs of individuals (Siavashpour, 2012: 55). Or, rules such as not creating privacy and shadow on adjacent land are included in the set of moral and religious norms.

Man is a member of various groups in society, and it is necessary for man's actions and effects to be more or less consistent with the norms and values of that society, or at least not to be indifferent to them (Shams and Qayyoomi-Bidhendi, 2022: 208). Because in any society, a large part of the way people live depends on rituals, customs, and behavior that affect all kinds of human actions (Gharibpour and Totunchi Moghaddam, 2022: 147) and belong to that entire society (Sutton and Giddens, 2014). Therefore, social norms have had the greatest impact in creating constraints and stabilizing social order. These norms include principles that are supported by habits, preferences, and public approval, and to which the individual feels a kind of obligation and habit. Even today, we accept many rules and judge others simply because society has accepted them. For example, not using public transit as a light-blocking architectural front that was common in the past as a social habit falls into this category (Siavashpour, 2011).

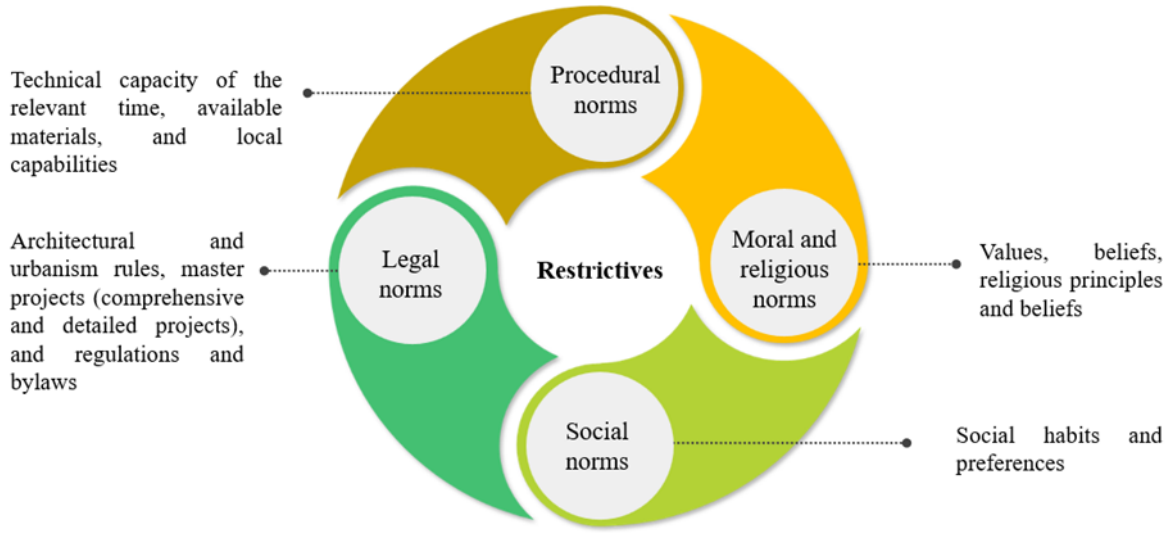


Fig. 3. Restrictives diagram, (Authors)

The limitations that moral and social norms draw are a flexible boundary of what is acceptable and what is unacceptable. In other words, although these norms themselves issue judgments for the individual, the individual translates these judgments spatially in the digest of their perception. Since these norms are internal to the majority of members of a society, it can be assumed to be a two-way, and mostly from bottom to up, approach. Since moral and social norms are natural - and not constitutive - in nature, they guide society towards a natural and profound order. While legal norms lack such ability. There is usually a very precise and conventional boundary between what the law accepts and what it does not accept, which in this respect blocks any kind of individual intervention on individuals (Siavashpour, 2012).

5. Case study

Reading the appearance of architecture and urban planning of any art is similar to creating a text, and the production of each text is based on the context and background of its originating society (Afari & Falamaki, 2015). To clarify what has been said about the difference in the factors that strengthen and constrain, the historical and modern contexts are compared from this perspective. The four normative factors mentioned above can be traced in both instances, but the order of the factors in terms of importance is different in the two instances.

Norms that give consistency to historical contexts: In past architecture, to cover a space, either flat or curved coverings had to be used. To use a flat covering, the architect needed a beam, which was a horizontal element to transmit the roof forces, and this is exactly what made the dome popular in certain regions. That is, the lack of congruous wood in regions such as the Iranian Plateau and Mesopotamia led to the creation of curved roofs and domes that could cover large openings without the use of beams. In addition, the use of wooden beams in the interior had the limitation that rows of columns close to each other had to be used to pass the beams. Since the length of the wooden beams could not exceed a certain limit, it was necessary to erect a large number of columns to support them. Therefore, the widespread use of the dome to cover the roof is considered a technical skill and ability (Hatami Nesari et al., 2022: 13).



Fig. 4. Dome of Firuzabad Palace, view from the interior, source: Cultural Heritage Website

Another example of available materials and local capabilities in these types of norms is the restriction on observing proportions, which exists in different architectures but varies depending on the context of regional conditions. We can refer to the role of tatami in Japanese architecture, because the numerical characteristic of Japanese houses is not traditionally the familiar square meters or feet, but rather the area of a Japanese house, the Japanese tatami (Figure 5) (Suzuki 2024). A tatami is not a unit of measurement in the usual sense, but rather a mat (mattress) of specific dimensions, although there is a rotation in one direction or another.

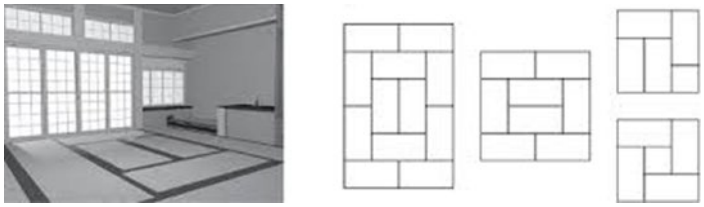


Fig. 5. Tatami in Japanese house, (Alsina & Nelsen, 2015)

These proportions are also present to some extent in historical Iranian houses. Over the past century, especially with the expansion of urban life, patterns have gradually emerged in the lives of city dwellers, many of whose consequences have had direct effects in various directions. Among these effects, we can mention the requirements that the new architecture has created in residential homes, and the furnishing of the floors of rooms has been limited to certain dimensions (Figure 6) (Jouleh, 2011).



Fig. 6. Studying the placement and matching of carpets in houses from the Safavid to Qajar periods, (Bashiri and Dolat Abadi, 2020)

The results of the analysis of case studies of houses from the Qajar and Pahlavi periods in Tehran show that in most houses in Tehran, the room dimensions were based on (Iranian and Greek golden proportions), (proportions based on ceiling decorations (Figure 7)), (proportions based on common carpet dimensions, with the floor of the room surrounding the carpet dimensions) (Bashiri and Dolat Abadi, 2020: 179). Of course, the importance of this issue has faded now.

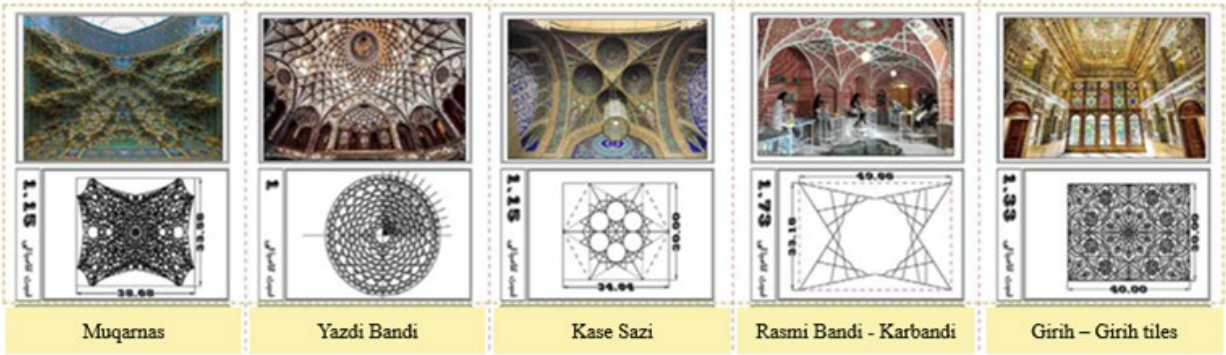


Fig. 7. Examining ceiling decorations used in homes (Bashiri and Dolat Abadi, 2020: 184)
The role of moral norms is next in importance in shaping architecture in contexts. Etemadinia House (Figure 8) is also one of the Qajar houses in Birjand in South Khorasan. Around its courtyard, there are parts with different uses, and its surroundings are decorated with brickwork, which adds to its beauty. One of the unique features of this house is its lack of visibility to neighboring houses, and despite the high height of the building compared to the surroundings and also because of its stepped height, this principle has been observed, and of course, neighboring buildings do not overlook its interior space (Hashemi Zarjabad et al., 2014).



Fig. 8. Etemadinia House, Birjand, (Hashemi Zarjabad et al., 2014: 87)

The religious and specific issues of Iranians have influenced architecture. One of these characteristics is respect for private life and the respect it accords. Another is the self-esteem of Iranians, which can also be seen in Iranian houses in some way. In this type of house, the interior space is separated from the exterior space by a wall, and the only part of the building that is exposed and connected to the outside is the entrance, called the "Hashti ". Hashti usually has a portal with two stone benches on either side, so that guests can sit on the benches between the time the door is knocked and the owner opens it, rather than waiting standing. Carving and installing relatively large platforms was not an easy task, but the spirit of hospitality and respect of the Iranians encouraged them to build these platforms (as benches) (Noroozi and Shayeste, 2013).



Fig. 9. The vestibule of the Araste and Pardeli houses in Birjand and the Sabaghian houses in Kashan (from right to left) (Hashemi Zarjabad et al., 2014)

Ultimately, legal norms in the form of rulings by the ruler or governor became necessary to establish order at a time when society itself had no solution for most of the above norms.
Norms that give consistency to Contemporary contexts: Legal norms have the greatest impact in creating restrictions and shaping the social order of units. Architectural and urbanism rules, master projects (comprehensive and detailed projects), and regulations and bylaws are included in this category. Procedural norms, compared to the role they played in the past, have less of an impact on creating restrictions today due to advances in technical knowledge.



Fig. 10. New structures, covering the long length

Today, moral norms have also lost importance. In urban societies, if the deterrent effect of laws is reduced for any reason, moral principles do not have much impact on the construction process (Siavashpour, 2012).

5. Findings

From what has been said, it follows that laws and restrictions are on the path to shaping a mechanical and constitutive order, but there is the possibility that laws, in logical coordination with other norms, can create flexible conditions for the growth of the environment. Norms inherently have a very restrictive role, but an individual can always interpret the relevant norm in a given spatial (context, culture, etc.) and chronological situation.

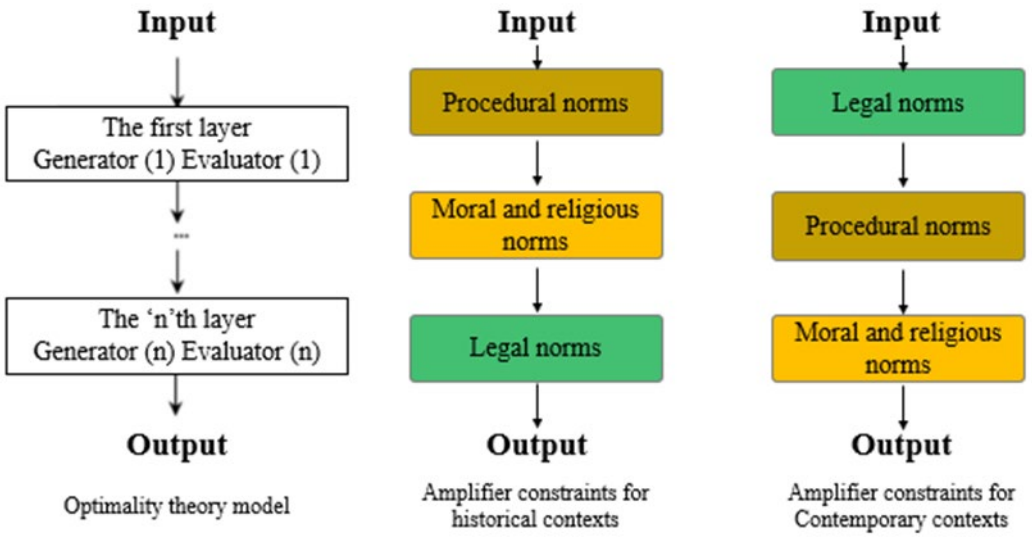


Fig. 11. Model for ranking constraints in terms of importance in contemporary and historical contexts, (Authors)

Considering the issues raised in this research and the complete study of optimality theory and its study in the field of architecture and urban planning, the issues raised can be summarized in the diagram below.

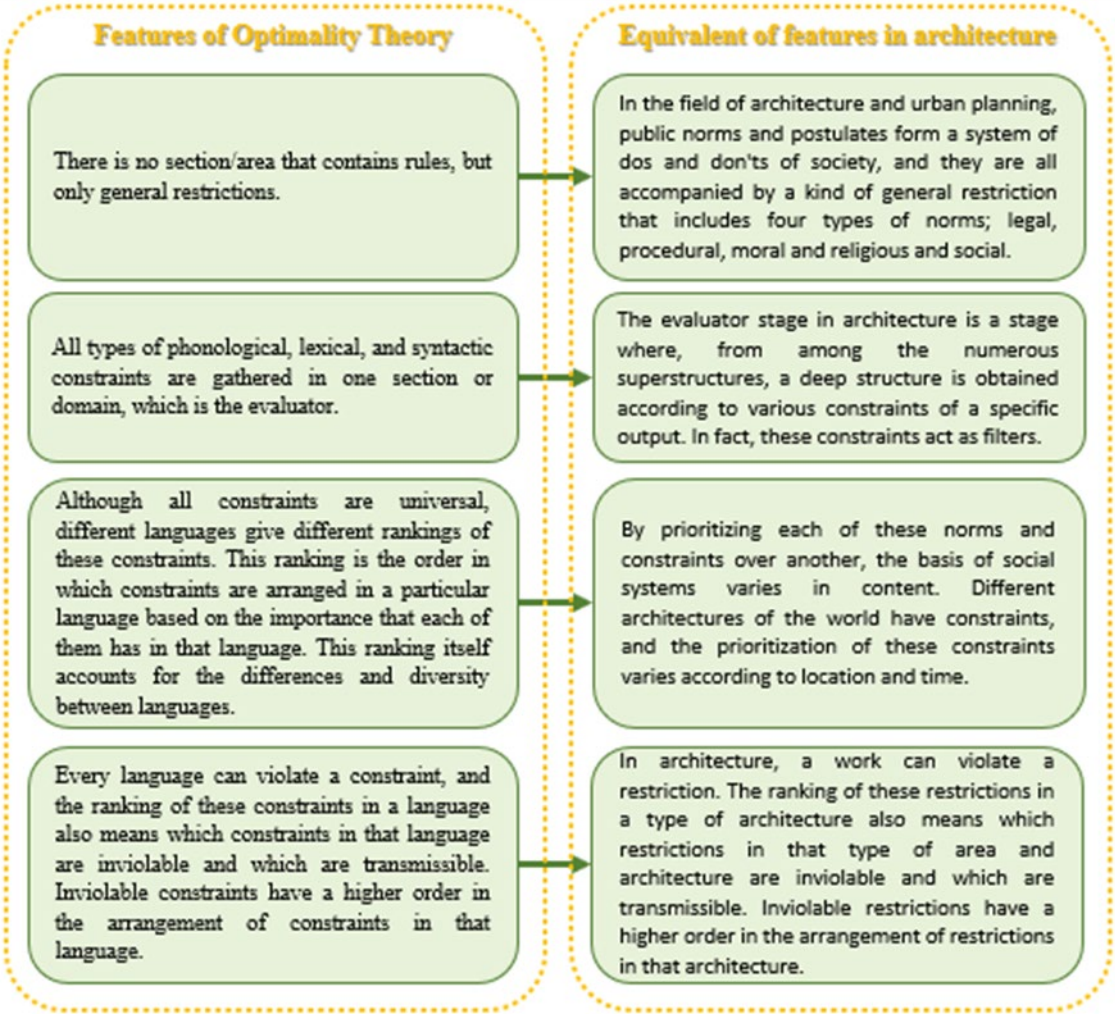


Fig. 12: Summary of Optimality Theory in Architecture, (Authors)

5. Conclusion

Prince and Smolensky's optimality theory is one of the most prominent theories in the field of linguistics. Given the importance of using linguistic theories in architecture and urban planning, along with other fields, this research aims to study the relevance and usage of this theory in the field of architecture and urban planning. Its findings show that: In the theory of optimality, there is only talk of general restrictions, and instead of rules, limiters play a key role in this theory; in the field of architecture and urban planning, general norms and general prefers form the system of dos and don'ts of a society, and they are all accompanied by a type of universal limitation that includes four types of legal, procedural, moral and religious and social norms.

Legal norms and restrictions mean architectural and urbanism rules, master projects (comprehensive and detailed projects), and regulations and bylaws and procedural norms, Technical capacity of the relevant time, available materials, and local capabilities; Moral and religious norms mean Values, beliefs, religious principles and beliefs, and social norms mean the social habits and preferences of the society. However, each of these norms can always have a different interpretation in the spatial (context, culture, etc.) and chronological situation.

Furthermore, although all constraints in this theory are universal, different languages prioritize these restrictions differently; therefore, types of architecture in different parts of the world, in addition to different interpretations of each norm, have different prioritizations of norms and constraints, which leads to differences in them. Both language and architecture reflect current trends, fashions, important tendencies, Sustainable concerns, specific values, and a wide range of other human preoccupations, and their nature is fundamentally social. Every people and nation, with its own culture, lives in a natural habitat, and the characteristics of the environment undoubtedly influence the way people live. The constraints of human life and the spaces built by them are influenced by the two dimensions of place (geography) and time (history). Also, any language can transgress a constraint, so in the architecture, the constraints can be transgressable or intransgressable, with intransgressable constraints having a higher order in the arrangement of constraints in that architecture. The characteristics and principles of optimality theory and its equivalent in architecture show that any design and alternative for designing and constructing a space can be correct and appropriate provided that it is evaluated by norms and constraints and the most appropriate one is selected; this evaluative stage shows that a design or input can be correct for one region and not in another. Therefore, the differences seen among architectures in different parts of the world are rooted in differences in constraints and the ranking of these constraints according to their spatial (geographical) and chronological situation. To design space as best as possible, architects and urban planners must be aware of these constraints and the importance of each in different places and times, and know which of these norms and constraints are inviolable.

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A COMPARATIVE STUDY OF COURTYARD GARDENS IN ISLAMIC AND EUROPEAN TRADITIONS

Abdullah YASSEN[129], Mehmet Akif IRMAK[130]

Abstract
Courtyard gardens, within Islamic and European architectural traditions, are an architectural structure that offers influential examples based on environment, spirituality, and building form across the Middle East, the Persian cultural basin, North Africa, and Southern Europe. Throughout centuries, these regions—connected to one another through trade, migration, and intellectual interactions—have developed inward-oriented gardening spaces that reflect both shared climatic challenges and their own distinctive cultural values. In Islamic contexts, while the physical structure of courtyards, the rhythmic placement of water elements, and the meaningful use of vegetation function as the metaphorical formation of a paradise-like order, they also balance heat by providing a microclimatic environment and structure social life by ensuring privacy. European traditions, particularly in Mediterranean regions, evolved from classical precedents and internalized monastic courtyards, peristyles (the columned courtyard in Ancient Greece), and Renaissance cortiles (the inner courtyard found in Renaissance architecture); these spaces combined botanical interest with aesthetic refinement. These indoor or semi-indoor garden spaces often served as areas for artistic display, scientific research, and social gathering, revealing a long historical trajectory toward integrating natural elements into the structural center. Furthermore, throughout the architectural movements that emerged in the Renaissance period, they came to the forefront with special courtyard designs in palace and villa gardens. The French palace gardens and Italian villa gardens stood out as important examples of this period. The reciprocal interactions between Islamic and European cultural spheres, especially within the vast Mediterranean basin, further enriched these traditions by introducing innovative irrigation techniques, significant botanical practices, and ornamental motifs. Within the scope of this study, it aims to present a comparison of the structural, functional, and aesthetic characteristics of courtyard gardens in Islamic and European traditions. In this comparative evaluation, it is shown that courtyard gardens not only respond to physical, ecological, and climatic demands but also serve as spaces where broader philosophical, spiritual, and social needs are fulfilled. As a result, in both Islamic and European regions, courtyard gardens are seen as dynamic outcomes of cultural identity, ecological adaptation, and aesthetic demands, and it is understood that these spaces are the shared product of numerous physical, aesthetic, climatic, and sociological elements.
Keywords: Courtyard Gardens, Islamic Gardens, Courtyard Gardens in Europe

Introduction

"The "courtyard," when viewed spatially, is a spatial solution that is achieved by the need for the life of the building to be integrated with that of the partially open space. It is an area that is completely or HalfWAY enclosed with a structure or high walls, Usually rectangular or square in principal form, and is consistent with the form of the architectural whole in which it is positioned." (Ekim, 2012).
Furthermore, According to "The National Building Code" (2005), the courtyard is defined as:
"Space permanently open to the sky, enclosed fully or partially by building and may be at ground level or any other level within or adjacent to a building." The basic courthouse comprises of the following components:
 The courtyard Semi-enclosed arcade or verandah The rooms
The following features of 'Typical Courtyard house' are analyzed to understand the various aspects of the courthouse typology. Though the various elements mentioned hereabove have transformed with the needs of various nations and their respective cultures, still it is observed that these elements can be found in almost all courthouses of the global scenario. (Gupta & joshi ,2021)
Courtyards are enclosed outdoor areas but tend to be open to various elements of life, with another name for this structural arrangement being "ventilated patio house."

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"Definition of the Courtyard: An unroofed area that is completely or partially enclosed by walls or buildings, typically one forming part of a castle or large house."(Lea & Runcie, 2002).
Despite the fact that there is a vast range of variations with regard to the sizes of the courtyards, this spatial arrangement basically creates a cloistered area which is private in nature, and is basically a source of light, air, and warmth. It can be used for various purposes such as resting, playing children, praying or meditating, women's activities, or socializing. (Taleghani et al., 2014)
Courtyard is a type of construction that have existed since the day humans started their house constructions. (Bridson, 2012). Courtyards were originally found in the Middle East, where the climate is harsh; however, over time, as more of their area is covered, then outdoor activities can be effectively carried out indoors.
The courtyard is also one of the architectural elements that are being constantly\ deformed by the new typology of housing. Therefore, this architectural element also requires further study. Indeed, the system of courtyards has undergone a significant shift in current architectural practices with the development of new technology, new building materials, social change, as well as cultural change, among other factors.

Methodology
This research uses qualitative comparative analysis by literature. This was done through secondary research by sourcing literature from peer-reviewed journals and publications. The journals were reviewed for similarities and differences in courtyard gardens from Islamic as well as European cultures. Document analysis was performed on literature from journals for extraction of comparable data. The data was considered on three aspects: types of courtyards, vegetation and landscape design, and cultural ideas.

Literature Review
Origionally The courtyard is one of the key features of the mosque of the prophet. The courtyard is also planned a space with walls and porticoes differing according to type of hypostyle mosque. There are There is involvement, too, in some other actions which took place in the courtyard, apart from religious activities, it is determined.The courtyard was constructed through reason and purpose.(man et al, 2017).
Research from scholarly literature highlights that the European courtyard construction architectural history can be traced back to Greco-Roman domestic architecture, where open spaces surrounded by architectural constructions were the pivotal concept in designing Greco-Roman homes and cities. In ancient Greek and Roman domestic architecture, the Greek home and the Roman "domus" comprised central open spaces such as the atrium and the peristyle courtyard (Edwards et al, 2006).

Historical & cultural context
Islamic courtyard\gardens
In this study, a range of regions and countries were examined, including the Ottoman Empire/Turkey, Persia/Iran, Syria, Morocco, and Andalusia, over an extended period of Islamic architectural evolution, with a particular emphasis on courtyards and open living spaces.



Figure 1. Medersa Ben Youssef (URL1)

Persia
The main idea of Persian gardens lay in the geometrical quadripartite division with a pavilion in its intersection. This composition is inspired from the pre-Islamic Persian notion of dividing the earth into four quarters, that is further believed to be inspired by the geometrical motifs of Mesopotamia and Sindh Valley civilizations (Massoudi 2009).


Figure 2. Kashan Hotel Courtyard (URL2)


Figure 3. Bagh-e Fin Garden (URL2)

Ottoman era\Türkiye

The arrangement and design of the environment of mankind begins with the prehistoric age. In the prehistoric age, firstly, the use of caves for housing purposes has been commenced, and with the progress of construction and production, the formation of housing and open spaces has been commenced. The formation of cities is commenced with the identification and development of structure based on the socioeconomic structure. In the Anatolia, which has been a home to many civilizations, houses have been developed based on the topographic, climatic, socio-cultural, and socioeconomic structure. The properties of such houses include the requirement of housing structure, which is satisfied, and open spaces. (Bozkurt ve Altınçekiç, 2013).

The courtyards, according to their properties, are a construction element known by different names such as outer courtyard, porch courtyard, fountain courtyard. The origin of the word "aule", which is Greek, is named as 'sahn' in the Islamic architecture before the naming of courtyard, and the word "harim' is used in the Turkish architecture. Courtyards; It has been a basic construction element with pools, fountains, shade galleries in the center acting as a coolness source in the Islamic as well as Turkish architecture. (Cantay, 1991).


Figure 4. Mihrimah Sultan Mosque Courtyard, Istanbul(URL3)


Figure 5. Bakewell Ottoman Garden(URL3)

Syria

Courtyard accommodation has been practiced from the start of the third millennium before common era, when it appeared in the architecture of Bilad al-Sham, as well as in the architecture of the area between the rivers Tigris and Euphrates. The Arabs adopted the idea of a courtyard in travelling, when they stopped over in the desert. They encircled a courtyard with their tents, which protected them from bad weather conditions, providing a degree of safety for their cattle as well. The development of Arab-Islamic architecture led to a significant role of the courtyard. It is very probable that the Nomadic life in the desert exerted a certain effect on the indefinite houses of the Arabs. The courtyard meets a basic requirement of an open living space. (Al Abidin, 2004).

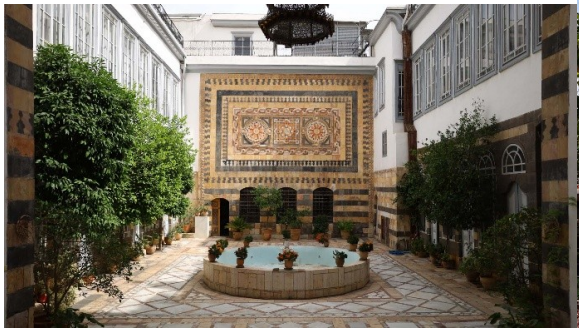


Figure 6. Bayt al-‘Aqqad Courtyard (URL4)



Figure 7. Al-Azem Palace Courtyard(URL4)

Morocco

The Riad typology was introduced and formalized during the Islamic period: courtyard houses with rooms facing internally onto a central garden or patio. This became the emblematic typology of Moroccan urbanism in the medinas. Adaptation to local climatic conditions was made: mountainous regions employed pitched roofs, while pre-Saharan zones used domes and flat roofs. (Belatik and Atki 2019).



Figure 8. Traditional Moroccan Riad (URL5)



Figure 9. University of Al-Qarawiyyin Courtyard (URL13)



Figure 10. La Villa des Orangers marrakech (URL13)

Andalusia\Spain

Andalusia is geographically, politically, and culturally situated in the southwestern part of Spain. The provinces that define Andalusia are Almería, Málaga, Cádiz, Seville, Córdoba, Jaén, and Granada. The most notable part of Andalusia, from a historical perspective, is the fertile valley of the River Wadi al-Kebir, which includes the provinces of Córdoba, Seville, and the province of Cádiz. The name "Andalusia" has a rich history in that it evolved from the Arabic transformation of a territory known as "Iuada hiatus," which is translated

from Visigothic as "a lot of lands," which sounded "al-Andalus" when translated from Arabic (Bednorz & Barrucand, 1992).

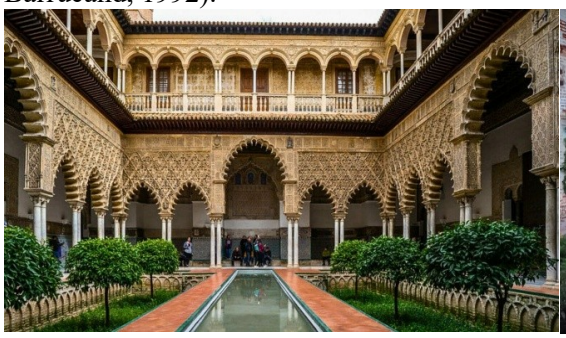


Figure 11. Royal Alcázar of Seville(URL10)



Figure 12. Alhambra Garden, Granada (URL10)



Figure 13. Alhambra Palace Courtyard(URL10)

The emergence of the Islamic tradition in Spain, which dates back to the early 8th century (Ruggles, 2008), introduced a development within the scenery of the region (Nazeri, 2017). In the periods of 711 to 1492 AD, the presence of Muslims within the Iberian Peninsula introduced a significant impact on the strategic topography of the region, apart from affecting the political scene. Among the most important legacies of the Islamic civilization to the Andalusian territory are gardens, which are an implementation of the principles of the Persian garden design. The Andalusian gardens showcase a unique blend of architectural, design, and other traditions that result from centuries of Islamic domination.

The gardens are characterized by the use of components of the Chaharbagh design, which is a Persian garden design that focuses on symmetry, water utilization, and geometric design. The design has been identified as the most vital source of inspiration that results in gardens with Islamic designs in the Middle East and Spain (Turner, 2005).



Figure 14. Similarity Between Persian Carpet and Garden Layout(URL10)

European Gardens\courtyards

France&Italy

when thinking of the "European "in general sense, France and Italy comes to mind due to the general reputation they have on the general arts and architecture between the 4th and the 7th centuries and for the several movements they've been through (Baroque, Renaissance Etc.)



Figure 15. Hôtel de Soubise Courtyard(URL11)

In the **Renaissance,** the courtyard appeared as a cultivated space with strong links to the ideals of civilization, artistry, and domesticity, which were characteristic of the era. The courtyard appears in literature as a central, decorated space that is more than a void, which is a merely functional space (Boccaccio, Decameron 1.0). Boccaccio gives a description of the villas of the aristocracy, which have large, beautiful courtyards with loggias, gardens, and decorated rooms, which are essentially the center of civilized recreation. The courtyard acted as a space that appeared in sacred and profane stories told by artists such as Piero della Francesca, Donatello, and others who sought to analyze the ideals of proportion, order, and harmony in the courtyard. Additionally, the courtyard served as a space of production that is evident in Vasari's Lives of artists. (Nelson,2014).



Figure 16. Boboli Gardens(URL11)



Figure 17. Villa Giulia Courtyard (URL12)



Figure 18. Villa Medici Courtyard(URL12)



Figure 19. Palazzo Massimo Interior Patio(URL12)

During the **Baroque** phase (from late 17th century onwards), the courtyard functioned as a part of a larger axial order. They were highly articulated with alleys lined with trees. They functioned more as spaces leading up to the garden, road, and cityscape, thus exemplifying order and control over nature, especially in royal residences. In contrast to this, during Renaissance times, cities grew in terms of population and commerce, but without altering their original structure (Ludwig ,2021).



Figure 20. Abbaye Notre-Dame de Sénanque(URL12)



Figure 21.(Alternate View)(URL12)




Figure 22. Palazzo Farnese Courtyard (URL16) Figure 23. Palazzo Farnese (Alternate View)(URL16)

Architectural Elemental Review
Water
Islamic: Water is a crucial on, symbolic (paradise, ceremonial), climatic (evaporation cooling), or social (cleaning, assembly), usually provided as watercourses, ponds, fountains along axes in courtyards. (Brown, 2024).




Figure 24. Alhambra Palace Water Feature (URL17) Figure 25. Traditional Damascene House Courtyard(URL14)

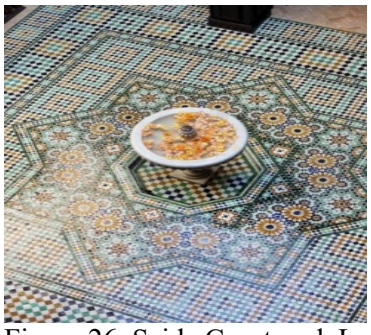



Figure 26. Saida Courtyard, La Sultana Fountain(URL5) Figure 27. Mahinestan Raheb Hotel Courtyard(URL6)

European
"In courtyards of Renaissance-Baroque gardens, water was either for show or not there at all, with courtyards as processional areas, for display, or drainage more important than ritual or evaporation cooling." Fountains are found largely as public or symbolically prestigious elements (Gil, 2022).


Figure 28. Italian Fountain(URL15)


Figure 29. Hamilton Garden(URL9)

Spatial

Islamic: Oasis courtyards: private, internalized micro-environments; small scale, shaded galleries, symmetrical axes between public/private domains, regulating climate. (Soflaei et al. 2016).


Figure 30. Maktab Anbar Courtyard(URL4)

European

European courtyards, especially the Italian one, were generously proportioned processional emptiness surrounded by arcades, ambitious in their assertion of power, circulation, and order, linking space from street front to representational interiors.


Figure 31. Château de Versailles Courtyard (URL18)

Ornamental

Islamic

Ornament is dominated by geometric patterns, calligraphy, and tessellation: non-figurative, symbolic, often incorporating architecture (tiles, muqarnas) for rhythmic effect of layers of meaning (Abdullahi, 2013).



Figure 32. Islamic Ornamentation(URL5)



Figure 33. Islamic Decorative Detail(URL10)



Figure33. Islamic Decorative Detail(URL10)



Figure 35. Maktab Anbar Ornamentation(URL4)

European

Decoration is governed by classical orders, figuration in sculpture and relief—narrative, figurative, with independent meaning related to either civic or religious or dynastic themes (Van Eck, 2020).



Figure 36. Arlenia Fountain (URL15)



Figure 37. Château de Versailles Ornamentation(URL15)



Figure 38. Château de Versailles Ornamentation (URL12)

Vegetation

In **Islamic** courtyard gardens, vegetation has long been included in the composition. Plants are placed around the four-part water channels and paths, including fruit trees, scented shrubs, and shade-giving plants (man et al, 2017).

In contrast, **European** courtyard gardens, formal parterres, formal garden layouts, and decorative florals or tree alignments emphasize geometric composition, perspective, and seasonal color. Ornamental hedges, clipped design, and axes feature. (Musazade, 2024).

Conclusion and Recommendations

While comparing these two civilizations in general, it is observed that Islamic culture had more people-oriented spaces in their courtyards in relation to their lifestyle and need for privacy. European culture, in contrast, had a different way of using these spaces, which are primarily focused on display. The benefit of these European spaces is based on their access to a larger piece of realty to be developed, unlike in countries within the Middle Eastern region, which have not enjoyed this luxury but were able to accommodate spaces for both private and social functions. Due to population and construction cost trends, this type of accommodation is now a basic necessity turned luxury in nature.

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USING GIS TO IDENTIFY AREAS WITH WIND ENERGY POTENTIAL IN KOSOVO

Ferim Gashi[131], Edon Shemsedini[132], Shkumbin Lushaj[133],Yusuf Kizilkan[134]

Abstract
The use of Geographic Information Systems (GIS) has become essential in the assessment of sustainable renewable energy potentials, and in our case, in evaluating wind energy potential. In Kosovo, where the need to expand clean energy production is becoming a national priority, such approaches offer an effective means for evaluating the spatial distribution and feasibility of wind energy resources. Kosovo, located in the central part of the Balkan Peninsula, possesses a diverse topography and favorable climatic conditions that make it a suitable environment for wind power development. Its geographical position, characterized by elevated mountain ranges such as the Sharr Mountains and the Accursed Mountains, as well as open valleys like the Dukagjini and Kosovo Plains, creates spatial variations in wind speed. Understanding these variations is essential for identifying optimal sites for wind energy potential.
Geography plays a fundamental role in this process by examining the relationship between natural conditions, human activities, and spatial patterns. As a modern geographical tool, GIS, through its analytical and visualization capabilities, integrates spatial data and transforms it into valuable practical knowledge that supports decision-making within sustainable planning frameworks.
The methodology enables the assessment of each parameter in relation to geographical objectives and sustainable development requirements. The analysis also deals with the processing and integration of several data layers, such as wind speed and wind energy at functional height for modern turbines.
The final products of this work include maps of areas with potential for the development of wind energy and spatial models that provide an important and strategic basis in the energy sector. Through these results, we aim to support public and private institutions and various organizations that aim to orient investments towards areas with greater potential for the use of renewable resources, contributing to energy diversity and reducing dependence on non-renewable resources.
The study highlights the role of GIS as a much-needed tool for analyzing renewable energy potential and supporting sustainable energy policy management approaches in Kosovo.
Keywords: GIS, Renewable Energy, Wind Energy, Kosovo

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A COMPARATIVE STUDY OF SAFAVID CERAMICS AND OTTOMAN (IZNIK) CERAMICS

Seyyed Mohammad Mirshafiee[135], Ma'sume Alizadeh Asl[136]

Abstract:
Safavid ceramics and Ottoman Iznik ceramics represent two of the most distinguished artistic achievements of the Islamic world during the 16th and 17th centuries. This study, conducted through a descriptive–analytical approach, compares these two artistic traditions in terms of technique, aesthetics, decorative motifs, color application, and cultural–historical background. The findings indicate that although both traditions developed under the influence of Persian, Chinese, and Anatolian artistic exchanges, each evolved into an independent visual identity with distinctive characteristics. Safavid ceramics are known for their delicate body structure, refined linearity, transparent glazes, soft turquoise and cobalt hues, and fluid ornamental compositions. In contrast, Iznik ceramics are characterized by their white fritware body, the distinctive "Armenian bole" red pigment, strong color contrasts, and highly organized geometric or repetitive arrangements originating from institutionalized court workshops.
The comparative analysis shows that Safavid ceramics tend to reflect poetic sensibilities, organic movement, and decorative richness rooted in Iranian artistic culture, whereas Iznik ceramics demonstrate visual order, structural consistency, and a court-oriented production system shaped by Ottoman imperial policies. Differences in chromatic expression are among the most significant distinctions: vibrant contrasting colors dominate Iznik works, while Safavid ceramics exhibit softer tonal variations. Ultimately, this study concludes that both ceramic traditions occupy prominent positions in Islamic art history, yet each presents a unique artistic trajectory and a fully developed aesthetic identity.
Keywords: Islamic Art, Iznik Safavid Ceramics, Safavid Ceramic Art

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THE SURVIVAL OF ART IN THE SMART WORLD: THE ROLE OF ADVANCED TECHNOLOGIES IN PRESERVING AND TRANSMITTING ARTISTIC HERITAGE

Sara Alsadat Nouri[137], Farimah Fatemi[138]

Abstract
Among the most important assets of human societies considering culture and identity, artistic heritage is facing new challenges during the Smart World era. In this respect, the contribution given in this research is oriented towards exploring how advanced technologies can contribute to the conservation, recreation, and sustainable transmission of artistic heritage, pointing at the need for an interdisciplinary approach. A qualitative methodology was applied, focusing on a case study of successful global projects- Louvre and Metropolitan Museum projects using virtual reality-and comparing digital projects in Iran and other countries, considering the opportunities of digitization and the related threats. A review of the related literature reveals that 3D digitization, augmented and virtual reality, AI for the restoration of damaged works, and blockchain for authenticity verification and forgery prevention are some of the tools that play a vital role in the more accurate preservation of artifacts. These technologies enable not only the passing of art to future generations and spreading it worldwide but also the creation of interactive platforms for equal access to cultural heritage by the general public. For example, AI applied to analyze traditional Iranian art patterns allows new interpretation and adaptation in view of the needs of the younger generation. It points out, however, that there are also a number of challenges: risks of over-commercialization, losses in authenticity in digital replicas, and inequalities in digital access. This research underlines the need for regulation through cultural policy-making in this domain and indicates that continued collaboration by artists, technology researchers, policy makers, and international institutions is necessary. In this aspect, art will survive in the smart world: not only by physical preservation but through creative reinterpretation and recreation for future generations.
Keywords: Digital Art, Cultural Heritage, Artificial Intelligence, Virtual Reality, Artistic Preservation

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COMPARATIVE ANALYSIS OF PRODUCTION STRUCTURE AND AESTHETIC FEATURES OF POTTERY IN KÜTAHYA, TURKEY, AND LALAJIN, HAMEDAN, IRAN

Seyyed Mohammad Mirshafiee[139], Ma'sume Alizadeh Asl[140]

Abstract
Kütahya in Turkey and Lalajin in Iran are among the most important centers of pottery in the region, each with a long-standing tradition in clay-based arts and playing a significant role in shaping their countries' artistic identity and handicraft production. This study aims to provide a comparative analysis of the production processes, artistic styles, raw materials, and economic systems associated with pottery in these two cities. The research adopts a descriptive–analytical approach, and data were collected from library sources, art documents, previous studies, and existing pottery samples.
The findings indicate that Kütahya, relying on its long-standing porcelain tradition and advanced glazing techniques, has been successful in developing artistic pottery and export-oriented production. In contrast, Lalajin, focusing on traditional forming methods, the diversity of small-scale workshops, and the authenticity of its local style, has secured an important position in Middle Eastern pottery. The comparison highlights significant differences in material composition, clay quality, firing technologies, decorative patterns, and market systems. Combining Kütahya's technological and marketing experience with Lalajin's cultural capital could enhance production levels, diversify products, and strengthen artistic interactions between the two centers.
Keywords: Pottery production, Iranian artistic ceramics, Turkish artistic ceramics, Lalajin ceramics, Kütahya ceramics

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TRACES OF URBAN VITALITY IN ERZURUM: A SPATIAL ANALYSIS OF CUMHURIYET AVENUE

Saffan Safa Şanlık[141], Defne Dursun[142]

Abstract
Urban vitality refers to the degree to which urban areas are socially, economically, and culturally dynamic, attractive, and sustainable. The concept encompasses factors such as the active use of urban spaces by people, the intensity of social interactions, the diversity of economic activities, and the richness of cultural life. It serves as a crucial indicator for assessing the quality of life and sustainability of cities or specific urban areas. In medium-sized cities today, urban vitality tends to weaken due to issues such as functional monotony, accessibility problems, and spatial discontinuities—leading to a decline in both user density and overall quality of life.
This study aims to analyze the level of urban vitality along Cumhuriyet Avenue—an axis of historical and spatial significance in the city center of Erzurum—through spatial indicators. Observations reveal that the avenue does not display a homogeneous structure in terms of user density and public space quality. To clarify the underlying causes of these variations, the study focuses on three main indicators: public space quality, functional diversity, and accessibility. Based on quantitative methods, data were collected through field observations, pedestrian density measurements, and functional mapping. Functional diversity was assessed by the distribution of land-use types, accessibility by pedestrian linkages and spatial continuity, and public space quality by indicators such as seating and resting opportunities, physical environment characteristics, and intensity of use.
Findings indicate that areas with higher levels of urban vitality correspond to those characterized by greater functional diversity, pedestrian accessibility, and spatial continuity. Conversely, zones with lower vitality are primarily associated with mono-functionality, physical disconnections, and access limitations.
In this context, the study emphasizes the necessity of data-driven planning approaches to enhance urban vitality in a sustainable manner. It highlights that identifying vitality levels through measurable spatial data is particularly critical for developing strategic, evidence-based, and public-space-oriented planning policies in medium-sized cities. The research concludes by providing quantitative, strategy-oriented recommendations aimed at improving spatial quality and guiding decision-makers toward more vibrant urban environments.
Keywords: Urban Vitality, Public Space Quality, Spatial Continuity, Functional Diversity, Medium-Sized Cities.

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DECISION MODEL BASED ON SPHERICAL PROBABILISTIC HESITANT FUZZY AGGREGATION INFORMATION

Shahzaib Ashraf[143]

Abstract
Spherical fuzzy set is very efficient in solving multi-criteria decision making (MCDM). Probability hesitant fuzzy sets (PHFSs) are more profit in describing the hesitancy with different occurring probabilities experienced by the decision makers. In this study, we develop the generalized idea of spherical probabilistic hesitant fuzzy sets (SPHFSs), which is a hybrid structure of spherical fuzzy sets and probabilistic hesitant fuzzy set to tackle uncertain information. Firstly, this paper proposes some basic operations of SPHFSs and discusses some interesting elementary properties and their relationships. Moreover, this paper proposes a list of novel algebraic averaging/geometric aggregation operators under spherical probabilistic hesitant fuzzy information to aggregate the uncertain information in an effective and reliable way. Finally, a numerical application regarding urban residential problems is presented to illustrate the consistency of the developed decision-making technique.
Keywords: Spherical probabilistic hesitant fuzzy set, Aggregation operators, Decision Making.

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EVALUATION OF THIN-LAYER DRYING MODELS FOR ZIZIPHUS LOTUS LEAVES IN FORCED CONVECTION

Khaoula Chatir[144], Haytem Moussaoui[145], El Houssayne Bougayr[146], Lhoucine Oufni[147]

Abstract
This study investigates the drying kinetics of wild jujube leaves (Ziziphus lotus), a medicinal plant widely valued in the Mediterranean region. As interest in natural medicinal plants continues to grow, it becomes increasingly important to optimize drying processes to preserve the bioactive compounds contained in the leaves. Experimental drying tests were carried out under forced convection at three temperatures (40, 50, and 60 °C) to establish drying curves and identify the most suitable kinetic models. Several mathematical models (Lewis, Page, Henderson and Pabis, logarithmic, and Midilli–Kucuk) were evaluated and compared using statistical criteria. The results indicate that the Midilli–Kucuk model offers the best performance in describing the drying behavior of Ziziphus lotus leaves at all tested temperatures, achieving high coefficients of determination (R^2) and minimal prediction errors. These findings provide a valuable foundation for optimizing industrial drying processes for this high-value medicinal plant.
Keywords: Ziziphus lotus, Forced convection drying, Midilli–Kucuk model

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AI FOR EARTH: STRATEGIC INTEGRATION OF ARTIFICIAL INTELLIGENCE AND TOURISM TO ACCELERATE SDG PROGRESS UNDER CLIMATE CHANGE

Nauman rasool[148]

Abstract
Climate change is changing the world's tourism sector, posing a threat to cultural heritage, biodiversity, and the livelihoods of the millions of people who rely on coastal and nature-based tourism. Using artificial intelligence (AI) to develop climate-resilient, sustainable tourism has become a strategic priority in international sustainability agendas. The theoretical and analytical framework of AI for Earth, which is described in this study, explains how AI-driven technologies may be methodically incorporated into tourism planning, management, and governance to advance towards the SDGs. The framework combines data from climate science, tourism analytics, machine learning applications, and environmental management to pinpoint five high-impact areas: (1) climate-risk prediction for tourism destinations, (2) AI-enabled biodiversity and ecosystem monitoring, (3) energy-efficient and low-emission smart tourism infrastructure, (4) behavioral nudging for sustainable tourist choices, and (5) governance models that embed AI ethics, transparency, and inclusivity. AI can use these mechanisms to help vulnerable communities, optimize resource use, improve adaptive capacity, and lower environmental footprints. The research emphasizes ethical issues, implementation obstacles, and policy routes necessary for responsible adoption. This paper views AI as a cross-sectoral driver for enhancing tourism's contribution to climate action and attaining SDG goals, rather than merely a technological tool.
Keywords: Artificial İntelligence; Sustainable Tourism; Climate Change; SDGs; Environmental Monitoring; Climate-Risk Prediction; AI Governance; Smart Destinations.

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DIGITAL ART PEDAGOGY: AN EXAMINATION OF REMOTE LEARNING PROCESSES

Hokuma Safarli Aghasoy[149]

Abstract
The rapid digital transformation that accelerated in the aftermath of the COVID-19 pandemic has profoundly reshaped art education, both structurally and pedagogically. This paper examines the emerging opportunities, limitations, and evolving learning models brought about by digitalization and the integration of technology in art education, alongside the growing prevalence of distance and online instructional modalities. The study employs a thematic analysis grounded in academic research, educational reports, institutional practice examples, and qualitative data collected from art students between 2020 and 2024.
Findings indicate that online art education offers substantial advantages in terms of accessibility, flexibility, and cost-effectiveness, particularly for theoretical and lecture-based courses. Digital learning management systems, online workshops, and video-based instructional modalities have become instrumental in supporting pedagogical processes. In studio-based practice, digital tools—including drawing tablets, 3D modeling software, virtual exhibition platforms, and online portfolio systems—have increasingly complemented traditional methods, enhancing the depth and quality of process-oriented assessment.
Moreover, online masterclasses and international collaborations have expanded the global reach of art education, enabling students to engage with artists, educators, and institutions beyond geographical boundaries. However, the incorporation of technology into art education also presents a number of pedagogical challenges. The sensory and spatial dimensions of sculpture, ceramics, performance arts, and site-specific practices cannot be fully replicated in digital environments. Additional issues such as inadequate technical equipment, unstable internet infrastructure, and diminished student motivation further complicate the effectiveness of remote learning.
In conclusion, digitalization has not served merely as a temporary remedy for disrupted educational systems but has instead fostered the development of a new pedagogical paradigm in art education. Distance learning, online studio practices, and technology-based production tools are poised to become permanent components of a hybrid, multilayered, and internationally accessible educational model shaping the future of art pedagogy.
Keywords: Digitalization, Remote Art Education, Hybrid Learning Models

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MODERN ARCHITECTURE AS A CATALYST FOR SMART VILLAGE DEVELOPMENT (CASE OF BUKNARI COMMUNITY, CHOKHATAURI MUNICIPALITY, GURIA RE-GION)

Saba Santeladze[150], Eka Devidze[151], Gela Santeladze[152], Nino Devidze[153], Lali Mikeladze[154][155]

Abstract
Buknari, a village in Chokhatauri Municipality, Guria Region, Georgia, has been an established community since 1871. Over the 20th century, the village developed key public infrastructure, including a market, kindergarten, school, and a first aid centre, alongside cultural initiatives such as theatrical performances and early radio broadcasting. Following the collapse of the Soviet Union, many administrative and cultural buildings deteriorated, resulting in socioeconomic decline and insufficient public services.
The study investigates the potential of modern architecture as a catalyst for smart village development in Buknari. Using a mixed-methods ap-proach, including semi-structured interviews, focus group discussions, and on-site field observations, the research identifies main challenges, such as inadequate public and recreational spaces, limited digital connec-tivity, and ruined infrastructure. Based on the findings, the study propos-es community-centered, sustainable architectural interventions aimed at revitalizing Buknari, enhancing social cohesion, and promoting socioeco-nomic and cultural development.
The study contributes to understanding how modern architectural strate-gies can transform rural settlement into smart, sustainable community, offering practical insights for rural revitalization and community development initiatives.
Keywords: Smart Village, Modern Architecture, Sustainable Commu-nity, Rural Revitalization

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CASSON HYBRID NANOFLUID FLOW OVER INCLINED CYLINDER WITH VARIABLE PROPERTIES UNDER MAGNETIC DIPOLE EFFECTS

Nadeem Abbas[156], Wasfi Shatanawi

Abstract
The present study explores the nonlinear MHD flow and heat transfer analysis of a Casson hybrid nanofluid past an inclined stretching cylinder under the influence of a magnetic dipole field. The model incorporates variable thermal properties and thermal radiation to capture realistic transport phenomena in technologically relevant applications. The hybrid nanofluid is composed of dual nanoparticles suspended in a Casson base fluid, which enhanced thermal conductivity and modified viscous resistance. The governing equations formulated via boundary-layer approximations are transformed into a dimensionless system and solved numerically. A neural network analysis framework is employed for data-driven prediction and optimization of the flow and thermal characteristics. The sensitivity analysis highlights key dimensionless parameters affecting velocity, thermal distribution, and skin friction. The results of the present analysis are presented in detail in graphical and tabular form. Our results enable fine-tuning of flow regulation in advanced cooling and material processing systems.
Keywords: Casson Hybrid Nanofluid; Inclind Stretching Cylinder; Magnetıc Dıpole Effects; Neural Network Analysis.

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THE USE OF ETHNIC MOTIFS IN THE DESIGN OF GASTRONOMIC SPACES: CULTURAL IDENTITY AND CUSTOMER EXPERIENCE

Dilnaz Shugurbekova[157], Dinara Isakova[158]

Abstract
Ethnic motifs used in gastronomic spaces are not merely decorative elements; they represent cultural identity, carry historical memory into the space, and enrich the overall customer experience. This study examines how motifs from various cultures are integrated into interior design, how they strengthen brand identity, and how they contribute to the sustainability of cultural heritage. The aim is to determine the role of ethnic elements in experience-oriented design - which has become increasingly important in the gastronomy sector - and to reveal their impact on customer perception. The method consists of literature review and case studies of selected gastronomic venues worldwide. Examples from Kyrgyz, Turkish, Japanese, African, and Indian cultures were analyzed to understand the application of ethnic motifs in spatial components such as walls, flooring, furniture, textiles, lighting, music, and food presentation. Findings show that ethnic motifs enhance brand identity, create a sense of curiosity and belonging, and significantly increase social media visibility. "Instagram-friendly" areas were found to contribute to higher visitor engagement. Additionally, the use of ethnic design highlights cultural heritage, supports local artisans, and transforms gastronomic venues into unique experiential spaces. In conclusion, ethnic motifs are an essential design tool that strengthens both the aesthetic and experiential value of gastronomic spaces. The study offers recommendations such as balanced motif use, incorporation of local materials, and integration of culturally meaningful elements into design processes.
Keywords: ethnic motif, gastronomy design, cultural heritage, customer experience, interior design

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DESIGNING THE PROMPT: TOWARD A STANDARDIZED ONTOLOGY FOR TEXT TO IMAGE VISUALIZATION IN INTERIOR DESIGN

Muhammad Danial Ismail[159], Arniatul Aiza Mustapha[160], Abu Bakar Abd Hamid[161]

Abstract
The increasing adoption of artificial intelligence (AI) driven text to image (TTI) systems in interior design has transformed how designers conceptualize, communicate, and visualize spatial ideas. While existing research has largely focused on the technical performance of generative models, less attention has been given to the linguistic interface through which designers interact with these systems, namely the interior design terminologies used in prompting. This study initially began as a literature review examining how interior design language is represented and operationalized within TTI workflows. Drawing on highly cited publications indexed in the Scopus database, the review identified seven recurring terminological domains, while also revealing significant inconsistencies in how these terms
are defined and applied across design discourse and AI generated visualizations. Building on these findings, the research produced a standardized language system for TTI use in interior design. The principal outcome of the study is the development of a Controlled Prompt Vocabulary (CPV) for interior design consisting of 270 terms, organized into ten hierarchical domains: Spatial, Materials, Furniture, Lighting, Style, Colour, Atmosphere, Sustainability, Cultural, and Technical Rendering & Prompt Logic. Each term is systematically structured through four attributes: a precise definition grounded in interior design discourse, its conventional interior design usage, its interpreted function within TTI systems, and a controlled sample prompt. This structure ensures semantic clarity, reduces overlap between terms, and enhances machine interpretability. The dictionary was constructed through refering multi source interior design literature, professional practice conventions, and
documented behaviors of major TTI platforms such as Midjourney, Stable Diffusion, and DALL·E. Terms were selected only if they are demonstrably used in real interior design contexts and produce consistent visual outcomes by generative models. Ambiguous or purely stylistic adjectives were either excluded or repositioned within perceptual domains to prevent semantic inflation. Particular attention was given to domains often underrepresented in generative systems, including sustainability strategies, surface performance, ergonomic considerations, and culturally specific interior typologies, addressing known biases toward stylistic and Western centric representations. The study demonstrates that terminological inconsistency is not merely a linguistic issue but a design operational problem that directly affects the accuracy, inclusivity, and reliability of AI generated interior visualizations. By
formalizing a standardized ontology and prompt dictionary, this research bridges the gap between human design intent and machine interpretation. The resulting CPV is proposed as a transferable framework for design practice, pedagogy, and future research, positioning prompt language as an emerging design medium within AI mediated interior design workflows.
Keywords: Text to Image (TTI), Interior Design Ontology, Artificial Intelligence (AI), Prompt Vocabulary, Semantic Alignment

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EXAMINING VISITOR SATISFACTION IN HERITAGE TOURISM: INSIGHTS FROM TWO MUSEUMS IN TASHKENT

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Abstract
Heritage tourism in emerging economies, including Uzbekistan, continues to be insufficiently explored within the academic literature, despite its growing importance for cultural preservation and economic diversification. To contribute to this underdeveloped field, the present study introduces a dual-pathway framework aimed at explaining visitor satisfaction in two major heritage museums located in Tashkent. Drawing on survey data collected from a diverse group of museum visitors, the study examines how two key dimensions—exploration and experience outcomes—shape overall satisfaction. The exploration pathway reflects opportunities for visitors to discover historical narratives, learn from exhibitions, and meaningfully engage with cultural artifacts. The experience outcome pathway captures visitors' emotional reactions, enjoyment, and perceptions of value during their museum visits. The findings indicate that both pathways significantly influence satisfaction, while emotional engagement emerges as an especially strong predictor. This aligns with contemporary heritage tourism research emphasizing that visitors increasingly seek memorable and affective experiences rather than purely informational content. Emotional resonance helps transform museum visits into personally meaningful encounters that deepen connections to cultural heritage. From a managerial perspective, the results highlight the importance of strengthening both service quality and experiential design. Enhancing staff communication, interpretive clarity, and spatial organization can enrich the exploration dimension. At the same time, introducing interactive displays, digital tools, narrative-based exhibitions, and visually engaging environments can heighten emotional involvement. By strategically developing these complementary pathways, heritage museums in Uzbekistan can improve visitor satisfaction, stimulate greater cultural engagement, and reinforce the broader value of heritage tourism within the country's evolving tourism landscape.
Keywords: Heritage tourism, Visitor satisfaction, Emotional engagement, Exploration, Experience outcome, Museum management

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THE EMERGENCE OF INDIVIDUALISM IN THE FAMILY ENVIRONMENT: THE CASE OF IRAN

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Abstract
One of the most significant social developments of the second half of the twentieth century was the transformation of the family institution in Western society. This transformation involved a series of institutional and cultural changes that led to the emergence of various family forms in the West; these forms differed from the nuclear family in terms of structure and function. The nuclear family was once considered one of the hallmarks of modern society. Analytically, and also in terms of the structural and value dimensions of the family, two dimensions of change within the family can be distinguished; the first dimension concerns structural and functional changes within the family. The most important of these changes are developments such as an increase in divorce rates, a decline in fertility, and the separation of sexual relations from the rules of marriage. These changes encompass the changes conceptualised by Beck under the heading of individualisation. Rising divorce rates, increasing age at marriage, declining fertility rates, and decreasing marriages are considered the most significant challenges facing the family in Iran today. These challenges have been conceptualised as a series of structural and functional changes occurring within the family under the heading of the individualisation of the family institution. One of the most significant consequences of these changes is the emergence of individualism in the family sphere; this implies a shift in family values, namely that individual desires take precedence over collective desires. This study examines individualism in the family sphere, emphasising the level of commitment to family values. The aim of this study is to answer the question of whether it is possible to speak of the emergence of individualism in the Iranian family sphere, considering recent developments in Iranian society in general and in the family in particular. This study was conducted using a survey method and involved 408 Tehran citizens. Analysis of the research findings revealed that family values have changed in parallel with the emergence of individualism, but that this change differed according to each of the five dimensions of family values examined. Accordingly, individuals are individualistic in terms of the hierarchical and control dimensions of family values, partially individualistic in terms of the self-control dimension, moderately individualistic in terms of the traditional dimension, and collectivist in terms of the attachment dimension. Comparisons between different age, gender, and education groups showed that the level of individualism in the area of family values is higher among women, young people, and those with university education.
Key Words: Family values, changes in family structure, individualisation, individualism.

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FROM PAST METALLURGY TO FUTURE CONSERVATION: ELECTROCHEMICAL STUDY OF GREY CAST IRON PROTECTION

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Abstract
This work investigates the corrosion behavior of two historical grey cast iron alloys from the 19th and 20th centuries, denoted GCI-A and GCI-B, in a 0.5 M phosphoric acid medium, using sodium dodecyl sulfate (SDS) as a corrosion inhibitor. The effects of temperature, critical micelle concentration (CMC), and inhibition efficiency were systematically examined through conductimetry, electrochemical impedance spectroscopy (EIS), potentiodynamic polarization, scanning electron microscopy (SEM), and ICP-OES analysis. Results reveal that the higher copper and manganese contents in the alloys contribute to enhanced intrinsic corrosion resistance. SDS adsorption on the metal surface, governed by both physisorption and chemisorption mechanisms, effectively suppresses both anodic and cathodic reactions, indicating mixed-type inhibition behavior. An increase in acid concentration was found to decrease the CMC, whereas rising temperature led to an increase in CMC values. At an optimal SDS concentration of 10^{-4} M, a significant reduction in iron dissolution was observed for both alloys. Electrochemical measurements demonstrated a substantial decrease in corrosion current densities, with inhibition efficiencies reaching up to 95%. SEM observations confirmed the protective role of SDS, showing reduced graphite flake size and surface degradation. These findings underline the effectiveness of SDS as a promising corrosion inhibitor for the protection and conservation of historical grey cast iron artifacts in heritage restoration contexts..
Keywords: Grey cast iron, Corrosion, Sodium Dodecyl Sulfate (SDS), CMC, EIS

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VISUAL HERMENEUTICS OF ATTAR: A DIGITAL PILOT STUDY ON THE MANUSCRIPT MINIATURES

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Abstract
This paper proposes a visual-hermeneutic approach to the works of the Persian Sufi poet and mystic Fariduddin Attar (d. 1221) by examining miniature paintings associated with his mystical narratives. Although numerous textual studies have explored Attar's writings, there is still no digital archive or systematic analysis that connects his concept of seyr u sulūk (the spiritual journey) with its visual representations in manuscript miniatures. Today, these visual materials are scattered across museums, private collections, and art catalogues, and remain largely unexplored from a Sufi-philosophical perspective.
The study aims to present a digital pilot model that maps the visual interpretation of Attar's mystic journey through selected miniatures. By focusing particularly on the representation of birds and symbolic landscapes, this research attempts to reveal how miniature artists translated the stages of spiritual ascent into visual forms. The methodology combines visual hermeneutics, iconographic analysis, and a conceptual framework derived from Attar's Mantıqu't-Tayr, where each bird corresponds to a specific psychological or spiritual condition.
This paper argues that miniature art functions as a visual commentary (tafsīr) on Sufi cosmology, offering a non-textual yet profound insight into mystical experience. The proposed digital pilot model also outlines the structure of an online visual archive, which could serve as a foundation for future interdisciplinary studies that bring together Islamic mysticism, art history, digital humanities, and cultural heritage research. It is suggested that such a model contributes to the preservation of intangible cultural memory and opens new possibilities for contemporary interpretations of classical Sufi literature.
Ultimately, this study demonstrates how Attar's imagery may be reactivated as a cultural heritage tool bridging past and future, through digital reconstruction and visual analysis. The pilot phase invites academic collaboration to expand the miniature data into a publicly accessible image database.
Keywords: Visual Sufi Memory, Miniature and Spiritual Journey, Digital Preservation of Cultural Heritage

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INTEGRATING FISH-CENTRIC DESIGN INTO SUSTAINABLE TOURISM AND ARCHITECTURAL SPACES

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Abstract
Tourism is shifting toward experiences rooted in nature, authenticity and local identity. Aquatic environments have always shaped human settlement, culture and economy. Architecture also moves toward biophilic design because people respond better to spaces that reflect natural cues. This creates an opportunity to rethink how fish and aquatic ecosystems can inform both visitor experience and spatial design. This topic connects directly to KEF's focus on cultural heritage, architecture, and sustainable tourism. Fish-based interventions sit at the intersection of these fields. They bring ecological value, cultural symbolism, and design opportunities that can contribute to the kind of integrated thinking KEF promotes.
This study had four main objectives: first, to understand how fish-related features influence tourism experiences; second, to examine how they contribute to heritage interpretation; and third, to evaluate their sustainability and design implications and finally to identify the barriers limiting successful aquatic design implementation.
Keywords: Architectural Spaces, Fish Design, KEF

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LOW-COST FLEXIBLE SENSOR PLATFORM BASED ON LASER-INDUCED GRAPHENE (LIG): MORPHOLOGY AND SURFACE CHEMISTRY ORIENTED ASSESSMENT

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Abstract
LIG is a prominent carbon platform in flexible sensor technologies due to its ability to be fabricated on the polymer surface in a single step using a CO2 laser and its suitability for rapid prototyping without the need for a mask. In this study, within the scope of a LIG-based flexible sensor development approach, the effects of fabrication parameters such as laser power, scan rate, and line spacing on structural and chemical properties were analyzed, and a comprehensive characterization of LIG was reported to provide a basis for sensor applications. The fabricated LIG patterns were evaluated in terms of morphology, defect/grain structure, and surface chemistry using scanning electron microscopy (SEM), Raman spectroscopy, and X-ray photoelectron spectroscopy (XPS), respectively. SEM images revealing a porous and hierarchical carbon network structure after laser-assisted transformation demonstrated that features critical to sensor performance, such as conduction path continuity and surface area, can be tuned via laser parameters. Raman spectra of LIG shows typical D (1346.56 cm^{-1}), G (1570.27 cm^{-1}), and 2D (~2673.89 cm^{-1}) bands, suggesting the formation of LIG. XPS analysis revealed the characteristic peaks of carbon (C) and oxygen (O) elements. The binding energy of the C 1s peak in the spectrum was centered at 284.5 eV, and the O 1s peak at 531.08 eV. These characterizations affirm that LIG provides an 'adjustable' material platform for resistance-based sensing modes: temperature, strain sensors, and real-time physiological monitoring (recording of body temperature change; joint movement/position; posture; and respiration-induced deformation) in E-skin/osystems, smart textiles and wearable systems. The porous hierarchical morphology and a surface functional groups depetentencies of the parameters represent that LIG could be evaluated in place where interactionis needed such as human-machine interfaces, soft robotics, performance monitoring even electrochemical sensing applications (point-of-care diagnostic systems, environmental monitoring of ions, heavy metals, and other pollutant markers, as well as food safety analysis) as a flexible electrode. In this regard, the work addresses uncovering the critical morphological and surface chemical design requirements for transitioning to alternate use cases building on printable and scalable low-cost laser printing.

Keywords: Laser-induced graphene, LIG, flexible sensor, carbon materials.

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PROSPECTS FOR CREATION BASALT INDUSTRY PLANTS IN THE COUNTRIES OF THE WORLD

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Annotation
Basic provisions on the need to create and develop plants in the basalt industry in countries around the world. In recent years, successful developments have been made in technologies and equipment for the production of basalt continuous fibers (BCF).
The strength, chemical and thermal resistance, low hygroscopicity and high operating performance characteristics of basalt continuous fiber allow its widespread use in the production of reinforcing materials and composites. At the same time, BCF has the most priority ratio of characteristics-to-price.
Basalt fiber is the only fiber produced from ready-to-use natural raw materials. The main power input for preparing basalt raw materials for fiber production is achieved under natural conditions.
Basalts are rocks of igneous origin. The Earth's crust consists of 30–60% basaltic magmatic rocks.
Basalt deposits are found in numerous outcrops of many countries, and its reserves are virtually unlimited.
Industrial production facilities have been established - plants for the production of basalt fiber reinforcing materials and composites, basalt fabrics, non-woven materials, basalt paper, prepregs. Products of BCF and BCF materials plants are more demand in the construction, road building and earthquake-resistant engineering, energy, oil and gas industry, basic branches of industry and also in public utilities.
BCF materials are in demand in most countries where there isn't a domestic metallurgical industry. These countries are forced to import steel reinforcement (rebar), I-beam, T-beam and various shaped products, sheet materials, pipes, stainless steel and non-ferrous alloy products, aluminum profiles, and other materials. BCF reinforcing materials and composites are similar metal and alloy alternatives to imported materials. BCF composites and reinforcing materials can and should be produced in these countries from local basalts.
In today of significantly rising energy costs and increasing demands for industrial decarbonization, the cost of metal products has increased and will continue to grow in future.
The production of BCF, BCF reinforcing materials and composites take in 20 times less energy resources compared with the production of steel, rolled steel and other metal products.
In industrialized countries, strong, lightweight, corrosion-resistant BCF reinforcing and composite materials and products are in demand for high-tech industries, such as: the automotive, mechanical engineering, aviation, shipbuilding, power and cable industries.
BCF and BCF materials plants are high-tech, environmentally friendly, and cost-effective production facilities that meet the global market demand.
Basalts are also a raw material for the production of thermal insulating and sound - proof fibers and materials, basalt, scales and basalt castings.
The availability and accessibility of basalt raw materials, as well as the demand of basalt fiber materials and products on the global market, will urgently require the creation of basalt industry plants worldwide.
Previously, there was the Stone Age (Era), then the Era of Iron, and the Era of Basalt is dawning now.
The 21-st century marks the beginning of the Era of basalt technologies and materials and their widespread use in the world.
Key words: basalt continuous fibers, BCF reinforcement, composites.

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GLOBAL RESEARCH LANDSCAPE ON VISUAL POLLUTION IN ENVIRONMENTAL STUDIES: A COMPREHENSIVE SCIENTOMETRIC ANALYSIS

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Abstract
This study offers a comprehensive examination of the global scientific landscape surrounding visual pollution by conducting a scientometric analysis of publications indexed in the Web of Science Core Collection. Using the search query TS = "visual pollution" AND WC = (Environmental Sciences OR Public Environmental Occupational Health) and applying no temporal restrictions, a total of 1,336 records were retrieved, of which 1,269 were research and review articles. The growing volume of publications over the past two decades shows that visual pollution has gradually emerged as an important topic within environmental sciences and public health. Scholars increasingly approach it not only as a matter of aesthetic degradation but also as an issue linked to human well-being, environmental justice, and the quality of shared public spaces. The analysis reveals that China, the United States, and India are currently the most influential contributors to this field, followed by England, Italy, Spain, Australia, and Germany. Prominent institutions such as the Chinese Academy of Sciences, the University of California system, Harvard University, the Helmholtz Association, and the French National Centre for Scientific Research (CNRS) demonstrate sustained productivity, indicating that research on visual pollution is becoming embedded in major academic networks. Leading journals—including Science of the Total Environment, Marine Pollution Bulletin, and Environmental Pollution—highlight the strong environmental orientation of the field. However, the thematic diversity of the retrieved publications shows that visual pollution is increasingly being discussed in relation to urban planning, landscape management, cultural heritage, and architectural design. Overall, the findings suggest that research on visual pollution is still evolving and lacks unified conceptual or methodological foundations. This presents an opportunity for scholars to develop clearer definitions, robust assessment tools, and interdisciplinary frameworks. The insights generated from this study can support policy development, enhance visual quality in cities, and contribute to more sustainable and aesthetically coherent urban environments.
Keywords: Visual Pollution, Environmental Sciences, Scientometric Analysis, Urban Landscape, Sustainable Urban Planning.

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CONCERNING SASANIAN GLYPTIC ARTIFACTS AT THE NATIONAL MUSEUM OF GEORGIA

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Abstract
Over the centuries, especially in antiquity and the Early Middle Ages, the Georgian world was in close contact with pre-Islamic Iran. It was obvious that Georgian-Iranian cultural relations developed along with the extant political-economic interactions, and these processes were adequately reflected in the pre-Christian and early Christian Georgian civilization, particularly when eastern Georgia (Iberia) became politically influenced by the Sasanian Empire (224-651 AD).
Among the rich archaeological findings in Georgia, the rarest examples of Sasanian silverware, seals, and coins are already distinguished from the Early Sasanian period. However, the majority of the Sasanian artifacts discovered in Georgia are excellent seals. The bulk of them are kept at the Simon Janashia State Museum's Glyptic Fund.
The images carved on Sasanian seals, almost all, are of symbolic meaning and appear closely related to the ancient religious beliefs, astral cults, deities and their zoomorphic counterparts. In Sassanian glyptic monuments, animal representations are common and are characterized by naturalistic performance and subtle, plastic forms, especially on the early Sassanian gemstones, although later depictions are also very expressive. The bull is one of the most important of the massive ungulates in Sasanian glyptic, and particularly, the zebu bull symbolically associated in Iranian mythology with the primal bull, Gao-Spenta, and the deity of victory, Vretragna; incarnating as well the god Mithra.
The article discusses the description, attribution, and dating of the different bull representations found on the engraved gems kept in the various collections of the S. Janashia State Museum's Glyptic Fund. Five groups were formed based on stylistic and iconographic characteristics of bull depictions.
Keywords: Iranian-Georgian cultural relations, Sasanian glyptics, National Museum of Georgia



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CHARACTERIZATION OF EUPHORBIA MILII FLOWER EXTRACT AND ITS APPLICATION ON SILK FABRIC

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Abstract
The increasing concern about the health hazards and environmental impact of synthetic dyes has sparked consumers' interest in natural dyes. Unlike synthetic dyes, which commonly contain toxic components, natural dyes are sustainable, renewable, and biodegradable. The present study seeks to extract natural dye from the flowers of Euphorbia milii (Euphorbiaceae), recognized for its diverse medicinal properties, in order to obtain novel shades of natural dyes. The dye was extracted in aqueous condition by boiling the Euphorbia milii flower petals in distilled water at 95°C for 45 minutes. The obtained flower extract was characterized to determine its chemical composition, phytochemical analysis, and functional groups present using UV-VIS spectroscopy, liquid chromatography, and Fourier transform infrared spectroscopy (FTIR). Pre-processed cotton and silk fabric was dyed using the above extract at 85°C for 45 mins at varied pH levels with 5 g/L alum as a mordanting agent. A calorimetric study of the dyed samples was carried out to find out the color strength using a spectrophotometer. The dyed fabric samples have also been assessed for their colorfastness to washing, water, and rubbing, and satisfactory results were found. It was observed that a range of vivid colors are achieved, which can be used to dye textile materials to overcome the shortcomings of synthetic dyes.
Keywords: Euphorbia milii flower, Natural dye, UV-VIS spectroscopy, FTIR spectroscopy, Dyeing

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VERTICAL DEVELOPMENT OF IRANIAN URBAN NEIGHBORHOODS AND THE SOCIAL RELATIONSHIPS OF APARTMENT LIVING IN ISFAHAN

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Abstract
Urban neighborhoods in Iran are experiencing vertical development with increasing population and the increasing spread of apartment living. Urban neighborhoods in Iran are experiencing vertical development with increasing population and increasing apartment living. The vertical development of urban neighborhoods has changed social relationships. This research was conducted using a survey method with the aim of examining the social relationships and social capital of apartment living in Isfahan in 2024. The statistical population consists of all people aged 20 and over in Isfahan. 200 questionnaires were distributed using cluster, stratified and simple random sampling methods. Results: According to the results of this study about 49 percent of respondents know their neighbors poorly. The average level of neighborhood is about 50% and the average of neighborhood relations is 38%. According to the results of the study, there is a significant relationship between the social trust and neighborhood relations. The average of neighborhood social capital is 32%. There is a significant relationship between the social capital and neighborhood relations
Keyword: neighborhood relations, Vertical development, social capital of apartment living, Iranian urban neighborhoods

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EXPLORING SENSORY AND SPATIAL PREFERENCES AND MOVEMENT BEHAVIOURS AMONG NEURODIVERGENT PUPILS

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Abstract
In many educational contexts, learning is often associated with rigid classroom-based environments that prioritise passive knowledge absorption. This study explores the effectiveness of sensory-based learning strategies in enhancing spatial vision, movement and body awareness among low-function students in secondary school students in Puncak Alam, Malaysia. The study focuses on two objectives: firstly, to understand how movement-based activities affect students' engagement and self-regulation; secondly, to explore their preferences related to environmental design, including colour, lighting and levels of crowding in different spatial contexts. A total of 8 pupils aged 13-17 years participated in the study with low functioning intellectual capacity. The data collection involved preference-based questionnaire, movement checklists and observations conducted during the workshop day. The results showed that the pupils preferred cool colour tones, ambient and colourful lighting, and calm indoor settings, often choosing to be alone or with familiar individuals. However, they displayed greater openness to social interaction in outdoor settings, likely due to reduced sensory pressure. Additionally, most students responded positively to movement-based activities such as spinning and swinging, indicating that these activities help maintain attention and emotional regulation. This study emphasises how important it is to incorporate guided facilitation and sensory-based approaches to support low-functioning students in classroom environments. The findings demonstrate the successful engagement of students with cognitive and sensory processing issues in structured environments that incorporate visual choices and movement-based activities. Moreover, the results indicate the importance of the spatial organisation and design decisions' effect on special children. Overall, the study highlights the value of combining sensory-motor strategies with thoughtful interior design to create more inclusive learning environments.
Keywords: Colour studies, Neurodivergent children, Spatial preference

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HISTORIC BUILDING INFORMATION MODELING (HBIM) FOR MONITORING THE HEALTH OF HERITAGE BUILDINGS

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Abstract
Building Information Model (BIM) has become a hot topic in the building industry in recent years. This technology can be considered as a procedure, database, software or even a 3D model, however it includes all these functions and other things. A standard for heritage objects is the Heritage (Historic) Building Information Model (HBIM). It not only allows for the storage of spatial data and metadata, but it also allows for the documentation of modifications to such structures. The application's scope ranges from a simple document repository to conservation planning tools to building and renovation simulation tools. Heritage building documentation, restoration, retrofitting, and management can all benefit from heritage BIM. To document and analyze the structure of historic buildings, a lot of investigation tools can be used and integrated. The science and engineering community agreed that BIM tools are important for controlling and sharing information, but there is still a lack of research on building situations evaluation in HBIM. This study proposed a methodology for sharing and reusing data collected through records analysis, damage survey, and diagnostic investigation obtained from field. As a result, data needs for project planning and project management can be organized as feedback in BIM models.
Keywords: BIM, HBIM, Heritage Building, Health Monitoring, Restoration

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ACOUSTIC SIMULATION OF ROOM ENVIRONMENTS USING RHINO AND GRASSHOPPER: A PARAMETRIC FRAMEWORK FOR OPTIMIZED SOUND DESIGN

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Abstract
Room acoustics are an essential factor in room design, which affects both usability and acoustics in a space. This research work aims at developing a parametric simulation methodology for room acoustics using Rhino and Grasshopper software with the Pachyderm Acoustic plugin for hybrid geometric acoustics. The simulation strategy takes into consideration algorithmic geometry parameterization and simulation methods such as image source calculations and ray tracing simulations, which are used for estimating important parameters such as reverberation time (RT60), sound pressure level (SPL), clarity (C50), and speech transmission index (STI). A case study of a hypothetical lecture room demonstrates how this simulation can be used and focuses on geometry and parameters for improving acoustics in a room. The results show a possible decrease in RT60 of up to 30% in medium frequency bands, which makes a contribution towards sustainability in architecture because it decreases prototyping requirements.
Keywords: Acoustic Simulation, Room Acoustics, Parametric Design, Sound Propagation

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COMPARISON OF THE EARLY ISLAMIC INFLUENCE FROM THE UMAYYAD, ABBASID AND FATIMID

Ar. Asma Khalid[195]

Abstract
The comparative analysis of the Umayyad (661–750 CE), Abbasid (750–1258 CE), and Fatimid (909–1171 CE) dynasties, focusing on articulated political authority, religious legitimacy, and cultural identity through Islam, the Quran and sayings of the last Prophet (PBUH). The compilation of Islamic manuscripts and material culture, artistic, textual production and political history is central to the governance and political history. Lessons learned from the theoretical, historical, oral and documentary evidence, the paper presents a context of Islam and its spread in architecture, design and beyond. Collections preserved in museums, including the Victoria and Albert Museum (V&A), the Aga Khan Museum, and the Metropolitan Museum of Art (MET), the analysis deeply rooted in historical, artistic and manuscript studies. The Umayyad dynasty is classified as the formative imperial, political, and expansionary period of Islam. Umayyad legitimacy rested on Qurayshi lineage and the consolidation of power following the early conquests. The Qur'anic manuscripts written in angular Kufic script, as well as architectural inscriptions associated with mosques and commemorative monuments, functioned as visual assertions of Islamic sovereignty. The Abbasid dynasty marked a fundamental transformation in Islamic governance and culture, shifting the basis of authority from monumentality to institutionalized knowledge and bureaucracy. The Abbasids developed Baghdad into a cosmopolitan imperial capital and fostered an expansion of literary production. The translatory movement wss based on understanding the early techniques, art culture, material use and philosophical approach, revised according to the teaching of Islam in practicality, in addition to theoretical documentation and knowledge preservation. The knowledge was preserved through the foundation of libraries and the documentation of religious, scientific, and philosophical contexts. Abbasid Qur'anic manuscripts exhibit six different refined scripts, increased legibility, and systematic layout, for people who were accepting Islam but spoke different dialects. The calligraphy as an art for manuscripts, architectural monuments and institutional setup was practised with precision based on the teachings of Islam. The Fatimids' rule strengthened the foundation and expansion of Islam with political and religious supremacy, besides the existence of the Shia and Sunni sects. Their artistic use of material and technique was reflected in aristocratic objects ranging from manuscript design, coinage, textile, ceramic and metalware. The study compares the three dynasties that practiced art as an adoption of monumental architectural practices that different artists commissioned and worked for other art disciplines or vice versa.
Keywords: Umayyad Dynasty, Abbasid Dynasty, Fatimid Dynasty, Islamic manuscripts, material culture, museum studies, Islamic art

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KÜRESEL İKLİM DEĞİŞİKLİĞİ VE KARBON SALINIMINDA EKOSİSTEMLERİN ROLÜ VE BİTKİLERİN KARBON TUTMA KAPASİTELERİNİN BELİRLENMESİNDE KULLANILAN YÖNTEMLERİN ANALİZİ

Hüccet Vural[196], Ayşe Karahan[197]

Özet
İklim değişikliği sorununa neden olan küresel ısınma üç aşamalı olarak gerçekleşmektedir. Bunlar sera gazlarının salınımı, sera gazlarının izlenmesini içeren karbon ayak izi ve salınan sera gazlarının tutulmasını içeren karbon yutak alanlarının planlanması ve geliştirilmesidir. Temel hedef öncelikli sera gazı salınımının en aza indirilmesi olmakla beraber karbon ayak izinin takibi ve yutak alanların planlanması da küresel iklim değişikliği ile mücadele için önemlidir. Atmosfere yayılan karbonu yutarak depolayan doğal veya insan yapımı alanlar karbon yutak alanı olarak tanımlanmaktadır. Karasal ekosistemler ve okyanuslar karbonu tutma bakımından iki önemli yutak alan olarak görülmektedir. Okyanuslar 48.000 Gt toplam karbonun 39.000 Gt'lik kısmını tutarak küresel ölçekte en büyük karbon yutak alanı olarak kabul edilmektedir. Diğer kalan kısım karbon ise karasal ekosistemlerde tutulmaktadır. Karasal ekosistemlerde karbonun % 19'u bitkilerde, % 81'i toprakta depolanmaktadır. Orman ekosistemleri, atmosferden CO_2'i fotosentez süreci ile uzaklaştırarak, önemli ölçüde yutak görevi üstlenmektedir. Atmosferden uzaklaştırılan CO_2, ormanlarda yer alan ağaçların ve diğer bitkilerin gövde yaprak, dal ve köklerinde, diri ve ölü örtüde ve toprakta depolanmaktadır. Dolayısıyla orman bitki örtüsü ve toprakları, atmosferdeki karbondioksiti emme ve depolama potansiyeline sahip önemli bir karasal karbon havuzu görevi üstlenmektedir. Literatürde farklı yöntemler kullanılarak bitkilerin bünyelerinde ne kadar karbon tuttuğu ile ilgili çeşitli araştırmalar bulunmasına rağmen bitkilerin bireysel bazda ne kadar karbon tuttuğu ile ilgili daha derin araştırmalara ihtiyaç bulunmaktadır. Hükümetler arası İklim Değişikliği Paneli (IPCC) kılavuzları orman ekosistemlerinde karbon yutaklarının tahmini için yıllık hacimsel büyüme, biyokütle dönüşümü, genişleme faktörü ve karbon fraksiyonuna dayalı olarak ağaçların karbon tutma hesabını tavsiye etmektedir. Bu araştırmada farklı ekosistemlerin ve bitkilerin karbon tutma kapasitelerinin belirlenmesi ve analiz edilmesinin yanında özellikle bitkilerin karbon tutma performansının belirlenmesinde kullanılan yöntemlerin analiz edilmesi amaçlanmıştır. Araştırmada doküman inceleme yöntemi ile birlikte derinlemesine yapılan literatür tarama yönteminden yararlanılmıştır. Yapılan tarama sonucunda bitkilerin karbon tutma kapasitelerinin tahmininde biyokütle yöntemi, asimilasyon/fotosentez yöntemi, girdap kovaryans yöntemi, model simülasyon yöntemi ve uzaktan algılama yöntemlerinin kullanıldığı görülmüştür. Araştırmada bu yöntemlerin üstün ve zayıf yönleri ile günümüzde kullanılabilirliği tartışılmış ve sonuçta karbon yutak alanlarının planlanması ile ilgili çeşitli öneriler getirilmiştir.
Anahtar Kelimeler: Karbon Salınımı, Yutak Alan, Bitkiler, Ekosistem

THE ROLE OF ECOSYSTEMS IN GLOBAL CLIMATE CHANGE AND ANALYSIS OF METHODS USED TO DETERMINE THE CARBON SEQUENCE CAPACITY OF PLANTS

Abstract
A comprehensive fight against global warming and climate change is needed for a sustainable world. Global warming, which causes climate change, occurs in three stages. The first stage is the emission of greenhouse gases, the second stage is the carbon footprint stage, which involves monitoring greenhouse gases, and the third stage is the planning and development of carbon sinks, which involve capturing the emitted greenhouse gases. While the primary goal is to minimize greenhouse gas emissions, monitoring the carbon footprint and planning carbon sinks are also important in the fight against global climate change. Natural or man-made areas that absorb and store carbon released into the atmosphere are defined as carbon sinks. Terrestrial ecosystems and oceans are considered two important carbon sinks. Oceans are considered the largest carbon sink globally, absorbing 39,000 Gt of the total 48,000 Gt of carbon. The remaining carbon is stored in terrestrial ecosystems. In terrestrial ecosystems, 19% of carbon is stored in plants and 81% in soil. Forest ecosystems play a significant role as sinks by removing CO_2 from the atmosphere through photosynthesis. The CO_2 removed from the atmosphere is stored in the trunks, leaves, branches, and roots of trees and other plants in forests, in the living

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and dead vegetation, and in the soil. Therefore, forest vegetation and soils serve as an important terrestrial carbon sink with the potential to absorb and store carbon dioxide from the atmosphere. Although various studies exist in the literature regarding how much carbon plants sequester using different methods, more in-depth research is needed on how much carbon individual plants sequester. The Intergovernmental Panel on Climate Change (IPCC) guidelines recommend estimating carbon sinks in forest ecosystems by calculating the carbon sequestration of trees based on annual volumetric growth, biomass conversion, expansion factor, and carbon fraction. This research aims to determine and analyze the carbon sequestration capacities of different ecosystems and plants, and specifically to identify the methods used to determine the carbon sequestration performance of plants. The research utilized a combination of document review and in-depth literature review. The review revealed that biomass method, assimilation/photosynthesis method, vortex covariance method, model simulation method, and remote sensing methods are used to estimate the carbon sequestration capacities of plants. The research discusses the strengths and weaknesses of these methods, their current applicability, and ultimately offers various suggestions regarding the planning of carbon sink areas.
Keywords: Carbon Emissions, Carbon Sink, Plants, Ecosystem

1. Giriş

Küresel ısınma ve bunun sonucu meydana gelen iklim değişikliğinin temel nedeni olarak insan faaliyetleri ve insan ihtiyaçlarının karşılanmasının doğal bir sonucu olarak gösterilmektedir. Hükümetlerarası İklim Değişikliği Paneli (IPCC) raporunda, gözlemlenen ısınmanın insan kaynaklı olduğu ve sera gazlarının atmosfere salınımından kaynaklandığı bildirilmektedir. Atmosferde sera gazı emisyonlarında meydana gelen artış, doğal sera etkisinin bozulmasına ve atmosferin ısınmasına neden olmuş ve olmaya da devam etmektedir. Kirletici gazlar olarak;

- Karbondioksit (CO_2),
- Metan gazı (CH_4),
- Nitröz Oksit (N_2O),
- Azot Oksit (NOx),
- Partikül madde (PM),
- Ozon (O_3),
- Kloroflorokarbon (CFC)
- Kükürt Dioksit (SO_2) gazları sayılmaktadır (Yolasığmaz ve ark., 2016; Kanat ve Keskin, 2018; Birpınar, 2022).

Karbondioksit (CO_2) atmosfere salınan sera gazları içerisinde en büyük orana ve etkiye sahiptir (Birpınar, 2022; Dong ve ark., 2024). Atmosferdeki küresel ortalama CO_2 konsantrasyonunun 419,3 ppme ulaştığı ve bir önceki yıla göre %1,1, sanayi devrimine göre ise %51 artış gösterdiği belirlenmiştir. Güncel rakamlarla 2023 yılında 420.52 ppm olan CO_2 değeri, 2024 yılında 423.43 ppm olarak kaydedilmiştir (Kayar ve ark., 2022). Her yıl atmosferde yaklaşık 2 ppmlik artış söz konusudur. Ayrıca gazlar içerisinde küresel ısınmaya en fazla karbondioksit (%50) neden olurken onu kloroflorokarbon (%22) ve metan (%13) gazları takip etmektedir (Demir, 2009; Kanat ve Keskin, 2018). Çeşitli nedenlerle sera gazlarının atmosfere salınımının artışı küresel ısınma ile açıklanmaktadır. IPCC raporları, küresel sıcaklık artışının sanayi devrimine göre 1,2 °C'nin üzerine çıkmasıyla birlikte küresel ısınmanın ortaya koyduğu olumsuz etkilerin hızlandığını vurgulamaktadır. Kuraklık, sel ve sıcak hava dalgalarının daha sık ve şiddetli etkileri hassas ekosistemler ve nüfuslar üzerinde orantısız biçimde etkisini göstermektedir. Yükselen deniz seviyeleri, şehirlerin biyoçeşitliliğin azalması, ormansızlaşma, arazi bozulmaları, hava kirliliği, vb. olumsuzluklar 1,5 kat daha fazla görünür hale gelerek insan hayatını daha fazla etkilemektedir (Fatimah ve ark., 2024). Özellikle atmosferde yaşanan olumsuzluklar hassas ve kırılgan kentsel ekosistemler üzerine etki etmektedir. Bu nedenle küresel sıcaklıklar artmaya devam ettikçe biyokütle üretimi ve sürdürülebilir arazi yönetimi uygulamaları ile karbon birikimi daha acil hale gelmektedir. Birleşmiş Milletler, Paris İklim Anlaşmasında öngörülen sıcaklık artışı sınır değerinin 1,5 °C'nin altında tutulabilmesi için küresel emisyonların 2030 yılına kadar %45 oranında azaltılması gerektiğini, bunun için çeşitli stratejilerin ve eylemlerin daha hızlı bir şekilde uygulanması gerektiği üzerinde durmaktadır (Birpınar, 2022; Fatimah ve ark., 2024).

İklim değişikliği ile mücadelede Birleşmiş Milletler İklim Değişikliği Çerçeve Sözleşmesinin (BMİDÇS)'ne taraf olan ülkeler her yıl "Ulusal Sera Gazı Envanterleri" hazırlamakla yükümlü tutulmuştur (Yolasığmaz ve ark., 2016). Ülkelerin emisyon oranları nüfusları ile kıyaslandığında sanayisi gelişmiş ya da fosil yakıtlara bağımlı üretim yapan ancak nüfusu düşük ülkeler üst sıralarda yer aldığı görülmüştür. Ülkelerin emisyon oranlarında; Katar (%39,7), Kuveyt (%24,4), Birleşik Arap Emirlikleri (%21,8), Avustralya (%18,6), ABD

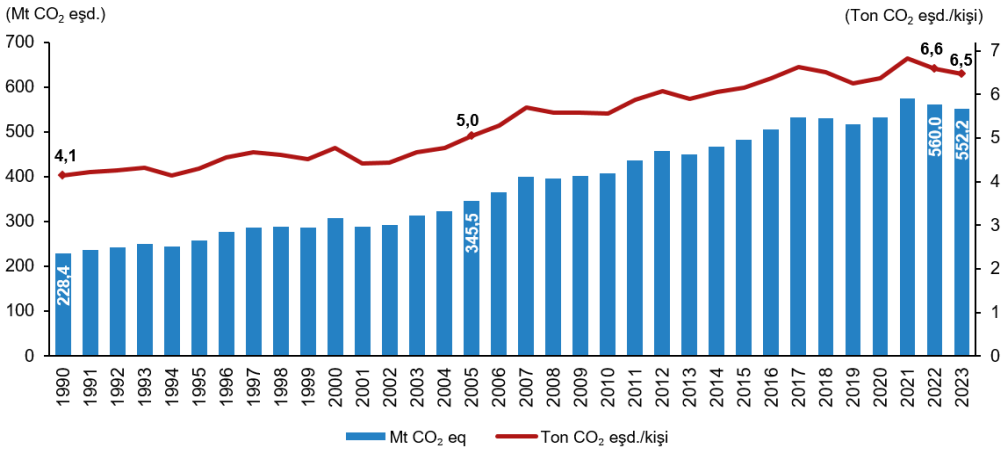
(%16,1), Kanada (%15,5), Japonya (%9,9) Almanya (%9,6) ve Çin (%7,7) en yüksek emisyon değerleri ile göze çarpmaktadır. 1850-2018 yılları CO_2 salınımında en fazla payı olan ülkeler ise sırasıyla Amerika, Çin, Rusya, Almanya, İngiltere ve Japonya olarak belirlenmiştir (Anonim, 2021). Ülkelerin 1990-2021 yılları arası kişi başı CO_2 salınım envanterleri incelendiğinde birçok ülkenin salınım miktarında azalma görülmesine rağmen bu hedefe (%45 azaltım) tam olarak yaklaşıldığı söylenemez. Bazı ülkelerin 1990, 2000, 2010 ve 2021 yılları emisyon değerleri aşağıda tabloda verilmiştir.

Tablo 1. Ülkelerin kişi başı yıllık toplam sera gazı emisyon değerleri, ton (Anonim, 2024).

ÜLKELER	**1990**	**2000**	**2010**	**2021**	**1990-2021 Arası Değişim**
Brezilya	8,29	7,07	7,74	4,06	-104,19
Kanada	18,11	19,48	25,03	14,95	-21,14
Çin	1,61	2,36	6,06	7,6	78,82
Fransa	5,7	5,73	4,34	3,47	-64,27
Almanya	11,61	9,7	9,75	7,45	-55,84
Hindistan	0,39	0,68	1,33	1,73	77,46
İran	3,07	4,86	6,53	8,56	64,14
Japonya	8,18	8,7	8,24	7,92	-3,28
Pakistan	0,58	0,69	0,74	0,92	36,96
Katar	28,53	44,58	37,8	35,69	20,06
Rusya	12,24	8,26	6,09	8,24	-48,54
S. Arabistan	16,1	15,43	18,6	17,41	7,52
Türkiye	2,18	3,05	3,48	4,95	55,96
İngiltere	10,02	9,21	7,9	5,04	-98,81
ABD	17,77	19,02	16,16	13,21	-34,52
TOPLAM	**144,38**	**158,82**	**159,79**	**141,2**	**-2,25**

Ülkelerin 1990-2021 yılları arası kişi başı CO_2 salınım miktarları ABD'de 17,77 tondan 13,21 tona, Rusya'da 12,24 tondan, 8,40 tona, Almanya'da 11,61 tondan 7,45 tona, İngiltere'de 10,02 tondan 5,04 tona, Japonya'da 8,18 tondan 7,92 tona ve Fransa'da 5,70 tondan 3,47 tona azalma meydana gelmiştir. Diğer taraftan incelenen ülkeler içerisinde Çin'de %78,82, Hindistan'da %77,46, İran'da %64,14, Pakistan'da %36,96, Katar'da %20,06, Türkiye'de %55,96 ve Sudi Arabistan'da %7,52 lik artış meydana gelmiştir. 15 ülkenin toplamında da %2,25'lik düşüşle global hedefin çok uzağında bir azalış meydana gelmiştir. Avrupa devletlerinin diğer büyük devletlere göre CO2 salınım miktarlarını azaltmada daha başarılı oldukları görülmüştür (Anonim, 2024).

Ülkemizde sera gazı emisyon istatistikleri Türkiye İstatistik Kurumu (TUİK) tarafından tutulmaktadır. TUİK verilerine göre Türkiye'de toplam sera gazı emisyonu 2022 yılında bir önceki yıla göre %2,4 azalarak 558,3 milyon ton (Mt) CO2 eşdeğeri olarak hesaplanmıştır. Kişi başı toplam sera gazı emisyonu 1990 yılında 4,1 ton CO_2 eşd., 2021 yılında 6,8 ton CO_2 eşd. ve 2022 yılında 6,6 ton CO_2 eşd. olarak verilmiştir. Ayrıca toplam sera gazı emisyonlarında 2022 yılında CO_2 eşd. olarak en büyük payın %71,8 ile enerji kaynaklı emisyonlardan kaynaklanırken, bunu sırasıyla %12,8 ile tarım sektörü, %12,5 ile endüstriyel işlemler ve ürün kullanımı kaynaklı ve %2,9 ile atık sektörü kaynaklı olduğu bildirilmektedir. Şekil 1'de Türkiye'de 1990-2022 yılları arası toplam ve kişi başı sera gazı emisyonu değişimleri verilmiştir (TÜİK, 2024).



Şekil 1. Türkiye'de 1990-2022 yılları arası toplam ve kişi başı sera gazı emisyonu değişimleri (TUİK, 2025)

İklim değişikliği sorununa neden olan küresel ısınmayı üç aşamalı olarak ele almak mümkündür. Birinci aşama sera gazlarının salınımı aşaması, ikinci aşama sera gazlarının izlenmesini içeren karbon ayak izi aşaması ve üçüncü aşama ise salınan sera gazlarının tutulmasını içeren karbon yutak alanlarının planlanması ve geliştirilmesi aşamasıdır. Dünya'da iklim değişikliğinin olumsuz etkilerinin görülmesi ile başlayan endişeler toplam sera gazı miktarının hesaplanmasına yönelik çabaları da beraberinde getirmiştir. Atmosfere çok sayıda sera gazı salınmasına rağmen pratikte en yüksek orana ve etkiye sahip sera gazının karbondioksit olduğu istatistiklere yansımaktadır. Nordhaus (1991)'e göre fosil yakıtlar ve ormansızlaşmanın neden olduğu CO2 %53,2, biyolojik ve tarımsal faaliyetler nedenli metan gazı %17,3, endüstriyel üretim kaynaklı kloroflorakarbon %21,4 ve enerji ile gübre kullanım kaynaklı azot oksitler %8,1oranında etkiye sahiptir (Nordhaus, 1991; Yolasığmaz ve ark., 2016).

İkinci aşama olan karbon ayak izi, sektörel faaliyetlerin sebep olduğu veya bir ürünün oluşum sürecinde biriken toplam karbondioksit (CO2) emisyon miktarının bir ölçüsü olarak tanımlanmaktadır (Wiedmann ve Minx, 2008). Günlük hayatın devamı için fosil yakıtların yanması ile yayılan karbondioksit miktarı olarak da ifade edilmektedir. Dolayısıyla fosil yakıtların sıklıkla kullanıldığı alanlarda enerjiye bağlı bir şekilde karbon ayak izi de artmaktadır. Üçüncü aşama atmosfere salınan sera gazlarının insanlara ve çevreye olan zararlarını azaltma ve ekonomik yarar haline getirme çabası olarak değerlendirilen karbon yutak alanlarının planlanması aşamasıdır. Atmosferden karbonu çekip tutan mekanizmaya "proses", ortama ise "yutak" adı verilmektedir (Serengil, 2018). Karbonu yutarak depolayan doğal veya insan yapımı alanlar karbon yutak alanı olarak tanımlanmaktadır (Anonim, 2025). Dünya genelinde okyanus ve su alanları, doğal ormanlar ve toprak yüzeyler; doğal karbon yutak alanlarını, insanlar eliyle oluşturulmuş açık-yeşil alanlar, tarım alanları ve ormanlar ise insan yapımı karbon yutak alanlarını oluşturmaktadır (Üreden ve Özden, 2018). Yeryüzünde karbonu tutma bakımından iki önemli yutak bulunmaktadır. Bunlar karasal ekosistemler ve okyanuslardır. Küresel ölçekte en büyük karbon havuzu okyanuslar (Toplam 48.000 Gt karbonun 39.000 Gt'lik kısmı) olmasına rağmen insan kontrolünde olması açısından karasal ekosistemler en önemli yutaklardır (Serengil, 2018).

Karasal ekosistemlerde karbonun % 19'u bitkilerde, % 81'i toprakta depolanmaktadır (Tuğluer, 2019; Kayar ve ark., 2022; Tuğluer ve Oğuz, 2022). Yine karasal ekosistemlerde en önemli yutak alanı olarak ormanlar kabul edilmektedir (Roxburgh ve ark., 2005; Thomas ve ark., 2007; Kaul ve ark., 2010; Khadanga ve Jayakumar, 2020; Riviere ve Caurla, 2021, Kayar ve ark., 2022; Lai ve ark., 2024; Anonim, 2025). 4,1 milyar hektarlık (ha) bir alanı kaplayan ormanlar toprak üstü karasal karbonunun %80'ini ve toprak altı karasal karbonun yaklaşık %40'ını tutmaktadır (Khadanga ve Jayakumar, 2020). Orman ekosistemleri, atmosferden CO_2'i fotosentez süreci ile uzaklaştırarak, önemli ölçüde yutak görevi üstlenmektedir (Lai ve ark., 2024). Atmosferden uzaklaştırılan CO_2, ormanlarda yer alan ağaçların ve diğer bitkilerin gövde yaprak, dal ve köklerinde, diri ve ölü örtüde ve toprakta karbon olarak depolanmaktadır (Anonim, 2025). Dolayısıyla orman bitki örtüsü ve toprakları, atmosferdeki karbondioksiti (CO_2) emme ve depolama potansiyeline sahip önemli bir karasal karbon havuzu görevi üstlenmektedir. Ormanlarda karbonun yaklaşık % 31'i biyokütlede, % 69'u toprakta depolanır (Tuğluer ve Oğuz, 2022). Orman ekosistemlerinin dışında kalan toprak, mera ve çayır ekosistemleri, sulak alanlar gibi diğer karasal ve sucul ekosistemler de karbon depolayarak karbon döngüsünde rol almaktadır. Özellikle sulak alanlar çok önemli yutak alanı olarak büyük oranda karbon tutmaktadır (Wang

ve ark., 2024; Sarıyıldız ve Tanı, 2024). Sulak alanlar tatlı su yüzeylerinin yalnızca %6-8'ini kaplamasına rağmen, küresel organik toprak karbon stokunun üçte birini tuttukları tahmin edilmektedir (Wang ve ark., 2024). Ağaçlar büyüdükçe, öldükçe ve çürüdükçe CO2 kaynağı ve yutak dinamikleri bozulmaya başlar ve görev yapamaz hale gelir. Bu durum orman yönetiminde bazı tedbirlerin alınmasını gerektirmektedir (Kaul ve ark., 2011).

Büyük ölçüde fosil yakıtların yakılması, ormansızlaşma ve endüstriyel faaliyetler nedeniyle insan kaynaklı karbon emisyonlarında süregelen artış, karbon tutulumunu artıran uygulamaların aciliyetini artırmıştır. Orman ekosistemleri, özellikle de bozulmamış olanlar, atmosferik karbonun yakalanması ve depolanmasında çok önemli bir rol oynamakta ve iklim değişikliğine karşı doğal bir savunma sağlamaktadır. Bitkiler karbonu fotosentez yoluyla tutmakta, kısmı solunum yoluyla atmosfere geri dönmekte, geri kalanı ise ayrışma süreçleri yoluyla toprak organik maddesi olarak depolanmaktadır. Ormanlar, sulak alanlar ve yeşil alanlar da dâhil olmak üzere kentsel ekosistemler bu bağlamda kritik öneme sahiptir. Sadece karbon depolamakla kalmaz, aynı zamanda biyoçeşitliliğe ve insan refahına fayda sağlayan değerli ekosistem hizmetleri de sunarlar. Kent ormancılığı, hızlı kentleşme ve sanayileşmenin doğal peyzajları büyük ölçüde değiştirdiği şehirlerde karbon birikimini artırmak için güçlü bir araç olarak ortaya çıkmıştır (Fatimah ve ark., 2024). Bu nedenle özellikle kentlerde karbon tutma yetisi yüksek olan alanların planlanması gerekmektedir. Bunun için bitkilerin bireysel bazda ne kadar karbon tuttuklarının belirlenerek planlamaya dâhil edilmesi önem arz etmektedir. Araştırmada bitkilerin karbon tutma kapasitelerinin belirlenmesine yönelik kullanılan yöntemlerin incelenmesi, yapılan bilimsel araştırma sonuçlarının analiz edilmesi ve bireysel bazda bitki karbon tutma kapasiteni belirlemek için en uygun yöntemin tespiti amaçlanmıştır.

2. Yöntem

Araştırmada veri toplama, analiz ve senteze dayalı sonuç belirleme yöntemleri kullanılmış ve temel olarak tarama yöntemi kullanılmıştır. Belge tarama yöntemi için iklim değişikliği, küresel ısınma ve sera gazı salınımı gibi anahtar kelimelerini içeren tüm ulusal ve uluslararası raporlar, web sayfaları ve yasal mevzuat incelenmiştir. Bu kapsamda IPCC raporları, COP raporları, Kyoto Protokolü, Paris Anlaşması gibi uluslararası sözleşmeler ile ulusal bazda Türkiye İklim Değişikliği Strateji Belgesi (2010-2023) ve İklim Değişikliği Azaltım Stratejisi ve Eylem Planı (2024-2030) belgeleri gözden geçirilmiştir. Ayrıca Çevre, Şehircilik ve İklim Değişikliği Bakanlığı'na bağlı "İklim Değişikliği Başkanlığı" resmi internet sitesi ve faaliyet raporları ile Türkiye'nin 2053 Net Sıfır Emisyon Hedefleri incelenmiştir. Ülkelerin sera gazı emisyon raporları ile TUİK'in "Türkiye 1990-2022 Sera Gazı Emisyon İstatistikleri" de tetkik edilmiştir.

Bilimsel metin ve araştırma taramasında karbon tutma, yutak, karbon ayak izi, …gibi anahtar kelimeler ile Google scholar, Web of science, Scopus, Ebsco, Tr dizin gibi veri tabanları taranmıştır. Ulaşılan literatürler alan ve yöntem bazlı kategorilere ayrılmış ve bitkilerin karbon tutma yetenekleri ile ilgili yapılan bilimsel araştırmalar sınıflandırılmıştır. Belirlenen yöntemlerin üstünlük ve zayıf yönleri ve günümüz için kullanılıp kullanılamayacağı analiz edilmiştir.

3. Bulgular

Yapılan literatür taraması sonucunda araştırmalarda bitkilerin karbon tutma kapasitesini ölçmek için biyokütle yöntemi, asimilasyon/fotosentez yöntemi, girdap kovaryans yöntemi, model simülasyon yöntemi ve uzaktan algılama yöntemlerinin kullanıldığı görülmüştür. Belirlenen bu yöntemler analiz edilmiş, üstünlük ve zayıf yönleri belirlenmiştir.

3.1. Biyokütle yöntemi

Dünyada ve Türkiye'de orman ekosistemlerinin karbon birikiminin hesaplanması konusunda birçok araştırma yapılmış ve farklı yöntemler kullanılmıştır. IPCC kılavuzuna paralel olarak ağaç biyokütlesinde biriken karbon miktarlarının hesaplanarak ormanlarda ki toplam karbon miktarının tahmin edilmesi yöntemi en yaygın olarak kullanılan yöntemdir. Bu yöntemde ülkelerin enlem derecesine bağlı olarak iğne yapraklı ve geniş yapraklı ağaçlar için belirlenen katsayılar kullanılarak ormanlar için tahmini karbon stokları hesaplanmaktadır. Karbon hesaplama yöntemlerinin en yaygını biyokütlede biriken karbon miktarından yola çıkarak, ormanlardaki toplam karbon birikiminin hesaplanmasıdır. Hesaplamada ulusal orman envanteri temel alınarak ormanlardaki karbon birikimi ve bilançosu, orman alanları üzerindeki bitkisel kütlenin ağaç türleri itibari ile dağılımını ve bunların fırın kurusu maddeye dönüştürülmüş miktarlarına dayanılarak hesaplama yapılmaktadır.

Karbon hesaplamalarında genellikle izlenen iki yoldan birisi, karbon kazanç-kayıp farkına dayanan karbon stok değişimi yöntemidir. Birim alandaki karbon tutulma miktarı, yaşayan canlı biyokütlede, ölü organik

maddede ve toprakta olan yıllık değişimlere göre karbon stokları toplamı hesaplanmaktadır (IPCC, 2006; Erkan, 2022). Biyokütle tahmininde üç farklı örnekleme yöntemi kullanılmaktadır. Bu yöntemler şunlardır: birim alan yöntemi, orta ağaç yöntemi, regresyon yöntemidir. Birim alan yöntemi belirlenen alanda ki tüm ağaçlar kesilerek kök, gövde, dal, yaprak ve kabuklar ayrılarak yaş ağırlıkları, kuru ağırlıkları ve toplam ağırlıklar belirlenir. Elde edilen sonuçlar hektar cinsine çevrilir ve meşçereyle ilgili biyokütle değerleri elde edilir. Orta ağaç yönteminde: alan içerisinden örnek alanları temsilen bir orta ağaç kesilerek bu ağaca yönelik biyokütle hesaplanır. Elde edilen sonuçlar alandaki ağaç sayısı ile çarpılarak alanın biyokütlesi belirlenir. Regrasyon yönteminde ise birden fazla ağaçtan alınacak ölçüler ile regrasyon denklemleri oluşturulur. Oluşturulan bu denklemler ile bitkinin biyokütlesi tahmin edilmektedir. Değişken olarak göğüs çapı ve boy gibi kolaylıkla ölçülebilen bölümleri alınmaktadır. Regrasyon denklemleri ağacın bileşenleri veya ağacın tamamı için oluşturulabilmektedir. Biyokütle ile ağacın karbon tutma yeteneğinin belirlenmesinde en yaygın ve güvenilir yöntem olarak dünya genelinde regresyon yöntemi kullanılmaktadır (Erkan, 2022; Kanlı, 2022).
Biyokütle yöntemi ağaçların allometrik büyüme denklemi ve buna karşılık gelen karbon içeriği yolu ile karbon depolama miktarının hesaplanması olup bitki büyüme endekslerine dayalı olarak biyokütle genişleme faktörü ve ağaçların temel odun yoğunluğuna göre hesaplanmaktadır. Ağaç allometrik veri tabanları ve i-tree gibi uygulamaların çoğu ABD ve Avrupa Birliği orjinli olmasından dolayı bazı ülkeler için pratik uygulamalardan uzaktır (Jin ve ark., 2023). Biyokütlede karbon depolanmasını artırmaya yönelik yönetim uygulamaları;
1) Yeni ormanlık alanların kurulması,
2) Mevcut ağaç meşcerelerinin yaşının artırılması,
3) Odun ürünleri ve odun atıklarındaki karbonun artırılması,
4) Ağaçlarda depolanan karbon kaybının azaltılması olarak gösterilmektedir (Plieninger, 2011).

3.2. Uzaktan algılama yöntemi

Uzaktan algılama yöntemi ile bitkilerin karbon tutma kapasitelerinin belirlenmesi yöntemi temelde biyokütle yöntemi ile paralellik göstermektedir. Daha geniş alanlarda veri elde etmek için kullanılan pratik ve uygun maliyetli bir yöntemdir. Geleneksel saha envanteri yöntemlerine göre oldukça avantajlıdır. Uzaktan algılama biyokütleyi doğrudan ölçme yeteneği olmamasına karşılık bitki örtüsü yapısı (taç boyutu ve ağaç yoğunluğu), dokusu ve yer üstü biyokütle ile ilişkisini belirleme yeteneğine sahiptir (Akpınar, 2022). Uzaktan algılama yöntemi, ayrıca sınırlı veri kullanılabilirliği veya erişilebilirliği olan geniş alanlarda arazi örtüsündeki değişiklikleri gözlemlemek için kullanılmaktadır. Arazi verisinin eksik olduğu alanlarda, karbon depolanmasını tahmin etmek için deneysel varsayımlara dayanan küresel değerler, yerel karbon stoklarının basitleştirilmiş tahminlerinde kullanılmaktadır (Gülçin, 2021).
Uzaktan algılama alanındaki gelişmeler, orman biyokütlesinin tahmini için yeni ve etkin bir yol açmıştır. Uzaktan algılama teknikleri sayesinde üretilen görüntülerin yorumlanması ve bu görüntülerden bilgi elde edilmesi amacı ile gerçekleştirilen piksel tabanlı ve nesne tabanlı (segmentasyon) görüntü sınıflandırma teknikleri, arazide ölçüm gibi yaklaşımlara göre daha hızlı ve pratik sonuçlar vermektedir. Üretilen veriler, düşünsel değil, farklı teknikler kullanılarak elde edilen yer yüzeyini ölçmeye dayalı bilgiler olduğundan bilgisayar destekli konumsal bilgi işleme, depolama ve arşivleme sistemi olan CBS için önemli bir veri kaynağı göstermektedir. Uzaktan algılama ile çok kısa zaman aralıklarında ve çok geniş arazi parçaları hakkında veri elde edilebilir. Geniş alanlarla ilgili bilgiler, CBS ortamına aktarıldığında analiz edilebilir ve diğer verilerle birleştirilebilir. Uzaktan algılama görüntülerinden elde edilen veriler ile arazi ölçümlerinin ve jeoistatistik enterpolasyon tekniklerinin birleştirilmesi orman biyokütle kaynaklarının daha yüksek doğrulukla haritalanmasını sağlar. Ülkemizin de üyesi olduğu Avrupa Çevre Ajansı, CORINE Programı kapsamında, tüm Avrupa için uydu görüntüleri üzerinden bilgisayar destekli görsel yorumlama yöntemi ile arazi sınıflandırması ile arazi örtüsü / kullanımı verisi üretilmektedir (Aydın-Kandemir ve Sarptaş, 2022).
Biyokütle tahmini için uzaktan algılama teknolojileri optik sistemler, RADAR ve LİDAR sistemler olmak üzere üç grupta toplanmaktadır (Akpınar, 2022). Son zamanlarda, LİDAR uzaktan algılama, bitki örtüsünün dikey yapısını ve yüksekliğini karakterize etmek ve yer üstü biyokütleyi çıkarmak için başarıyla kullanılmıştır. LiDAR, orman örtüsüne nüfuz ederek taç yüksekliği, taç örtüsü ve taç yapısı gibi üç boyutlu orman parametrelerini doğrudan ölçebilen aktif bir uzaktan algılama teknolojisidir. RADAR (Radio Detection and Ranging) ve LiDAR (Light Detection and Ranging) gibi aktif uzaktan algılama teknolojileri, biyokütle ve karbon tahmininde pasif optik teknolojilere göre önemli avantajlar sunmaktadır. Bu teknolojiler orman örtüsünü daha derinlemesine nüfuz ederek, orman yapısı hakkında daha fazla bilgi toplanmasını sağlar. RADAR sistemleri bulut örtüsünden bağımsız veri toplayabilme özelliğiyle öne çıkmakta; ancak yoğun orman

örtüsünün hâkim olduğu ekosistemlerdeki karbon tahmininde küresel sensör mevcudiyetinin yetersiz olması gibi belirli sınırlılıklar taşımaktadır (Demirel, 2025).

3.3. Fotosentez yöntemi

Bu yöntem bitki yapraklarının net fotosentez oranını ölçme esasına dayanmaktadır. Elde edilen ölçümler bir asimilasyon formülü kullanarak karbon tutulumunu hesaplar (Wang ve ark., 2021). Bitkiler atmosferden CO2 yi yalnızca fotosentez yoluyla absorbe eder. Asimilasyon yöntemi tek tek bitki üzerinden ölçümlere dayalı elde edilmesi nedeniyle diğer yöntemlere göre daha doğru sonuçlar verir ve kentsel yeşil alan bitkilerinin karbon yutağı hesaplamalarında sıklıkla kullanılır. Ancak ölçümler esnasında cihazların dış çevre şartlarından etkilenmeleri nedeniyle zor ve zaman alıcıdır (Dong ve ark., 2024).

Biyokütle yöntemiyle karşılaştırıldığında, asimilasyon yöntemi teorik olarak daha doğru sonuçlar verebilir, çünkü tutulan karbon, fotosentezden elde edilen karbon ile solunum yoluyla kaybedilen karbon arasındaki farktır. Daha yüksek karbon depolama ve tutma oranlarına sahip ağaçlar aynı zamanda daha yüksek net fotosentetik kapasitelere de sahiptir. Fotosentetik oranlar, dış çevresel faktörlerden etkilenen düzenli döngüsel değişimler gösterir ve tutarlı hava koşulları altında saatlik, emek yoğun ölçümler gerektirir.

Çeşitli ve geniş bir alana yayılmış kentsel yeşil alanlar için entegrasyon yöntemi önemli zorluklar içermektedir. Fotosentez oranları, iç fizyolojik ve ekolojik özelliklerin yanı sıra dış çevresel faktörlerden de etkilenir. Son çalışmalar, fotosentez oranlarını dolaylı olarak tahmin etmek için bu faktörler arasındaki içsel ilişkileri araştırmıştır (Chen 2020; Knyazikhin ve ark. 2012). Işık yoğunluğunun, özellikle fotosentetik olarak aktif radyasyonun (PAR), bitki fotosentez oranındaki değişiklikleri etkileyen birincil faktör olduğunu göstermektedir. Net fotosentez-ışık tepki eğrisi, sabit çevresel koşullar altında değişen PAR yoğunluğu ile fotosentez oranındaki değişimi tanımlar ve esasen PAR ile net fotosentez oranı arasındaki tek faktörlü ilişkiyi modeller. Bitkilere ait fotosentez değerler Han (2005), Zhang ve ark. (2013), Jin ve ark. (2023), tarafından geliştirilen formüller kullanılarak bitkilerin net karbon tutma değeri hesaplanır. Formüllerde istenilen değerler taşınabilir fotosentez sistemleri ile ölçülebilir. Ayrıca bu amaçla bitkilerin yaprak alan indekslerinin de hesaplanması gerekmektedir.

3.4. Eddy kovaryans yöntemi

Geniş bir alan üzerinden atmosfer ve toprak yüzeyi arasındaki enerji ve gaz transferinin (karbondioksit, su buharı, metan) doğru ve tahribahsız bir şekilde ölçülme metodudur. Eddy kovaryans (Eddy Covariance, EC) yöntemi, bitkilerde ve geniş ekosistemlerde gaz değişimini ölçmek için kullanılan bir tekniktir ve ekosistem bilimlerinde çok yaygın olarak kullanılır. Bu yöntem, ekosistemlerin karbon, su buharı ve enerji akışlarını doğrudan izler. Geliştirilen cihaz yardımı ile bitkilerin atmosfere ne kadar CO_2 saldığı veya ne kadarını tuttuğunu sürekli izlemektedir. Şekil 2'de bu amaçla geliştirlen cihaz görseli verilmektedir.



Şekil 2. Eddy kovaryans sistemi için geliştirilen cihaz

Düz, yatay olarak homojen bir yüzey ile üzerindeki atmosfer arasındaki ısı, kütle ve momentum alışverişini ölçmek için kullanılan girdap kovaryans yöntemi Montgomery (1948), Swinbank (1951) ve Obukhov (1951) tarafından önerilmiştir. Yüzey ile atmosfer arasındaki net taşıma tek boyutludur ve dikey akış yoğunluğu, dikey rüzgarın türbülanslı dalgalanmaları ile ilgilenilen nicelik arasındaki kovaryans ile hesaplanabilir. Girdap kovaryans tekniği, ekosistem ölçeğinde hem karbon hem de suyun dikey akışlarını ölçtüğü için, sıralı tarım sistemlerinin karbon ve su dinamiklerini nicelleştirmede oldukça uygun görünmektedir. Bu teknik, uzun yıllardır birçok ekosistemin karbon dengesini değerlendirmek için kullanılmaktadır. Ara sıra tarım yapılan alanlardaki ağaç örtüsü yüksekliklerindeki ve pürüzlülükteki yapısal farklılıklar, karmaşık hava akışı modellerine yol açabilir ve bu da bir noktada ölçülen akışları etkilemektedir. Ayrıca, iki ağaç örtüsü tipi arasındaki sıcaklık farklarıyla ilişkili adveksiyon ölçüm noktasında sürekli yukarı veya aşağı yönlü hava akışlarına neden olabilir ve bu da o noktada ölçülen akışları etkilemesi olasıdır. Girdap kovaryans tekniği genellikle nispeten homojen bitki örtüsüne sahip arazilerde uygulanır. Bununla birlikte, 'kuşak ve koridor' alanlar için bitki örtüsü açıkça homojen değildir ve düzenli ağaç kuşaklarının varlığı, özellikle kuşaklar boyunca rüzgar yönleri için karmaşık akış modellerine neden olabilir (Warda ve ark., 2012).

Girdap kovaryans tekniği, dikey rüzgar hızı ve CO2 karışım oranındaki dalgalanmalar arasındaki kovaryansı ölçerek, atmosfer ile bitki örtüsü arasındaki arayüzde CO2 değişim oranını belirler. Son on yılda, girdap kovaryans yöntemi, karasal ekosistemler ile atmosfer arasında bir yıl ve daha uzun süre boyunca karbondioksit akışlarını değerlendirmek için önemli bir araç olarak ortaya çıkmıştır. Girdap kovaryans yöntemi, atmosferik koşullar (rüzgar, sıcaklık, nem, CO2) sabit olduğunda, altta yatan bitki örtüsü homojen olmadığında ve rüzgar yönünde uzun bir mesafe boyunca düz bir arazide bulunduğunda en doğru sonucu verir. Girdap kovaryans yöntemi doğal ve karmaşık peyzajlarda veya zamanla değişen atmosferik koşullar altında uygulandığında, biyosfer ve atmosfer arasındaki CO2 değişiminin nicelleştirilmesi, atmosferik depolama, akı ıraksaması ve adveksiyon ölçümlerini içermelidir. CO2 akı ölçümlerinin uzun süreler (günlerden yıllara) boyunca ortalaması, rastgele örnekleme hatasını nispeten küçük değerlere düşürür. Ancak uzun veri kayıtları oluşturulurken veri boşlukları kaçınılmazdır. Veri boşlukları genellikle, CO2 değişiminin günlük ve yıllık toplamlarını üretmek için istatistiksel ve ampirik modellerden elde edilen değerlerle doldurulur. Öte yandan, rüzgarların hafif ve aralıklı olduğu gece saatlerinde akı ölçüm hataları sapma gösterebilir. Gece saatlerindeki sapma hataları, ekosistem solunumunun ölçümünde genellikle düşük tahminlere yol açar (Baldosshi, 2003).

3.5. Model similasyon yöntemi

[Model simülasyonu (ya da modelleme ve simülasyon), gerçek dünyadaki bir sistemi, süreci ya da olayı matematiksel ya da bilgisayar tabanlı modeller kullanarak taklit etme yöntemidir. Bu tür bir yaklaşım,

karmaşık olayları ya da sistemleri anlamamıza, tahminler yapmamıza ve bu sistemleri kontrol etmemize yardımcı olur. Ekosistemlerin nasıl çalıştığını anlamak için modelleme yapılabilir. Geliştirilen model simülasyonu kullanarak bitkilerin ne kadar karbon tuttuğunu hesaplamak mümkündür. Esasen bu yöntem yukarıda açıklanan biyokütle, fotosentez ve eddy kovaryans yöntemlerinde kullanılan verilerin bir system veya bir simülasyon yardımıyla gelecekle ilgili tahmin yapmaya yardımcı olmaktadır. Model simülasyonları ile bitkilerin karbon tutma kapasitesini hesaplamak, tarım stratejilerinin geliştirilmesi, ekosistem yönetimi, iklim değişikliği senaryoları gibi birçok alanda önemlidir. Özellikle, iklim değişikliği ile mücadelede karbon yutaklarının ne kadar önemli olduğu göz önüne alındığında, bu tür simülasyonlar gelecekteki karbon denklemi açısından kritik rol oynamaktadır.

Model similasyon yöntemine DAYCENT modeli örnek gösterilebilir. Bu model, toprak karbon döngüsünü modellemek için kullanılır. Bitkilerin karbon alımı ve toprakta depolanan karbon miktarlarını tahmin etmek için çevresel faktörlerle birleştirilmiş bir simülasyondur. DAYCENT, CENTURY biyokimyasal modelinin günlük zaman adımlı versiyonudur. Atmosfer, bitki örtüsü ve toprak arasında C ve N akışlarını simüle eder. Farklı toprak organik madde havuzları arasındaki C ve N akışları, havuzların büyüklüğü, C/N oranı ve malzemenin lignin içeriği ile abiyotik su/sıcaklık faktörleri tarafından kontrol edilir. Model, günlük maksimum/minimum hava sıcaklığı ve yağış, yüzey toprağı doku sınıfı ve arazi örtüsü/kullanım verileri (örneğin, bitki örtüsü tipi, ekim/dikim programları, besin takviyelerinin miktarı ve zamanlaması) gibi girdi verilerini kullanmakta, günlük N-gaz akışı (N2O, NOx, N2), heterotrofik toprak solunumundan kaynaklanan CO2 akışı, toprak organik C ve N, NPP, H2O ve NO3 sızıntısı ve diğer ekosistem parametreleri gibi veriler üretilmektedir. Modelde yapılan son iyileştirmeler ile NPP, toprak organik karbonu, N2O emisyonları ve NO3 sızıntısını simüle etme yeteneği, çeşitli doğal ve yönetilen sistemlerden elde edilen veriler test edilebilmektedir (URL; 2025).

Araştırmalarda ağaçların biyokütlesini temel alarak çeşitli similasyon ve programlar da geliştirilmiştir. Kaul ve ark. (2010) tarafından geliştirilen CO2FIX ve Tuğluer (2019) tarafından geliştirilen KARBİYOSİS modülü buna örnek olarak gösterilebilir. CO2FIX meşcere seviyesi simülasyon modeli, orman biyokütlesindeki, toprak organik maddesindeki ve odun ürünleri zincirindeki karbon stoklarını ve akışlarını ölçen, esasen biyokütle birikiminin karbon tutma ve depolamaya dönüştürüldüğü bir defter tutma yaklaşımı kullanan bir araçtır. Model, karbon dengesini 1 yıllık bir zaman adımıyla hesaplamaktadır. Temel girdi gövde hacmi büyümesi ve diğer ağaç bölümlerine (yapraklar, dallar ve kökler) karşılık gelen tahsis modelleridir. Canlı biyokütlede ki karbon stokları, bir yandan büyüme (birikim) ve diğer yandan ciro, ölüm, hasat ve ayrışma arasındaki denge olarak hesaplanır. Model; biyokütle, toprak (altlık ve humus), odun ürünleri, biyoenerji ve hem finansal hem de karbon muhasebesini içeren altı ana modüle ayrılmıştır (Kaul ve ark., 2010).

KARBİYOSİS programı C# programlama dili kullanılarak geliştirilmiş ve SQL veri tabanı sistemini kullanmaktadır. Program içerisine girilen envanter verileri ve formüller SQL veri tabanında saklanmaktadır. Program, veri tabanından biyokütle ve karbon depolama hesaplama formüllerini çekerek programa girilen envanter verileriyle ilişkilendirmesiyle biyokütle ve karbon depolama miktarlarını hesaplamaktadır. KARBİYOSİS programının kullanılabilmesi ve hesaplamaların yapılabilmesi için kullanıcılar bazı verilere ihtiyaç duymaktadır. Bu veriler ağacın latince adı, yaprak tipi, gövde çapı, gövde boyu, kabuk kalınlığı, örnek alınan dal yüzdesi, örnek alınan dal yaş ağırlığı, örnek alınan yaprak yüzdesi, örnek alınan yaprak yaş ağırlığıdır. Arazi çalışmaları ile elde edilen veriler programa entegre edilerek program çalışma alanındaki ağaçların toprak üstü biyokütle ve karbon depolama miktarını hesaplayabilmektedir. Kullanıcılar kullanım kolaylığı açısından programın ara yüzünde formülleri görmemektedir. KARBİYOSİS programı toprak üstü biyokütle ve karbon depolama miktarları hesaplamalarını kolaylıkla yapabilen Türkiye'deki ilk ve tek programdır (Tuğluer, 2019).

4. Sonuç ve Öneriler

Karbon stoklarının miktarının ortaya konmasındaki en büyük belirsizliklerden birisi, bitkilerin farklı yetişme koşullarına. bağlı olarak değişen dendrometrik özelliklerini kullanarak biyokütlelerinin tahmin edilmesinde standart modellerin olmamasıdır. Bu nedenle, küresel iklim değişikliğini azaltmaya yönelik yapılan projeleri uygulamak için, sistemli olarak ağaçların ve çalıların bitki biyokütlesinin önemli bir bölümünü örnekleyecek ölçüde farklı ekosistemlerde depolanan karbon hakkında yer temelli bilgilerin toplanması çok önemlidir. Bitkilerin karbon tutma kapasitesini ölçmek için oluşturulmuş çeşitli yöntemler ve modeller bulunmaktadır. Bu yöntemler, bitkilerin atmosferden karbon dioksit (CO_2) almasını, fotosentez yaparak karbon depolamasını ve bu karbonun ne kadarının bitki dokularında ve toprakta depolandığını hesaplamaya yöneliktir

Yer üstü biyokütledeki değişimleri belirlemek amacıyla farklı ölçümler yapılmakta, hasat ve allometrik ölçekleme teknikleri kullanılmaktadır. Biyokütlede yöntemi kullanımı kolay ve ucuz olması, mekânsal olarak çoğaltılabilir ve zaman içinde tekrarlanabilir olması ve çok çeşitli arazi ve peyzajlarda uygulanabilir olması nedeniyle tercih edilmektedir. Ancak pratikte, allometrik ve ölçüm tabanlı yöntemlerin çoğaltma ve örnekleme sıklığı açısından sınırlamaları vardır. Özellikle örneklem belirlemek için hasat edilme koşulu belirli miktarda ormanın tahribine de neden olmaktadır. Bir araştırma raporuna göre, dünyanın tropikal ormanlarının allometrik ölçümlerini belirlemek için yaklaşık 2400 ağaç hasat edilmiştir (Baldocchi, 2014). Bunun yanında bu yöntem bireysel bitkilerden ziyade orman ekosistemlerinin karbon tutma kapasitelerinde daha olumlu sonuçlar vermesi yöntemin sınırlılıklarındandır. Ayrıca ağaçların allometrik veri tabanları ve i-tree gibi uygulamalarının çoğunun ABD ve Avrupa Birliği orjinli olmasından dolayı diğer ülkeler için doğru sonuçlar vermemektedir.
Eddy kovaryans yöntemi, bitkilerin ve ekosistemlerin karbon alışverişini izlemek için yaygın olarak kullanılır. Bu yöntem, atmosferdeki CO_2 akışlarını sürekli olarak ölçer ve ekosistemin karbon yutaklarını belirler. Girdap kovaryans yönteminin popülaritesi kısmen, hava ve iklimin, bitki fonksiyonel tipinin, fenolojinin, kuraklığın, bozulmanın ve arazi kullanımının karbon, su ve enerji akışları üzerindeki rollerine ilişkin acil bilimsel soruları ekolojik açıdan önemli zaman ve mekân ölçeklerinde ele alabilmesi nedeniyle hızla artmıştır (Baldocchi, 2003). Son yıllarda, geliştirilen cihazlar ile, karbon, su ve enerji akışlarının nasıl değişebileceğine ilişkin belirli soruları ele almada başarılı olmuştur: Yöntem iklimsel veya yükseklik gradyanları boyunca, farklı arazi kullanımına göre ve bitki fonksiyonel tipine ve yoğunluğuna göre sonuç alınması yöntemi üstün kılmaktadır. Ancak en büyük sınırlılığı yüksek maliyetli cihazlara gereksinim duyulması ve bitkileri bireysel bazlı ölçmekten ziyade ekosistemlerin karbon tutma yeteneğini bütün olarak ele almasıdır. Gerçek zamanlı ve sürekli veri sağlaması ve ekosistem ölçeğinde karbon değişimini doğrudan ölçmesi üstün özelliği olarak görülmekte, yüksek maliyetli ve teknik açıdan zor olması ile düşük rüzgar hızı gibi durumlarda doğru sonuçlar vermemesi olumsuz yönleri olarak değerlendirilmektedir.
Bitkilerin karbon tutma kapasitesini ölçmek için uzaktan algılama ve coğrafi bilgi sistemleri (GIS) kullanılarak yapılan yöntemler de oldukça yaygındır. Uydu görüntüleri ve hava fotoğrafları ile bitki örtüsü ve toprak özellikleri analiz edilir, bu verilerle karbon depolama kapasitesi tahmin edilir. Uydu verileri, bitkilerin büyüme durumunu ve biyokütlesini izler. Coğrafi bilgi sistemleri (GIS) ile bitki örtüsünün yayılımı ve toprak verileriyle, karbon yutaklarını modellemek mümkündür. Büyük alanları izleyebilme imkanı sağlaması ve coğrafi özelliklere göre detaylı analiz yapılabilme yetenekleri avantajlı yönleridir. Verilerin doğruluğu, kullanılan uzaktan algılama teknolojisinin kalitesine bağlı olması ve en iyi sonuçları almak için kapsamlı veri analizleri gerekli olması dezavantajlı yönleri olarak görülmektedir. Uzaktan algılama yöntemi ve model similasyon yöntemi temelde biyokütle yöntemi verileri ile çalışılmaktadır.
Bitkilerin bireysel bazda karbon tutma yeteneklerinin belirlenmesinde en etkili yöntem fotosentez yöntemi olarak görülmektedir. Yöntem her bir bitkiyi ayrı ayrı değerlendirmekte, örneklem alınacak bitkilere fiziki müdahalenin olmaması yöntemi öne çıkarmaktadır. Yöntem bitkilerin fotosentez ve asimilasyon yetenekleri ile yaprak alan indekslerinin bir formül yardımıyla hesaplanması esasına dayanmaktadır. Bitkilerin fotosentez hızlarını tahmin etmek için karbon dioksit konsantrasyonu ve ışık şiddeti gibi faktörleri kullanır. Bu model, bitkilerin karbon emilimini daha doğru bir şekilde hesaplamak için kullanılır. Karbon alımını çevresel faktörlerle doğrudan ilişkilendirilmesi ve farklı bitki türleri ve çevresel koşullar için özelleştirilebilme olanağı olumlu yönü olarak kabul edilmekle birlikte değişken çevresel koşullara sahip bölgelerde doğru sonuçlar alınamama riski en olumsuz yönüdür. Diğer bir sınırlılığı bitkileri bireysel bazlı ele alması nedeniyle yoğun emek gerektirmektedir.
Sera gazı salınımının azaltılmasında kentsel açıkyeşil alanlar önemli rol oynamaktadır. Atmosfere salınan sera gazlarının en fazla olduğu alanların kentsel alanlar olduğu bilinmektedir. Bu nedenle kentlerdeki açık-yeşil alanların kentin hava kalitesine olumlu etkisinin ve atmosferdeki sera gazı miktarının düşürülmesindeki rolünün belirlenmesi önem arz etmektedir. Bitkilerin bireysel bazda karbon tutma ve depolama yetenekleri ile ilgili daha fazla araştırma yapılmalı, özellikle fotosentez yöntemi ile bitkilerin karbon tutma kapasitelerinin belirlenmesine yönelik çalışmalara daha fazla ağırlık verilmesi gerekmektedir. Kentsel alanlarda kullanılan ağaçlarının bünyelerinde ne kadar karbon biriktirdiklerinin bilinmesi ve peyzaj çalışmalarında buna yönelik tercihlerin yapılması kent ekosistemi açısından oldukça önemlidir. Peyzaj tasarımlarında kullanılacak bitki seçiminde bitkilerin estetik özellikleri, dendrolojik özellikleri ve ekolojik gereksinimleri kadar bitkinin karbon tutma yetisi de göz önünde bulundurulmalıdır.

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ÇEVRİMİÇİ ZİYARETÇİ YORUMLARI ÜZERİNDEN KÜLTÜREL MİRAS DENEYİMİNİN ANALİZİ: VAN KALESİ ÖRNEĞİ

Bahadır İnanç Özkan[198], Ahmet Edis[199]

Özet
Kültürel miras alanları, toplumların tarihsel belleğini ve kimliğini yansıtan önemli mekânlar olmasının yanı sıra, turizm bağlamında ziyaretçi deneyimlerinin şekillendiği çok boyutlu alanlar olarak öne çıkmaktadır. Günümüzde miras alanlarına yönelik ziyaretçi algıları, yalnızca tarihsel ve estetik değerlerle sınırlı kalmamakta; mekânsal deneyim, güvenlik, erişilebilirlik ve yönetim uygulamaları gibi unsurlarla birlikte değerlendirilmektedir. Bu bağlamda çalışmanın amacı, Van Kalesi'nde ziyaretçiler tarafından deneyimlenen kültürel miras unsurlarının hangi temalar etrafında şekillendiğini ortaya koymak ve bu deneyimlerin miras yönetimi ile ziyaretçi memnuniyeti açısından güçlü ve zayıf yönlerini analiz etmektir. Araştırma nitel araştırma yaklaşımı çerçevesinde yürütülmüş ve fenomenoloji deseni benimsenmiştir. Veri kaynağını, Tripadvisor platformunda Van Kalesi'ne ilişkin yapılan ziyaretçi değerlendirmeleri oluşturmaktadır. Araştırma kapsamında 2012–2025 yılları arasında Türkçe, İngilizce ve Rusça dillerinde yazılmış toplam 219 ziyaretçi yorumu içerik analizine tabi tutulmuştur. Yabancı dildeki yorumlar araştırmacılar tarafından Türkçe'ye çevrilmiş ve tüm veriler manuel olarak analiz edilmiştir. Elde edilen veriler kodlanarak temalar ve kategoriler altında sınıflandırılmıştır. Analiz sonucunda dört ana tema belirlenmiştir: "Kültürel Mirasın Algılanması", "Mekânsal Deneyim ve Fiziksel Çevre", "Güvenlik ve Rahatlık Boyutu" ve "Koruma, Bakım ve Yönetim Algısı". Bulgular, ziyaretçilerin Van Kalesi'ni Urartu uygarlığı merkezli çok katmanlı bir tarihsel miras alanı olarak algıladıklarını göstermektedir. Panoramik peyzaj ve görsel deneyim, ziyaretçi memnuniyetini artıran önemli bir unsur olarak öne çıkarken; erişilebilirlik zorlukları, güvenlik endişeleri ve temel hizmet eksiklikleri deneyimi olumsuz etkileyen başlıca faktörler olarak belirlenmiştir. Araştırma sonuçları, ziyaretçi deneyiminin yalnızca tarihsel algılarla değil, mekânsal ve yönetimsel unsurlarla birlikte şekillendiğini ortaya koymaktadır. Van Kalesi örneği, kültürel miras alanlarının sürdürülebilir yönetimi için ziyaretçi beklentilerinin dikkate alınmasının önemini vurgulamaktadır. Bu bağlamda çalışma, miras yönetimi politikalarına ve ziyaretçi odaklı planlama süreçlerine yönelik önemli çıkarımlar sunmaktadır.
Anahtar Kelimeler: Miras Turizmi, Kültürel Miras, Van Kalesi

ANALYSIS OF CULTURAL HERITAGE EXPERIENCE THROUGH ONLINE VISITOR COMMENTS: THE CASE OF VAN CASTLE

Abstract
Cultural heritage sites are not only important places that reflect the historical memory and identity of societies, but also stand out as multidimensional spaces where visitor experiences are shaped in the context of tourism. Today, visitor perceptions of heritage sites are not limited to historical and aesthetic values; they are evaluated in conjunction with elements such as spatial experience, safety, accessibility, and management practices. In this context, the aim of this study is to reveal the themes around which cultural heritage elements experienced by visitors at Van Castle are shaped and to analyze the strengths and weaknesses of these experiences in terms of heritage management and visitor satisfaction. The research was conducted within the framework of a qualitative research approach and adopted a phenomenological design. The data source consists of visitor reviews of Van Castle on the Tripadvisor platform. Within the scope of the research, a total of 219 visitor reviews written in Turkish, English, and Russian between 2012 and 2025 were subjected to content analysis. Reviews in foreign languages were translated into Turkish by the researchers, and all data were analyzed manually. The obtained data were coded and classified under themes and categories. The analysis identified four main themes: "Perception of Cultural Heritage," "Spatial Experience and Physical Environment," "Security and Comfort Dimension," and "Perception of Protection, Maintenance, and Management." The findings show that visitors perceive Van Castle as a multi-layered historical heritage site centered on the Urartu civilization. While the panoramic landscape and visual experience stand out as important factors that increase visitor satisfaction, accessibility difficulties, security concerns, and lack of basic services have been identified as the main factors negatively affecting the experience. The research results reveal that the visitor experience is shaped not only

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by historical perceptions but also by spatial and managerial elements. The example of Van Castle emphasizes the importance of considering visitor expectations for the sustainable management of cultural heritage sites. In this context, the study offers important insights for heritage management policies and visitor-focused planning processes.
Keywords: Heritage Tourism, Cultural Heritage, Van Castle

Giriş

Kültür kavramı, bilimsel alanda ilk kez XIX. yüzyılın sonlarında antropolog Edward Burnett Tylor tarafından "insanların edindiği bilgi, inanç, sanat, ahlak, hukuk, gelenek ve görenekler ile diğer yetenek ve alışkanlıkları içeren karmaşık bir bütün" (Tylor, 1871:1) olarak tanımlanmıştır. Bu başlangıç tanımından itibaren kültür, T.C. Kültür ve Turizm Bakanlığı (2025) tarafından "bir toplumu diğer toplumlardan farklı kılan, kendine özgü sanatı, inançları ve örf adetleriyle onun kimliğini oluşturan yaşayış ve düşünüş tarzı" olarak ele alınmıştır. Benzer şekilde UNESCO'da kültürü; sanat, yaşam tarzı, değer sistemleri ve inançları karakterize eden belirgin manevi, maddi, entelektüel ve duygusal özellikler bütünü olarak tanımlamıştır (UNESCO, 2025). Bu kapsamda kültür, toplumların sahip olduğu tüm değerleri ve ortaya koyduğu tüm unsurları kapsayan (Aktan ve Tutar, 2007:3), nesilden nesile aktarılan ve topluma kimlik kazandırarak diğer milletlerden ayıran temel bir sosyal yapı niteliği taşımaktadır (Ay ve Fidan, 2013:1136). Kültür, toplumsal kimliği ve düzeni sağlamanın yanı sıra, kültürel miras turizminin gelişiminde de en önemli araçlar arasında yer almaktadır (Bachleitner ve Zins, 1999:199).

Miras kavramı, literatürde disiplinler arası bir alana sahip olup, Türk Dil Kurumu'na (2025) göre "bir neslin kendinden sonra gelen nesle bıraktığı şey" olarak tanımlanmaktadır. Miras, geçmişten devralınan ve günümüzde kullanılan kültürel geleneğin taşıyıcısıdır (Nuryanti, 1996:249; Hall & McArthur, 1998; Graham, vd., 2000). Park (2014) ise mirası; tarihsel, kültürel ve entelektüel boyutları içeren geniş bir anlamlar dizisi olarak ele alır. Kavrama yönelik iki temel yanlış anlama mevcuttur: Birincisi, bir unsurun miras sayılması için "eski" olması gerektiği varsayımıdır ki, bu durum "eski" kavramının görece oluşunu ve yakın geçmişten gelen unsurların dahi miras değeri taşıyabileceği gerçeğini göz ardı eder (Wall, 1989; Timothy & Boyd, 2003). İkinci yanılgı ise mirasın yalnızca somut unsurlardan ibaret olduğu düşüncesidir. Oysa on dokuzuncu ve yirminci yüzyıl odak noktası somut kültüre (Veblen, 1965) yoğunlaşmış olsa da, bu sınırlı bakış açısı modern akademik ve endüstriyel çevrelerde kabul görmemektedir.

Günümüzde miras kavramı, somut eserlerin yanı sıra müzik, dil, geleneksel bilgi ve ritüeller gibi somut olmayan unsurları da kapsayacak şekilde genişlemiştir (Vaz da Silva, 2008; Smith & Akagawa, 2009; Stefano, vd. 2012). Bu geniş anlam dizisi nedeniyle Doğaner (2003) mirası; arkeolojik yapılar, folklor ve mutfak gibi unsurları içeren sosyo-kültürel miras ile su kütleleri ve bitki örtüsü gibi unsurları içeren doğal miras olarak sınıflandırmıştır. UNESCO'ya göre kültürel miras; sembolik, tarihi, sanatsal ve bilimsel değere sahip eserleri, anıtları, binalar ve alanları ifade etmektedir (UNESCO, 2025). Buna göre kültürel miras, binalar, antikalar gibi somut nesnelerde ortaya çıktığı gibi; müzik, dans, inançlar ve ritüeller gibi kültürün somut olmayan alanlarında da kendini göstermektedir (Timothy, 2011). Turistik çekicilikler arasında önemli bir unsur olarak konumlanan miras (Doğan, 2020: 86), hem kültürel hem de doğal nitelikleriyle çok yönlü bir yapıya sahiptir (Timothy & Boyd, 2006). UNESCO'nun somut olmayan miras listesini oluşturmasıyla (UNESCO, 2025) birlikte, kültürel geçmişin bu somut olmayan unsurlarının korunması ve turizm aracı olarak tanınması giderek artan bir öneme sahip olmuştur (Smith & Akagawa, 2009).

Kültürel miras, binlerce yıllık insanlık tarihi boyunca ortaya çıkan ve kuşaktan kuşağa aktarılan somut ve soyut değerlerin bütününü ifade eder (Ünsal ve Purhan, 2012:34). Bu değerler (Blake, 2000:68), toplumların ortak geçmişini ve ulusal kimliğini temellendirerek toplumsal dayanışmayı güçlendirir. Kültürel miras; tarihi kentler ve arkeolojik alanlar gibi somut unsurlar ile dil, ritüel ve müzik gibi soyut unsurlardan oluşan bütüncül bir yapı sergiler (İSMEP, 2014). Somut miras, mimari yapılar ve tarihi eserler gibi taşınabilir veya taşınamaz nitelikteki kalıntıları tanımlarken (Demir, 2008; Tansuğ, 2008), somut olmayan miras; sözlü gelenekler, uygulamalar ve becerileri içerir (UNESCO, 2025; T.C. Resmi Gazete, 2006). Ekonomik ve teknolojik değişimlerin etkisiyle uluslararası seyahat niteliği değişmiş ve geleneksel kitle turizminden alternatif turizm türlerine yönelim hızlanmıştır. Tarihi ve kültürel kaynaklara odaklanan bu yeni turizm türleri, ziyaretçi taleplerindeki çeşitlenmeye yanıt vermekte ve yerel kalkınmaya katkı sunmaktadır (Martini vd., 2016; Ayaz, vd., 2018). Kültürel miras, literatürde "toplulukların paylaştığı ortak bir bağ" olarak geçmiş, bugün ve gelecek arasında süreklilik sağlayan bir yapı olarak görülür (Tunçer, 2017). Ulusal kimliği temsil eden kültürel mirasın evrensel değer taşıyan unsurları, UNESCO Dünya Miras Sözleşmesi kapsamında "anıtlar", "yapı toplulukları" ve "sitler" şeklinde sınıflandırılmaktadır (UNESCO World Heritage Convention, 1972). Kültürel miras; tarihi mekânlar gibi somut kalıtımı ve gelenek, ritüel gibi somut olmayan kültürel belleği kapsayan bütüncül bir

yapıdır (Herbert, 1989; Zeppel ve Hall, 1992). Somut miras, taşınır (arşiv belgeleri) ve taşınmaz (sit alanları) ayrımıyla sınıflandırılarak gelecek kuşaklara aktarılması gereken varlıkları içerir (Kuşçuoğlu ve Taş, 2017). Bu bütünsel yaklaşım, kültürel mirasın korunması ve turizm bağlamında sürdürülebilir değerlendirilmesi için temel bir çerçeve sunmaktadır.

Miras turizmi, alternatif turizm türleri içinde, kültür turizminin ayrılmaz bir bileşeni veya uzmanlık alanı olarak incelenir. Turizmin en köklü biçimlerinden olan bu alanın (Dallen & Boyd, 2006) kökenleri, hac yolculuklarına işaret edilerek antik çağa kadar uzanır (Timothy, 2011). Turizm sektöründeki hızlı büyüme sonucunda miras turizmi, önemli bir alan haline gelmiştir (Tlabela & Munthree, 2012). Kavramsal olarak miras turizmi; bir nesilden diğerine geçen kaynakların kullanımını (Özgüç, 1998) veya tarihi yapılar ve doğal güzellikler gibi miras niteliğindeki unsurları odak noktasına alan bir turizm türünü ifade eder (Yale, 1991). Aynı zamanda miras turizmi, toplumun geçmişe ait somut ve soyut tüm değerlerine sahip çıkmasıyla ilgili kültürel bir hareketin sonucu olarak tanımlanır (Light, 2000).

Miras turizmine yönelik artan talep, sosyo-kültürel ve küresel dinamiklerin birleşimiyle şekillenmiştir (Aliağaoğlu ve Temurçin, 2004). Bu ilginin temelinde, bireysel ve kolektif kimliğin inşasına zemin hazırlayan geçmişe yönelik merak ve kültürel varlıkları koruma motivasyonu yatmaktadır (Harwey, 1997). Küreselleşmenin (globalleşme) etkisiyle artan yerel kültür ve tarihe duyulan ilgi (Aliağaoğlu, 2004) ile yeni orta sınıfın kültürel cazibelere atfettiği değerin yükselmesi gibi toplumsal değişimler (Williams, 1998) de miras turizminin gelişimini destekleyen diğer önemli faktörlerdir. Destinasyonların temel çekicilik unsurlarından biri olarak miras, turistlerin seyahat nedenlerini belirlemede kritik bir role sahiptir (Rabinson, 1976). Turizm paydaşları açısından, miras turizminin işleyişini kavrayarak kültürel mirasın korunması, etkin turizm yönetimi ve yerel ekonomik kalkınma arasında doğrudan bir ilişki kurmak mümkündür (Gürsoy, vd., 2019). Bu yaklaşım, ziyaretçilere özgün deneyimler sunarken yerel kimliğin güçlenmesine de katkı sağlamaktadır (Ramkissoon, vd, 2012; Seyfi, vd, 2020).

Bu çalışma, Van Kalesi'nde ziyaretçiler tarafından deneyimlenen kültürel miras unsurlarının hangi temalar etrafında şekillendiği ve söz konusu deneyimlerin alanların miras yönetimi ile ziyaretçi memnuniyeti açısından ne tür güçlü ve zayıf yönleri ortaya koyduğu sorularına yanıt aramaktadır. Çalışma, ziyaretçi deneyimini "Kültürel Mirasın Algılanması", "Mekânsal Deneyim ve Fiziksel Çevre", "Güvenlik ve Rahatlık Boyutu" ve "Koruma, Bakım ve Yönetim Algısı" temaları çerçevesinde incelemektedir. Söz konusu çalışmanın önemi, kültürel miras alanlarının sürdürülebilir yönetimine ve ziyaretçi memnuniyetini şekillendiren çok boyutlu faktörlerin belirlenmesine odaklanmaktadır. Van Kalesi bağlamında, araştırma hem tarihi ve arkeolojik değer algısını hem de fiziksel çevreye (erişilebilirlik, panoramik manzara) yönelik deneyimleri ortaya koymaktadır. Ayrıca, fiziksel güvenlik endişeleri, temel hizmet eksiklikleri ve yönetimsel düzenlemeler gibi hususların ziyaretçi deneyimi üzerindeki doğrudan etkisini analiz ederek , miras alanlarının idari süreçlerle ne denli yakından ilişkili olduğunu göstermekte ve yönetim stratejilerinin geliştirilmesine bilimsel bir zemin sunmaktadır.

Yöntem

Bu çalışma kapsamında nitel araştırma yöntemi benimsenmiş, araştırma deseni olarak ise fenomenoloji (olgubilim) tercih edilmiştir. Fenomenoloji; araştırmacının aslında farkında olduğu ancak derinlemesine ve ayrıntılı bir kavrayışa sahip olmadığı olgulara odaklanmaktadır. Bu desen, araştırmacılara tam anlamıyla nüfuz edilemeyen olguları uygun bir zeminde inceleme fırsatı sunması bakımından önemlidir (Yıldırım ve Şimşek, 2016). Bu çerçevede, araştırmada cevap aranan temel soru şu şekildedir:

"Van Kalesi'nde ziyaretçiler tarafından deneyimlenen kültürel miras unsurları hangi temalar etrafında şekillenmektedir? Söz konusu deneyimler, bu alanların miras yönetimi ve ziyaretçi memnuniyeti açısından ne tür güçlü ve zayıf yönleri ortaya koymaktadır?"

Araştırmanın evrenini, Tripadvisor platformunda Van Kalesine yönelik yapılan ziyaretçi değerlendirmeleri oluşturmaktadır. Araştırma kapsamında veri kaynağı olarak Tripadvisor'ın tercih edilmesinin temel nedenleri; a) dünyanın en büyük seyahat platformu niteliği taşıması, b) 859 milyonu aşan yorum ve görüşü barındırması ve c) 49 farklı pazarda, 29 dilde hizmet sunması olarak sıralanabilir (Tripadvisor, 2025). Araştırmanın evreni ve örneklemi araştırmanın veri setini, Tripadvisor platformunda Van Kalesi'ne yönelik İngilizce, Rusça ve Türkçe dillerinde yapılan ziyaretçi değerlendirmeleri oluşturmaktadır. Söz konusu alana yönelik yorumlar için herhangi bir zaman kısıtlamasına gidilmemiş; 2012-2025 yılları arasını kapsayan ve belirtilen dillerde yazılmış tüm yorumlar analize dahil edilmiştir. Bu çerçevede; Van Kalesi için 144 Türkçe, 65 İngilizce ve 10 Rusça olmak üzere toplam 219 yorum incelemeye alınmıştır.

Verilerin çözümlenmesinde, nitel araştırma tekniklerinden biri olan içerik analizi kullanılmıştır. İçerik analizinde temel amaç, elde edilen verileri açıklayabilecek kavramlara ve ilişkilere ulaşmaktır. Bu süreçte veriler derinlemesine bir işleme tabi tutulmuş; birbirine benzeyen ifadeler belirli kavram ve temalar etrafında bir araya getirilerek yorumlanmıştır (Yıldırım ve Şimşek, 2016). Veriler, 10-11 Aralık 2025 tarihlerinde Tripadvisor üzerinden çekilmiştir. İngilizce, Rusça ve Türkçe yorumların tamamı okunmuş; yabancı dildeki yorumlar araştırmacılar tarafından bizzat Türkçe'ye çevrilmiştir. Çeviri sürecinde herhangi bir otomatik çeviri aracına başvurulmamış, analizler de bilgisayar destekli programlar yerine manuel olarak gerçekleştirilmiştir.
Veri ayıklama aşamasında, her üç dildeki yorumlar öncelikle incelenmiş ve anlam bütünlüğü kontrol edilmiştir. Çeviri kaynaklı herhangi bir anlam kayması yaşanmaması adına metinler titizlikle okunmuştur. Nihai aşamada, Türkçe'ye çevrilen İngilizce ve Rusça yorumlar, halihazırda Türkçe yazılmış olanlarla birleştirilerek bütüncül bir analize tabi tutulmuştur. Araştırmaya Lehçe, Arapça, Portekizce, Japonca, Korece, Endonezce, İtalyanca, Almanca, Fransızca ve Felemenkçe dilleri dahil edilmemiştir.
Araştırmanın iç geçerliliğini (inandırıcılık) sağlamak adına elde edilen veri ve bulgulara müdahale edilmemiş; dış geçerlilik içinse araştırma süreci ve analiz adımları detaylandırılmıştır. Veriler objektif bir bakış açısıyla yorumlanmıştır. Ayrıca çalışmanın geçerliliğini artırmak amacıyla şu stratejilere başvurulmuştur (Cresswell, 2019):
Uzun Süreli Etkileşim: Araştırmacılar, 2023, 2024 ve 2025 yıllarında çalışma sahalarında defalarca bulunmuş ve yerinde gözlem yapma imkânı bulmuştur. Bu saha deneyimi, araştırmanın temel dayanağını oluşturmaktadır.
Derinlemesine Betimleme: Araştırma süreci ve verilerin kodlanma aşamaları ayrıntılı bir şekilde açıklanarak sonuçların gerçekçiliği desteklenmiştir.
Kodlayıcılar arası tutarlılığı sağlamak adına, analizler ve sonuç bölümü nitel araştırma alanında uzman üç farklı akademisyenin görüşüne sunulmuş; gelen dönütler doğrultusunda gerekli düzeltmeler yapılmıştır.
Creswell (2021, s. 248), Lincoln ve Guba'nın (1985) nitel araştırmalarda güvenilirliği sağlamak adına önerdiği inandırıcılık, özgünlük, aktarılabilirlik, güvenilirlik ve onaylanabilirlik kavramlarına dikkat çekmektedir. Bu çalışmada inandırıcılığı artırmak amacıyla; analize dahil edilen yorum sayıları, örneklem seçim kriterleri, veri toplama araçları ve analiz süreçleri şeffaf ve detaylı bir şekilde ortaya konulmuştur.

Bulgular

Araştırmada elde edilen veriler neticesinde ortaya çıkan bulgular aşağıdaki tabloda sunulmuştur.
Tablo 1. Kültürel Mirasın Algılanmasına Yönelik Bulgular

Tema	Kategori	Alt-Kategori
Kültürel Mirasın Algılanması	Tarihsel ve Arkeolojik Değere Yönelik Algılamalar	Urartu, Tuşba, Kaya yazıtı, Xerxes, tapınak, antik, 3000 yıllık, tarih, medeniyet, Urartu başkenti, Kral Sarduri, Argişti, çivi yazısı, mağaralar, insanlık tarihi, badireler, kültür kolay oluşmamış, tarih hissi, geçmişle temas
	Çok Katmanlı Tarih ve Medeniyet Sürekliliği	Pers, Osmanlı, Selçuklu, Rus, Roma, Bizans, geçmiş uygarlıklar, birçok uygarlık izlerini bırakmış
	Eski Van Şehri	Eski Van, kızıl minare, kilise, külliye, horhor medresesi, eski yerleşim, yıkılmış şehir

Bu tema, ziyaretçilerin Van Kalesi'ni nasıl konumlandırdığını, yapıya hangi tarihsel anlamları yüklediğini ve kültürel mirasla nasıl bir bilişsel ilişki kurduğunu açıklamaktadır.

Tarihsel ve Arkeolojik Değerin Algılanması

Bu kategori, ziyaretçilerin Van Kalesi'ni yalnızca fiziki bir yapı olarak değil, Urartu uygarlığının kültürel ve arkeolojik mirasını temsil eden tarihsel bir odak noktası şeklinde değerlendirdiklerini göstermektedir. Yorumlarda geçen Urartu, Tuşba, kaya yazıtı ve antik dönem vurguları, ziyaretçilerin mekânı derin bir tarihsel bağlam içinde konumlandırdığını ve yapının binlerce yıllık süreklilik taşıyan bir medeniyet hafızası olarak algılandığını ortaya koymaktadır.

Çok Katmanlı Tarih ve Medeniyet Sürekliliği
Bu kategori, Van Kalesi'nin farklı uygarlıkların ardışık izlerini bir arada sunan çok katmanlı bir kültürel miras alanı olarak değerlendirildiğini göstermektedir. Ziyaretçiler, Pers, Osmanlı ve diğer tarihsel dönemlere yönelik göndermeler aracılığıyla kaleyi birden fazla medeniyetin izlerini taşıyan bütünsel bir tarih alanı olarak algılamakta ve bu çoklu tarihsel kimlik, mekâna yönelik bilişsel ilgiyi güçlendirmektedir.
Eski Van Şehri ile Kurulan Bağlantı
Bu kategori, ziyaretçilerin kaleyi çevresindeki eski yerleşim dokusuyla birlikte ele alarak mekânı geniş bir kültürel peyzajın parçası olarak yorumladıklarını göstermektedir. Yorumlarda Eski Van, minare kalıntıları, kilise yapıları ve külliye gibi unsurların sıkça dile getirilmesi, kalenin yalnızca kendi mimari yapısıyla değil, çevresindeki tarihsel katmanlarla bütünleşik bir miras alanı olarak anlam kazandığını ortaya koymaktadır.
Tablo 2. Mekânsal Deneyim ve Fiziksel Çevreye Yönelik Bulgular

Tema	Kategori	Alt-Kategori
Mekânsal Deneyim ve Fiziksel Çevre	Fiziksel Erişilebilirlik ve Ulaşım Zorluğu	Yokuş, tırmanmak, yorucu, yarım saat, uygun ayakkabı, merdiven, çocuklu ailelere uygun değil, yol kapalı, bakım, restore, kaygan, buzlu, yürüyüş yolu, ulaşım, tabelaların olmaması, girişin belirsizliği, bilgi panosu eksikliği, müzekart, nakit çalışılması, kredi kartı olmaması, sabah gidin, güneş batımı, rahat ayakkabı, rehber bulun
	Panoramik Peyzaj ve Görsel Deneyim	Manzara, göl, Süphan Dağı, panoramik, kuşbakışı, fotoğraf, gün batımı, ışık, atmosfer, büyüleyici, etkileyici, harikulade, muhteşem, nefes kesici

Bu tema, ziyaretçilerin Van Kalesi'yle kurdukları ilişkinin yalnızca tarihsel bir algıdan ibaret olmadığını; aksine fiziksel çevrenin, mekânın topografyasının ve manzara unsurlarının deneyimin niteliğini doğrudan belirlediğini gösteren bir çerçeveyi ifade etmektedir. Bu tema, kaleye ulaşım sürecindeki fiziksel zorlukların, yürüyüş yollarının niteliğinin, tırmanış sırasında hissedilen eforun ve kaleden görülen panoramik Van Gölü manzarasının ziyaretçilerin memnuniyetini, mekânsal algısını ve mekânı anlamlandırma biçimini nasıl şekillendirdiğini açıklamaktadır. Böylece mekânsal koşullar, ziyaretçilerin deneyimlerini bazen güçlendiren bazen de sınırlandıran temel bir bileşen olarak ortaya çıkmakta; Van Kalesi'nin yalnızca tarihsel değil, aynı zamanda fiziksel bir performans alanı olarak deneyimlendiğini göstermektedir.

Fiziksel Erişilebilirlik ve Ulaşım Zorluğu
Bu kategori, ziyaretçilerin kaleye erişim sürecini deneyimin önemli bir belirleyicisi olarak değerlendirdiklerini göstermektedir. Tırmanışın yoruculuğu, merdivenlerin durumu, yönlendirme eksiklikleri ve yürüme yollarının fiziksel kalitesi, yorumlarda sıkça vurgulanan unsurlar olup, ziyaretçilerin kaleye ulaşmak için harcadıkları fiziksel çabanın deneyimi hem olumlu hem de olumsuz yönde etkileyen bir faktör olduğu anlaşılmaktadır.

Panoramik Peyzaj ve Görsel Deneyim
Bu kategori, Van Kalesi'nin çarpıcı manzarası ve doğal çevresi sayesinde ziyaretçilerin estetik açıdan güçlü bir görsel deneyim yaşadığını göstermektedir. Van Gölü, Süphan Dağı ve geniş peyzaj görünümü, ziyaretçilerin mekânı bir "seyir noktası" olarak değerlendirmelerine yol açmakta; gün batımı ve fotoğraf çekimi gibi aktiviteler, kalenin deneyimsel değerini artıran başlıca unsurlar olarak öne çıkmaktadır.
Tablo 3. Güvenlik ve Rahatlık Boyutuna Yönelik Bulgular

Tema	Kategori	Alt-Kategori
Güvenlik ve Rahatlık Boyutu	Fiziksel Güvenlik ve Tedirginlik	Güvenlik yok, başıboş köpekler, korkuluklar yok, çocuk rehberlerin para istemesi, ıssız, tehlikeli, hırsızlık durumu, yapışkan satıcılar, zorla para isteme

	Temel Hizmetleri ve Ziyaretçi Destekleri	çay bahçesi, hediyelik eşya, yiyecek yok, tesis yok, açıklama yok, tabela eksi tuvalet, piknik alanı, Van evi

Bu tema, ziyaretçilerin kalede bulundukları süre boyunca karşılaştıkları sosyal ve fiziksel güvenlik koşullarının deneyimlerini nasıl etkilediğini ortaya koyan analitik bir yapıyı ifade etmektedir. Bu tema kapsamında, başıboş köpekler, koruma bariyerleri olmayan yürüyüş güzergâhları, çocuklarla gezi yapmanın güçlüğü, bazı yerel etkileşimlerin rahatsızlık yaratması ve temel ziyaretçi hizmetlerinin eksikliği gibi unsurlar, ziyaretçilerin kendilerini ne kadar güvende, desteklenmiş veya risk altında hissettiklerini belirleyen faktörler olarak değerlendirilmektedir. Dolayısıyla bu tema, ziyaretçi deneyiminin yalnızca tarihsel ve estetik yönlerle değil, aynı zamanda fiziksel güvenlik ve temel hizmet sunumu ile şekillendiğini göstererek alan yönetiminin eksikliklerinin deneyimin bütüncül niteliğini nasıl etkilediğini ortaya koymaktadır.

Fiziksel Güvenlik ve Tedirginlik
Bu kategori, ziyaretçilerin kalede zaman zaman fiziksel güvenlik açısından tedirginlik yaşayabildiklerini göstermektedir. Başıboş köpekler, korunaklı olmayan yürüyüş alanları, çocukların dolaşımının riskli görülmesi ve bazı sosyal etkileşimlere yönelik rahatsızlık ifadeleri, ziyaretçilerin güvenlik algısını olumsuz yönde etkileyen unsurlar olarak yorumlarında yer almaktadır.

Temel Hizmetler ve Ziyaretçi Destekleri
Bu kategori, ziyaretçilerin kalede ihtiyaç duydukları temel hizmetlere erişimde çeşitli eksiklikler hissettiklerini ortaya koymaktadır. Tesis, yiyecek–içecek alanı, tuvalet veya bilgilendirme panosu gibi ziyaretçi desteklerinin yetersiz bulunması, deneyimin bütüncül niteliğini zayıflatan başlıca unsurlar arasında yer almakta ve alan yönetiminin ziyaretçi ihtiyaçlarını karşılamada sınırlı bir kapasite sunduğunu göstermektedir.
Tablo 4. Koruma, Bakım ve Yönetim Algısına Yönelik Bulgular

Tema	**Kategori**	**Alt-Kategori**
Koruma, Bakım ve Yönetim Algısı	Fiziksel Bakım ve Restorasyon	bakımsız, yalnız bırakılmış, restore edilmeli, daha iyi korunmalı, iyi restore edilmiş, sağlam, korunmuş, güçlü duruyor, betonlaştırılmış
	Yönetim ve Düzenleme	Giriş Ücretleri ve Müzekart, kontrol yok, kapı kapalı, müze kapalı, düzenleme yetersiz

Bu tema, ziyaretçilerin Van Kalesi'nin koruma durumu, restorasyon niteliği ve yönetim uygulamalarına ilişkin değerlendirmelerinin deneyim üzerinde belirleyici bir unsur olduğunu ortaya koymaktadır. Bu tema, alanın ne ölçüde bakımlı göründüğü, restorasyon çalışmalarının tarihsel dokuya uygunluğu, giriş- çıkış düzenlemelerinin işleyişi, bilgilendirme panolarının varlığı ya da yokluğu ve genel organizasyon yapısı gibi yönetimsel süreçlerin ziyaretçiler tarafından nasıl algılandığını açıklamaktadır. Bu bağlamda tema, Van Kalesi'nin yalnızca fiziksel bir miras değil, aynı zamanda yönetilmesi, korunması ve kültürel olarak sürdürülebilir hâle getirilmesi gereken bir alan olarak değerlendirildiğini göstermekte; ziyaretçi deneyiminin idari düzenlemelerle ne kadar yakından bağlantılı olduğunu ortaya koymaktadır.

Fiziksel Bakım ve Restorasyon
Bu kategori, ziyaretçilerin kalenin korunmuşluk düzeyine ilişkin değerlendirmelerinde önemli farklılıklar bulunduğunu göstermektedir. Bazı ziyaretçiler kaleyi bakımsız ve restorasyon açısından yetersiz bulurken, bazıları belirli bölümlerin iyi korunmuş olduğunu ifade etmektedir. Bu durum, alandaki koruma uygulamalarının ziyaretçi gözünde eşitsiz ve tutarsız bir biçimde algılandığını ortaya koymakta ve fiziksel korumanın deneyimin niteliği üzerindeki belirleyici rolünü göstermektedir.

Yönetim ve Düzenleme
Bu kategori, ziyaretçilerin alan yönetimine ilişkin eleştirilerinin deneyimin genel seyrini etkilediğini göstermektedir. Giriş düzenlemeleri, gişe uygulamaları, yönlendirme eksiklikleri ve alanın genel

organizasyonuna yönelik belirsizlikler, ziyaretçilerin kaleyi profesyonelce yönetilmeyen bir miras alanı olarak değerlendirmelerine yol açmakta ve yönetimsel koordinasyonun deneyim üzerinde doğrudan etkili olduğu anlaşılmaktadır.

Tartışma

Kültürel miras alanlarının turizm potansiyellerini tam olarak ortaya koyamamasının ardında, yetersiz altyapı, sınırlı devlet desteği ve mirasın önemine dair düşük farkındalık gibi etkenler rol oynamaktadır (Zahari vd., 2016; Jamin vd., 2020). Özellikle ulaşım, iletişim ve genel hizmet altyapılarındaki eksiklikler, hem turist deneyiminin kalitesini düşürmekte hem de bu tarihi öneme sahip alanlara erişimi kısıtlamaktadır (Gillen, 2018; Ridzuan vd., 2019). Turizmin gelişimi, büyük ölçüde ulaşım, konaklama, bilgilendirme sistemleri, altyapı ve üstyapı gibi temel hizmetlerin yeterliliğine bağlıdır (Abdullah vd., 2014; Sun & Lv, 2024). Yapılan bir araştırmada, Van Kalesi örneğinde, yiyecek-içecek, tuvalet veya bilgilendirme panoları gibi temel hizmet ve tesislerin ziyaretçilerce yetersiz bulunması, bütüncül deneyimin zayıflamasındaki ana unsurlar olarak saptanmıştır. Öte yandan, kültürel mirasın ticarileştirilmesi de turist algılarını şekillendiren karmaşık bir dinamik oluşturmaktadır. Zhang ve ark. (2021), ticarileşmenin bir yandan erişilebilirliği ve bilinirliği artırabileceğini, diğer yandan ise sunulan deneyimin algılanan özgünlüğünden uzaklaşmaya yol açarak turistlerin duygusal bağlarını zorlaştırabileceğini ifade etmektedir. Ticari kaygılar ile kültürel özgünlük arasındaki doğru denge, hayati öneme sahiptir; zira aşırı ticari yönelim, bazı ziyaretçileri yabancılaştırabilen ve mirasın metalaştırılmış bir yorumuna neden olabilmektedir.

Kültürel miras alanlarını ziyaret eden turistler, farklı algı ve motivasyonlar sergilemektedir. Palau-Saumell vd. (2012), miras alanlarına dair bilgi düzeyinin, turistlerin davranışsal niyetlerini ciddi ölçüde etkilediğini ve bilgili ziyaretçilerin bu alanları daha değerli görme eğiliminde olduğunu belirtmektedir. Apostolakis ve Jaffry (2006) ise tekrar ziyaret eden turistlerde kültürel değer algısının zamanla azalabileceğine dikkat çekerek, destinasyon yöneticilerinin ilgi ve algıyı canlı tutmak adına proaktif önlemler alması gerektiğini vurgulamaktadır. Bilgilendirici ve yönlendirici panolar, görevli personel ve yorumlayıcı unsurlar aracılığıyla bilgi eksikliğinin giderilmesi, vandalizm gibi olumsuz davranışların önlenmesine katkı sağlamakta, aynı zamanda alanın eğitimsel işlevini ve imajını güçlendirmektedir (Qian vd., 2022). Bu bilgilendirici yaklaşımlar, ziyaretçilerin tarih bilincini ve sorumluluk duygusunu geliştirmeye destek olabilir (Keillor vd., 1996; Çakar, 2018; Qu vd., 2021). Ancak miras alanlarının tarihsel bağlamının turistler tarafından göz ardı edilmesi, ahlaki bir kopuşa yol açan etik tartışmalar yaratabilmektedir (Kunwar vd., 2021; Lennon & Powell, 2018; Friedman, 2023; Vorina vd., 2024). Bu nedenle, miras alanlarının değerini korumak ve ziyaretçilerin bilinçlenmesini sağlamak için etik bir çerçeve oluşturulması kritik öneme sahiptir (Weeden, 2002; Shekhar & Valeri, 2022). Van Kalesi'ne ilişkin ziyaretçi deneyimleri incelendiğinde, özellikle fiziksel erişilebilirlik ve ulaşım zorluğuna dair unsurların deneyimi belirgin biçimde şekillendirdiği görülmektedir. Dik ve yorucu yokuşlar, uzun tırmanma süresi, merdivenlerin varlığı, kaygan ve buzlu zeminler ile yürüyüş yollarının yetersizliği gibi fiziksel koşullar; alanın çocuklu aileler, yaşlılar ve fiziksel kısıtı olan ziyaretçiler açısından erişilebilirliğini sınırlamaktadır. Bunun yanı sıra ulaşım imkânlarının yetersizliği, yolun zaman zaman kapalı olması ve uygun yönlendirme tabelalarının bulunmaması, ziyaretçilerin alanı algılayış biçimini olumsuz yönde etkilemektedir. Bilgilendirme panolarının eksikliği, giriş-çıkış düzenlemelerinin belirsizliği ve rehberli hizmetlere erişimde yaşanan güçlüklerin, ziyaretçilerin alan hakkında yeterli bilgi edinmesini engellediğini göstermektedir. Bu durum, Palau-Saumell vd. (2012)'nin bilgi–değer algısı–davranışsal niyet ilişkisini zayıflatmakta; alanın algılanan kültürel değerinin ve deneyim kalitesinin düşmesine yol açabilmektedir. Dolayısıyla Van Kalesi'nde fiziksel çevreye ve erişilebilirliğe ilişkin düzenlemelerin iyileştirilmesi, yalnızca ziyaretçi konforunu artırmakla kalmayıp, aynı zamanda alanın algılanan değerini ve kültürel aktarım kapasitesini güçlendirecek önemli bir yönetimsel müdahale alanı olarak öne çıkmaktadır.

Bu çalışmada elde edilen bulgular ışığında, Van Kalesi'ne yönelik ziyaretçi deneyiminin yalnızca alanın tarihsel ve fiziksel özellikleriyle değil, aynı zamanda koruma ve yönetim uygulamalarıyla da yakından ilişkili olduğunu ortaya koymaktadır. Ayrıca turizmi destinasyonlarına kolay erişilebilirlik ve ulaşım imkanları ziyaretçi deneyimlerini şekillendirmede önemli bir rol oynamaktadır (Lahteenmaki, 2025). Koruma, bakım ve yönetim algısı teması ziyaretçilerin Van Kalesi'ni ziyaret ederken yaşamış oldukları deneyimleri yansıtmaktadır. Kurnaz (2013) tarafından yapılan çalışmanın sonuçlarına benzer şekilde fiziki çevrenin düzeni, restorasyon durumu ve yönetim ve düzenleme eksiklikleri konularda ziyaretçilerin olumsuz deneyimleri ortaya çıkmıştır. Pourfaraj vd. (2020) bir miras alanının fiziksel bütünlüğü, yönetim süreçleri, bilgilendirme ve düzenleme mekanizmalarının ziyaretçilerin alanı algılayış biçimini ve deneyim kalitesini doğrudan etkileyen temel faktörler olarak tanımlamaktadır. Ziyaretçiler, bir miras alanını değerlendirirken yalnızca tarihsel

önemine değil; bakımlı olup olmadığına, restorasyonun özgünlüğüne, yönlendirme ve bilgilendirme altyapısına odaklanmaktadır. Bu unsurların eksikliği, alanın tarihsel değerini gölgeleyebilmektedir. Pourfaraj vd. (2020) da yönetimsel eksikliklerin bir miras alanının değerinin algılanmasını zayıflattığını ifade etmiştir. Kültürel miras alanlarına yönelik yapılan çalışmalar, koruma ve yönetim süreçlerinin turistlerin miras alanlarının algılanan değerini ve deneyim niteliğini doğrudan etkilediği belirlemiştir (Jaafar vd., 2015). Bu sebeple miras alanlarının yalnızca korunması değil, aynı zamanda etkin biçimde yönetilmesi gereken mekanlar olduğu söylenebilir. Bu bağlamda, Van Kalesi'nde ziyaretçi deneyiminin niteliğini artırmaya yönelik olarak koruma ve restorasyon çalışmalarının özgünlük ilkeleri doğrultusunda yürütülmesi, bilgilendirme ve yönlendirme altyapısının güçlendirilmesi ve alan yönetimine ilişkin bütüncül bir yaklaşımın benimsenmesi önem arz etmektedir.

Sonuç ve Öneriler

Bu çalışma, nitel araştırma yöntemlerinden fenomenoloji desenini kullanarak, Tripadvisor platformundaki ziyaretçi değerlendirmeleri üzerinden Van Kalesi'nde deneyimlenen kültürel miras unsurlarını ve bu deneyimlerin miras yönetimi ile ziyaretçi memnuniyeti açısından ortaya koyduğu güçlü ve zayıf yönleri incelemiştir. Toplamda 219 (144 Türkçe, 65 İngilizce, 10 Rusça) yorum içerik analizine tabi tutularak dört ana tema ve bunlara bağlı kategoriler belirlenmiştir.

Araştırmanın bulguları, Van Kalesi'nin ziyaretçi deneyimini şekillendiren çok boyutlu bir yapıyı ortaya koymaktadır. Ziyaretçiler, Van Kalesi'ni yalnızca fiziki bir yapı olarak değil, Urartu uygarlığının merkezi olan Tuşba'nın kültürel ve arkeolojik mirasını temsil eden tarihsel bir odak noktası şeklinde değerlendirmektedir. Kalenin Pers, Osmanlı, Selçuklu, Rus, Roma ve Bizans gibi birçok uygarlığın izlerini taşıyan çok katmanlı tarihsel kimliği, mekâna yönelik bilişsel ilgiyi önemli ölçüde güçlendirmektedir. Ayrıca, ziyaretçiler kaleyi, Eski Van Şehri'nin kalıntıları (minare, kilise, külliye) ile birlikte ele alarak geniş bir kültürel peyzajın parçası olarak yorumlamaktadır.

Deneyimin güçlü yönlerinden biri, Van Gölü, Süphan Dağı ve geniş peyzaj görünümü sayesinde ziyaretçilerin estetik açıdan güçlü bir görsel deneyim yaşamalarıdır. Bu panoramik peyzaj ve görsel deneyim, gün batımı gibi aktivitelerle kalenin deneyimsel değerini artıran başlıca unsurlar olarak öne çıkmaktadır. Ancak, fiziksel erişilebilirlik ve ulaşım zorlukları (yorucu tırmanış, kaygan yollar, yönlendirme/tabela eksikliği) deneyimi olumsuz etkileyen önemli bir zayıflık olarak belirlenmiştir.

Ziyaretçi memnuniyetini düşüren temel zayıflıklardan biri, kalede zaman zaman fiziksel güvenlik açısından tedirginlik yaşanmasıdır. Başıboş köpekler, korunaklı olmayan yürüyüş alanları, çocukların dolaşımının riskli görülmesi ve bazı sosyal etkileşimlere (para isteyen çocuk rehberler, yapışkan satıcılar) yönelik rahatsızlık ifadeleri, güvenlik algısını olumsuz yönde etkileyen unsurlar olarak yorumlarda yer almaktadır. Aynı zamanda, tesis, yiyecek–içecek alanı, tuvalet veya bilgilendirme panosu gibi temel hizmet ve ziyaretçi desteklerinin yetersiz bulunması, deneyimin bütüncül niteliğini zayıflatan başlıca unsurlar arasındadır.

Yönetimsel süreçlere ilişkin algı ise tutarsızlık göstermektedir; bazı ziyaretçiler kaleyi bakımsız ve restorasyon açısından yetersiz bulurken, bazıları belirli bölümlerin iyi korunmuş olduğunu ifade etmektedir. Bu durum, alandaki koruma uygulamalarının ziyaretçi gözünde eşitsiz ve tutarsız bir biçimde algılandığını ortaya koymaktadır. Yönetim ve düzenleme kategorisinde ise giriş düzenlemelerindeki belirsizlikler, gişe uygulamaları ve alanın genel organizasyonuna yönelik eksiklikler, ziyaretçilerin kaleyi profesyonelce yönetilmeyen bir miras alanı olarak değerlendirmelerine yol açmakta ve yönetimsel koordinasyonun deneyim üzerinde doğrudan etkili olduğu anlaşılmaktadır.

Gelecek araştırmalarda, veri kaynaklarının çeşitlendirilerek yüz yüze görüşmeler, odak grup çalışmaları ve yerinde gözlemlerle desteklenmesi, ziyaretçi deneyimlerinin daha derinlikli biçimde anlaşılmasına katkı sağlayacaktır. Ayrıca nicel ya da karma yöntemli araştırmalar aracılığıyla ziyaretçi memnuniyeti, güvenlik algısı ve hizmet kalitesi gibi değişkenler arasındaki ilişkiler istatistiksel olarak test edilebilir. Van Kalesi'nin benzer kültürel miras alanlarıyla karşılaştırmalı olarak ele alınması, miras yönetimi uygulamalarının güçlü ve zayıf yönlerini daha net ortaya koyabilir. Bunun yanı sıra, yerel halk ve yöneticilerin bakış açılarını içeren araştırmalar ile dijital uygulamaların (dijital rehberler, artırılmış gerçeklik vb.) ziyaretçi deneyimi üzerindeki etkisini inceleyen çalışmalar, kültürel miras alanlarının sürdürülebilir ve yenilikçi yönetimine yönelik önemli katkılar sunacaktır.

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TÜRK KÜLTÜRÜNDE DOĞA ALGISI VE KORUMA YAKLAŞIMLARININ DÖNEMSEL ANALİZİ

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Özet

Bu çalışma, Türk kültür coğrafyasında doğa algısının ve buna paralel gelişen doğa koruma yaklaşımlarının tarihsel süreç içerisindeki epistemolojik ve pratik dönüşümünü incelemektedir. İslamiyet öncesi erken Türk toplumlarında doğa, Gök Tanrı inancı merkezinde kutsal bir bütün olarak algılanmıştır. Dağ, su (özellikle "kutlu" nehirler), ulu ağaçlar (hayat ağacı sembolizmi) ve hayvanlar (totemizm izleri) gibi unsurlara atfedilen ruh ve anlamlar, toplumsal düzeyde güçlü bir çevre etiği oluşturmuştur. Bu dönemde doğal kaynakların kullanımı, ritüel ve saygı çerçevesinde, dengeyi bozmayacak şekilde sınırlandırılmıştır. İslamiyet'in kabulüyle birlikte bu kadim çevre etiği, Kur'an Kerim'in evrensel ilkeleri doğrultusunda yeni bir içerik kazanmıştır. Özellikle "Mizan" (denge), israf etmeme ("İsraf haramdır" ilkesi), bütün yaratılmışlara merhamet ve doğayı Allah'ın ayeti olarak görme anlayışı, çevresel sorumluluğu dini bir vecibeye dönüştürmüştür. Ayetler ve Hadis-i Şerif ile doğa korumaya yönelik atıflara sıkça rastlanmaktadır. Bu anlayış, Osmanlı Devleti döneminde vakıf sistemi aracılığıyla en somut kurumsal koruma pratiğine dönüşmüştür. Vakıfnameler; suyollarının temizliğinden, hayvan barınaklarının ("kuş evleri", hastaneleri), ormanların ve mesire alanlarının ("koruluk" statüsü) korunmasına kadar geniş bir alanı kapsayan, kamusal fayda odaklı bir çevre yönetimi modeli sunmuştur. Cumhuriyet döneminde ise doğa koruma, modernleşme ve kurumsallaşma yoluna girmiştir. Çevre yönetimi; yasal düzenlemeler (örneğin ilk Orman Kanunu), uluslararası standartlara uygun korunan alan statüleri (Milli Parklar, Tabiatı Koruma Alanları) ve planlı kalkınma politikalarıyla bilimsel ve yönetsel bir zemine oturtulmuştur. Doğa koruma artık kanunlar, devlet kurumları ve dernekler aracılı ile korunmaktadır. Tarihsel verilerin analizi, Türk toplumunda doğa ile uyumlu yaşam ilkesinin bir kültürel süreklilik gösterdiğini ve bu zengin kültürel mirasın, günümüz çevre politikaları ve sürdürülebilirlik yaklaşımları için derinlikli ve özgün bir referans kaynağı oluşturduğunu açıkça ortaya koymaktadır

Anahtar Kelimeler: Doğa, Koruma, Türk Kültürü, Korunan Alanlar, Osmanlı, Cumhuriyet Dönemi

Periodical Analysis of Nature Perception and Conservation Approaches in Turkish Culture

Abstract

This study investigates the epistemological and practical transformation of nature perception and the corresponding conservation approaches within the historical trajectory of the Turkish cultural sphere. In the pre-Islamic era, nature was perceived by early Turkic societies as a sacred whole, centered on the Gök Tanrı (Sky God) belief system. Elements such as mountains, water (particularly "blessed" rivers), ancient trees (symbolizing the Tree of Life), and animals (evidencing totemic influences) were attributed with spiritual essence and profound meaning, establishing a robust environmental ethic at the societal level. During this period, the utilization of natural resources was strictly governed by ritual and reverence, ensuring compliance with the principle of equilibrium. With the advent of Islam, this ancient environmental ethic acquired a new dimension, aligning with the universal principles of the Qur'an and Sunnah. The core concepts of "Mizan" (balance), the prohibition of "Israf" (wastefulness), compassion toward all creation, and viewing nature as an "Ayah" (sign) of Allah transformed environmental responsibility into a religious duty. Numerous references to nature conservation are found in the Qur'anic verses and the Hadith. This understanding evolved into the most tangible form of institutional conservation practice during the Ottoman Empire through the Waqf (endowment) system. Waqf documents established a public-interest-focused environmental management model, encompassing vast domains such as the maintenance of water channels, the provision of animal shelters ("Kuş Evleri" - birdhouses, and animal hospitals), and the preservation of forests and recreational areas under the "Koruluk" (preserve/grove) status. In the Republican era, nature conservation entered a phase of modernization and institutionalization. Environmental management was placed on a scientific and administrative footing through legal regulations (such as the first Forestry Law), the establishment of protected area statuses (National Parks, Nature Conservation Areas) conforming to international standards, and planned development policies. Conservation is now primarily overseen by laws, state institutions, and civil society organizations. The analysis of historical data unequivocally demonstrates that the principle of harmonious

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coexistence with nature exhibits a cultural continuity throughout Turkish history. This rich cultural heritage constitutes a profound and unique frame of reference for contemporary environmental policies and sustainability approaches.

Keywords: Nature, Conservation, Turkish Culture, Protected Areas, Ottoman Empire, Republican Period

1. Giriş

Bu bölümde, Türklerin geçmişten günümüze doğaya ve doğal varlıklara olan saygıları ile ormanlara yönelik korumacı yaklaşımları tarihsel bir perspektifle ele alınacaktır. Çalışmanın temel amacı, Türk kültür coğrafyasında doğa algısındaki dönüşümleri ve bu dönüşümlerin modern doğa koruma çabalarına etkisini açıklamaktır.

Doğa, insan müdahalesinden bağımsız işleyen, kendi kuralları olan devasa bir sistemdir. Türk Dil Kurumu'na göre "tabiat" olarak da adlandırılan bu kavram, canlı ve cansız varlıkların sürekli değişim içindeki uyumunu temsil eder (Anonim 2025). Türk toplumunda "doğayı koruma" olgusu, sadece fiziksel bir faaliyet değil, insan ruhunda var olan koruma duygusunun bilinçli bir tezahürüdür (İnal,1949). Bu makale, Türklerin tarih boyunca doğaya atfettiği değeri ve bu anlayışın zaman içindeki dönüşümünü ele almaktadır. Bu çalışma, İslamiyet öncesi Türk toplumlarındaki doğa koruma pratiklerinden başlayarak; İslamiyet sonrası ve Osmanlı İmparatorluğu dönemindeki gelişimleri incelemekte, Türkiye Cumhuriyeti'nin güncel doğa koruma stratejilerine analitik bir bakış sunarak Türk kültür havzasında doğanın ontolojik anlamını ve stratejik önemini kuramsal bir çerçevede ele almaktadır.

2. Yöntem

Bu çalışma, tarihi ve kültürel verileri inceleyen literatür taraması ve doküman analizine dayalı nitel bir araştırmadır. İslamiyet öncesi, Osmanlı ve Cumhuriyet dönemine ait temel inanç sistemleri, vakıfnameler, yasal düzenlemeler ve kalkınma planları incelenerek, doğa koruma yaklaşımlarındaki değişimler dönemsel olarak sınıflandırılmıştır.

3. Bulgular

Doğa koruma türkler için her zaman önemli olmuştur. Tarihler, kültürler ve inançlar değişse bile doğaya olan saygı daimdir. Dönemsel değişimleri aşağıda detaylı verilmektedir.

3.1. İslamiyet Öncesi Türklerde Doğa Algısı

İslamiyet öncesi dönemde Türkler için doğa, kutsal bir şaheser olarak kabul edilirdi. Bu dönemdeki inanç sistemleri (Totemizm, Şamanizm, Naturizm), doğadaki unsurlara (dağ, su, ağaç, hayvan) ruhsal bir güç atfedilmesine dayanıyordu (Kurbanov, 2025).

Kutsal Ormanlar ve Ötüken: Göktürk ve Uygur dönemlerinde Ötüken ormanları kutsal sayılmış, bu alanlardan uzaklaşmanın uğursuzluk getireceğine inanılmıştır. (Eliyarlı, 2004; Eroğlu ve Kılıç, 2005).

Hayat Ağacı Sembolizmi: Türk mitolojisinde ağaç, yer ve gök arasındaki bağı temsil eden kozmik bir merkezdir. Özellikle ulu ağaçların yanından geçerken saygı gösterilmesi ve bu ağaçların kesilmesinin yasaklanması, doğa korumanın en erken örneklerindendir (Türkmen ve Saylam 2023).

Hayvanlara Saygı: İnsan, doğanın tek hâkimi değil, bir parçası olarak görülmüştür. Kurt bağımsızlığı, kuşlar ise ruhun temsilcilerini simgelemiştir. Avlanma faaliyetleri bile katı ritüellere ve "gereksiz öldürmeme" ilkesine dayandırılmıştır (Taşer 2022).

3. 2. Türk-İslam Kültüründe Doğa ve Emanet Bilinci

İslamiyet'in kabulüyle birlikte doğa koruma anlayışı "emanet" kavramı etrafında şekillenmiştir. Doğanın Allah'ın bir nimeti olduğu ve bu dengenin bozulmaması gerektiği inancı, çevre etiğini güçlendirmiştir.

Dini Referanslar: Hz. Muhammed'in (SAV) "Kıyamet kopuyor olsa bile eldeki fidanın dikilmesi" yönündeki tavsiyesi, Türk-İslam kültüründe ağaçlandırma faaliyetlerinin temel motivasyonu olmuştur.

Vakıf Kültürü ve Çevre: Osmanlı döneminde doğa koruma çalışmaları vakıflar aracılığıyla kurumsallaşmıştır. Su yollarının bakımı, göllerin temizlenmesi ve muhtaç hayvanların korunması (leylek vakıfları, kuş evleri) bu dönemdeki incelikli çevre anlayışının göstergeleridir (Bayer, 1966).

Şehir Planlaması ve Mimari: Osmanlı şehirleri, topoğrafyaya zarar vermeden, doğal dokuyu koruyacak şekilde inşa edilmiştir. Fatih Sultan Mehmet gibi hükümdarların "ormanlardan dal kesenlere" yönelik sert uyarıları, devletin korumacı tavrını simgeler (Koç 2005).

3.3. Cumhuriyet Dönemi ve Modern Doğa Koruma

Cumhuriyet'in ilanı ile birlikte doğa koruma çalışmaları daha modern ve yasal bir zemine taşınmıştır.

Atatürk'ün Liderliği: Mustafa Kemal Atatürk'ün Ankara'da Atatürk Orman Çiftliği'ni kurması ve Yalova gibi şehirlerde ağaçlandırma seferberliği başlatması, Cumhuriyet'in doğa politikasının temelini oluşturmuştur (Yörük 2016).

Sivil Toplum Kuruluşları: 1923'te kurulan Türkiye Seyyahin Cemiyeti (Turing) ve 1928'deki Ağaç Koruma Kurumu (Himaye-i Eşcar) gibi yapılar, doğayı tanıtma ve koruma bilincini topluma yaymak için çalışmıştır (İnal, 1949).
Yasal Çerçeve ve Statüler: Günümüzde doğa koruma, belirli alanların "korunan alan" statüsüne alınmasıyla yasal bir güvence kazanmıştır. 1870'lerde başlayan yasal düzenlemeler, Cumhuriyet döneminde daha kapsamlı mevzuatlara dönüşmüştür (Demirel, 2005).

4. Tartışma

Elde edilen bulgular, Türk toplumunun doğayla uyumlu yaşam ilkesinin tarih boyunca süreklilik gösterdiğini desteklemektedir. Sanayi Devrimi sonrası artan çevre sorunlarına rağmen, koruma yaklaşımının dinden ve gelenekten hukuka ve bilime evrildiği görülmektedir. Bu kültürel miras, modern çevre politikalarına özgün bir bakış açısı sunma potansiyeli taşımaktadır.

- İslamiyet Öncesi Dönem: Doğanın kutsal kabul edildiği, dağ, su ve ağaç kültü gibi inançlarla çevresel etiğin ritüellerle korunduğu belirlenmiştir.
- Osmanlı Dönemi: Dini sorumlulukların etkisiyle vakıf sistemi aracılığıyla (su yolları, koruluklar, hayvan barınakları) kurumsal ve yerel koruma pratiklerinin uygulandığı tespit edilmiştir.
- Cumhuriyet Dönemi: Doğa korumanın yasal düzenlemeler (Orman Kanunu) ve korunan alan statüleriyle (Milli Parklar) bilimsel ve yönetsel bir zemine oturtulmuştur.

5. Sonuç ve Öneriler

Çalışma, Türk doğa koruma kültürünün çok katmanlı ve zengin bir mirasa sahip olduğunu sonucuna varmaktadır. Gelecek çalışmalar için bu kültürel mirasın, günümüz çevre sorunları (tür kayıpları ve ekosistem daralmaları) bağlamında nasıl bir onarıcı ve sürdürülebilir model sunabileceği üzerine odaklanılması önerilmektedir.
Türk tarihi, doğayla kurulan saygı odaklı bir ilişkinin zengin örneklerini sunmaktadır. Geçmişten gelen "emanet" ve "kutsiyet" bilinciyle, günümüzün modern koruma yöntemleri harmanlanmalıdır. Doğal kaynakların sürdürülebilir yönetimi ve korunan alanların artırılması, bu kadim kültürün gelecek nesillere aktarılmasında kilit rol oynamaktadır.
Bu çalışma geçmişte Türklerde Doğa koruma kavramına bakış açışını ortaya koymaktadır. Sonraki çalışmalarda şimdi ve gelecekte neler yapılması gerektiği üzerine araştırmalar için Zemin hazırlaması açısından önemlidir.

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ERZURUM KENTİ HÜSEYİN AVNİ ULAŞ MAHALLESİ BATI YERLEŞKESİNİN KENTSEL DOKU VE PEYZAJ KALİTESİNİN SWOT ANALİZİ İLE DEĞERLENDİRMESİ

Ömer Faruk İş, Işık Sezen

Özet
Bu çalışmada; Erzurum kentinin yeni yerleşim alanlarından biri olan Hüseyin Avni Ulaş Mahallesi Batı Yerleşkesi'nin kentsel doku ve peyzaj kalitesi bakımından incelenmesi amaçlanmıştır. Araştırmanın materyalini Erzurum kenti Palandöken İlçesi sınırları içinde yer alan Hüseyin Avni Ulaş Mahallesi Batı Yerleşkesi oluşturmaktadır. Araştırmanın yöntem aşamalarını etüt, veri toplama, analiz ve değerlendirme oluşturmaktadır. İlk aşama olan etütte jeolojik ve topoğrafik yapı, bakı, güneşlenme, rüzgar yönü, çevre ile bağlantılar, yolların genişliği, meydanların, refüjlerin yeterliliği, bitkisel çeşitlilik, parkların konumu ve yeterliliği incelenmiş; ikinci aşamada kent, kentsel doku, peyzaj, peyzaj kalitesi kavramları üzerine literatür taraması yapılmış, dünyada kentsel doku ve peyzaj kalitesi üzerine yapılmış örnek çalışmalar incelenmiş, araştırma alanı ile ilgili kamu kurum ve kuruluşlarında bulunan harita ve veriler toplanmıştır. Üçüncü aşamada yeşil alan, kat, boşluk-doluluk, çevre, eğim, bakı, ulaşım analizleri yapılmıştır. Ayrıca araştırma alanının kentsel doku ve peyzaj kalitesini belirlemek için mimar, inşaat mühendisi, çevre mühendisi, peyzaj mimarı, şehir ve bölge planlamacı, iç mimarlardan oluşan 93 kişilik odak uzman gruba SWOT (Strenghts, Weaknesses, Opportunities ve Threats) Analizi uygulanmıştır. Yapılan analiz ile Hüseyin Avni Ulaş Mahallesi Batı Yerleşkesi'nin kentsel doku ve peyzaj kalitesi açısından güçlü ve zayıf yönler ile gelecekte oluşabilecek fırsatlar ve tehditlerin neler olabileceği uzman görüşüyle belirlenmeye çalışılmıştır. Anket verilerine SPSS programında istatiksel analizler yapılmıştır. Elde edilen bulgulara göre araştırma alanın en önemli avantajının sitelerin çoğunda kapalı otoparkın bulunması; en önemli dezavantajın yeni yapılan sitelerin çoğunda siteye ait yeşil alanın bulunmaması, yeşil alan olarak ayrılan ortak mekanların sert zeminle döşenmiş olması; en önemli fırsatın araştırma alanında yeni eğitim ve sağlık tesislerinin açılmasının yaşam kalitesini artırması; en önemli tehdidin ise yerleşkenin kurulduğu yerden fay hattının geçmesinden dolayı olası depremde risklerin artmasıdır. Araştırmanın sonucunda yerleşkede peyzaj kalitesi yönünden eksikler tespit edilmiş, alanın mevcut durumu, sorunları ve potansiyeli incelenerek, sürdürülebilir bir gelişim için öneriler sunulmuştur.
Anahtar Kelimeler: Kentsel Doku, Peyzaj, Peyzaj Kalitesi, Erzurum

EVALUATION OF URBAN TEXTURE AND LANDSCAPE QUALITY OF THE WEST CAMPUS OF HÜSEYİN AVNİ ULAŞ NEIGHBORHOOD IN ERZURUM CITY WITH SWOT ANALYSIS

Abstract
This study aims to examine the Hüseyin Avni Ulaş Neighborhood West Campus, one of the newest settlements in Erzurum, in terms of urban fabric and landscape quality. The research material consists of the Hüseyin Avni Ulaş Neighborhood West Campus, located within the boundaries of the Palandöken district of Erzurum. The methodological stages of the research consist of survey, data collection, analysis, and evaluation. In the first stage, the survey examined geological and topographic structure, aspect, insolation, wind direction, connections with the environment, road width, adequacy of squares and median strips, plant diversity, and the location and adequacy of parks. In the second stage, a literature review was conducted on the concepts of city, urban fabric, landscape, and landscape quality. Global exemplary studies on urban fabric and landscape quality were examined, and maps and data from public institutions and organizations related to the research area were collected. In the third stage, analyses were conducted on green space, floor area, void-occupancy, environment, slope, aspect, and transportation. Additionally, a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis was conducted on a focus group of 93 experts, including architects, civil engineers, environmental engineers, landscape architects, urban and regional planners, and interior designers, to determine the urban fabric and landscape quality of the Hüseyin Avni Ulaş Neighborhood West Campus. This analysis aimed to identify the strengths and weaknesses of the Hüseyin Avni Ulaş Neighborhood West Campus, along with potential future opportunities and threats, using expert opinion. Statistical analyses were conducted on the survey data using SPSS. The findings indicated that the most significant advantage of the research area is the availability of indoor parking in most of the housing complexes; the most significant disadvantage is the lack of green space in most newly constructed housing complexes, and the fact that common spaces designated as green spaces are paved with hard surfaces; the most significant opportunity is the potential for improved quality

of life through the opening of new education and healthcare facilities in the research area; and the most significant threat is the increased risk of earthquakes due to the fault line passing through the campus's location. As a result of the research, deficiencies in terms of landscape quality were identified in the campus, the current situation, problems and potential of the area were examined and suggestions for sustainable development were presented.
Keywords: Urban Texture, Landscape, Landscape Quality, Erzurum

1. Giriş / Introduction

Kent; toplumsal, siyasal, yönetsel ve ekonomik işlevlerin tüm bireyler için birlikte gerçekleştiği ortak kullanılan bir yaşam mekânıdır. Kent kavramı, kentte yaşayan bireyi kuşatan; birey ile kentsel çevre arasında karşılıklı ilişki ve etkileşimi içeren çok katmanlı bir yapıyı tanımlamaktadır (Hayta, 2016).

Doku, birbirine benzer ya da tamamlayıcı birim biçimlerin belirli bir düzen içinde bir araya gelmesiyle oluşan yapıyı tanımlar. Kent dokusu, yapılı çevreyi oluşturan binalar ile açık alanlar arasındaki mekânsal ilişkilerin; bu ilişkilerin ölçek, oran ve düzen özellikleri çerçevesinde değerlendirilmesiyle tanımlanan bir kavramdır (Ocakçı, 2012; Altaban, 2013; Erkan, 2015)

Peyzaj, kelime anlamı olarak görünüm, manzara anlamlarına gelir. Fransızcadan dilimize geçmiştir. Peyzaj, İnsanlar tarafından algılandığı şekliyle, karakteri doğal ve/veya beşerî unsurların karşılıklı etkileşimi ve birikimli etkileri sonucunda biçimlenen bir mekân olarak tanımlanmaktadır.

Peyzaj çeşitli gruplara ayrılmıştır. Bunlar doğal peyzaj ve kültürel peyzajdır.

Doğal Peyzaj : Doğal peyzaj, insan etkisinin bulunmadığı ya da çok sınırlı olduğu, doğal süreçlerin belirlediği dengeler doğrultusunda oluşan bütüncül bir çevresel yapıyı tanımlar.

Kültürel Peyzaj : Doğal çevre unsurlarının insan müdahalesiyle dönüştürülerek işlevsel ve mekânsal nitelik kazandığı alanlar kültürel peyzajı oluşturmakta; bu peyzajlar, ortaya çıkan kullanım biçimleri doğrultusunda farklı adlandırma ve sınıflandırmalara tabi tutulmaktadır (Uslu, 2003 ; Yazgan, 2003)

Peyzaj kalitesi, bir alanın fiziksel, biyofiziksel ve görsel özelliklerinin, estetik bütünlük ve mekânsal uyum açısından değerlendirilmesini ifade eden çok boyutlu bir kavramdır. Bu değerlendirme, peyzajın mevcut karakterinin belirlenmesine ve planlama–tasarım süreçlerinde sürdürülebilir kararların geliştirilmesine temel oluşturmaktadır (Asur, 2018).

Araştırmanın Amacı

Bu çalışmada; Erzurum kentinin yeni yerleşim alanlarından biri olan Hüseyin Avni Ulaş Mahallesi Batı Yerleşkesi'nin kentsel doku ve peyzaj kalitesi bakımından incelenmesi amaçlanmıştır.

2. Yöntem / Methodology

Araştırmanın yöntem aşamalarını etüt, veri toplama, analiz ve değerlendirme oluşturmaktadır. İlk aşama olan etütte jeolojik ve topoğrafik yapı, bakı, güneşlenme, rüzgar yönü, çevre ile bağlantılar, yolların genişliği, meydanların, refüjlerin yeterliliği, bitkisel çeşitlilik, parkların konumu ve yeterliliği incelenmiş; ikinci aşamada kent, kentsel doku, peyzaj, peyzaj kalitesi kavramları üzerine literatür taraması yapılmış, dünyada kentsel doku ve peyzaj kalitesi üzerine yapılmış örnek çalışmalar incelenmiş, araştırma alanı ile ilgili kamu kurum ve kuruluşlarında bulunan harita ve veriler toplanmıştır. Üçüncü aşamada yeşil alan, kat, boşluk-doluluk, çevre, eğim, bakı, ulaşım analizleri yapılmıştır. Ayrıca araştırma alanının kentsel doku ve peyzaj kalitesini belirlemek için mimar, inşaat mühendisi, çevre mühendisi, peyzaj mimarı, şehir ve bölge planlamacı, iç mimarlardan oluşan 93 kişilik odak uzman gruba SWOT (Strenghts, Weaknesses, Opportunities ve Threats) Analizi uygulanmıştır. Yapılan analiz ile Hüseyin Avni Ulaş Mahallesi Batı Yerleşkesi'nin kentsel doku ve peyzaj kalitesi açısından güçlü ve zayıf yönler ile gelecekte oluşabilecek fırsatlar ve tehditlerin neler olabileceği uzman görüşüyle belirlenmeye çalışılmıştır. Anket verilerine SPSS programında istatiksel analizler yapılmıştır.

3. Bulgular / Findings

Araştırma alanının kentsel doku ve peyzaj kalitesini belirlemek için uygulanmış olan SWOT Analizi anketinin ana kütle büyüklüğünü Erzurum kentinde aktif olarak özel şirkette ve kamu kurumlarında çalışan mimar, inşaat mühendisi, çevre mühendisi, peyzaj mimarı, şehir ve bölge planlamacı, iç mimarlar oluşturmuştur. Meslek odaları, kamu kurumları, üniversiteler, özel sektörlerle iletişime geçilmiş ve yaklaşık olarak 3500 uzmanın olduğu tespit edilmiştir. Bu durumda ana kütle büyüklüğü 400'dür. Anket uygulanacak olan örneklem

büyüklüğünün saptanmasında İslamoğlu (2003), Özdamar (2003), Büyüköztürk vd (2008) ve Yazıcıoğlu (2004)'nun kullandığı basit tesadüfi örnekleme yöntemi kullanılmıştır.
Örnekleme büyüklüğünün saptanmasında kullanılan formül aşağıdaki gibidir:

$$n = \frac{Z^2 NPQ}{ND^2 + Z^2 PQ}$$

n = Örnek Büyüklüğü
Z = Güven katsayısı (1,96)
P = Ölçülmek istenen özelliğin kitle bulma ihtimali (%95 = 0,95)
Q = 1-P (0,05)
D= Kabul edilen örnekleme hatası (%5= 0,05)
N = Ana kütle büyüklüğü (3500)

Örnekleme büyüklüğünün saptanmasında kullanılan formül aşağıdaki gibidir:

$$n = \frac{(1{,}96)^2 . 3500.0{,}95.0{,}05}{3500.(0{,}05)^2 + (1{,}96)^2 0{,}95.0{,}05}$$

Çalışma kapsamında veriler yukarıdaki formüle yerleştirildiğinde %95 güven aralığında toplam örneklem büyüklüğü (n=72) olarak belirlenmiştir. Anket 72'den fazla kişiye uygulanmış 93 kişinin değerlendirmesi dikkate alınmıştır.

Tablo 1. Ankete katılanların demografik özellikleri

Demografik Özellikler	Değişkenler	N	Yüzde (%)
Cinsiyet	Kadın	43	%36,56
	Erkek	50	%63,44
Yaş Dağılımı	22-35	50	%53,76
	36-45	31	%33,33
	46-55	12	%12,90
	56-65	0	%0
	66 ve üstü	0	%0
Medeni Durum	Evli	55	%59,14
	Bekar	38	%40,86
Eğitim Düzeyi	Okur-yazar değil	0	%0
	İlkokul	0	%0
	Ortaokul	0	%0
	Lise	0	%0
	Ön Lisans	2	%2,15
	Lisans	42	%45,16
	Yüksek Lisans	25	%26,88
	Doktora	24	%25,80
Çalıştığı Kurum	Kamu	69	%74,20
	Özel Sektör	24	%25,80
Meslek	Mimarl	22	%23,65
	Peyzaj Mimarı	24	%25,80
	ŞBP	4	%4,30
	İnşaat Mühendisi	22	%23,65
	Harita Mühendisi	5	%5,37
	Çevre Mühendisi	3	%3,22
	Elektrik Mühendisi	12	%12,90
	Jeoloji Mühendisi	1	%1,07

Tablo 1'de görüldüğü gibi ankete katılanların %36,56'sı kadın, %63,44'ü erkek; %53,76'sı 22-35 yaş, %33,33'ü 36-45, %12,90'I 46-55 yaş aralığında; %59,14'ü evli, %40,86'sı bekar; %2,15'i ön lisans, %45,16'sı lisans, %26,88'i yüksek lisans, %25,80'i doktora mezunudur.

Tablo 2. Uzmanlara göre araştırma alanının kentsel doku ve peyzaj kalitesi yönünden avantajları

AVANTAJLAR		Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum	Ortalama Puan
	N	Kişi (%)	Kişi (%)	Kişi (%)	Kişi (%)	Kişi (%)	
Palandöken Dağı'na yakınlığı ile bilinen bir mahalle olması, doğal güzellikler ve kış sporlarına erişim imkanı sunar.	93	4 (%4,3)	11 (%11,8)	16 (%17,2)	45 (%48,4)	17 (%18,3)	4
Şehir merkezine yakın bir konumda yer alması, ulaşım açısından avantaj sağlar.	93	2 (%2,15)	7 (%7,53)	6 (%6,45)	56 (%60,2)	22 (%23,7)	3,92
Bölgede bulunan okullar, ailelerin çocuklarını yakın çevrede okutabilme imkanı sunar.	93	2 (%2,15)	9 (%9,68)	5 (%5,38)	60 (%64,5)	17 (%18,3)	3,87
Yeni inşa edilen binalar ve konut projeleri, modern bir yaşam alanı sunar.	93	4 (%4,3)	14 (%15,1)	19 (%20,4)	37 (%29,8)	19 (%20,4)	3,51
Şehrin diğer bölgelerine göre alanın havası daha temizdir. Yeni yapılarda kullanılan yalıtım ve yakıt türleri havanın daha temiz olmasını sağlamaktadır.	93	4 (%4,3)	7 (%7,53)	11 (%11,8)	50 (%53,8)	21 (%22,6)	3,82
Şehir hastanesine yakınlığı büyük bir avantajdır.	93	1 (%1,08)	6 (%6,45)	6 (%6,45)	51 (%54,8)	29 (%31,2)	4,07
Üniversiteye yakın olması büyük bir avantajdır.	93	2 (%2,15)	5 (%5,38)	5 (%5,38	54 (%58,1)	27 (%29)	4,06
Yeni bir yerleşim alanı olduğu için kafe, restoran ve diğer ticaret alanlarının açılması ile hem yakın çevresindeki mahallelere hizmet sunması, hem de üniversite öğrencileri için yeni bir sosyal mekan oluşturması bir avantajdır.	93	2 (%2,15)	5 (%5,38)	5 (%5,38)	53 (%57)	28 (%30,1)	4,08
Erzurum kenti soğuk bir iklime sahip olduğu için kapalı otopark önemli bir zorunluluktur. Sitelerin çoğunun kapalı otaparkının bulunması büyük bir avantajdır.	93	2 (%2,15)	2 (%2,15	2 (%2,15)	33 (%35,5)	54 (%58,1)	4,45

Tablo 2'de görüldüğü gibi uzmanlara göre araştırma alanın en önemli avantajı olarak 4,45 ortalama puan ile; Erzurum kentininin soğuk bir iklime sahip olmasından dolayı kapalı otopark önemli bir zorunluluk olduğu için sitelerin çoğunun kapalı otoparkının bulunmasıdır.

Tablo 3. Uzmanlara göre araştırma alanının kentsel doku ve peyzaj kalitesi yönünden dezavantajları

DEZAVANTAJLAR	Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum	Ortalama Puan
Yeni yerleşim alanı olduğu için altyapı çalışmalarında eksiklikler ve yetersizliklerin olması bir dezavantajdır.	0 (%0)	8 (%8,6)	13 (%14)	49 (%52,7)	23 (%24,7)	3,93
Parklar, spor alanları ve kültürel tesislerin azlığı bir dezavantajdır.	2 (%2,15)	8 (%8,6)	12 (%12,9)	36 (%38,7)	35 (%37,6)	4,02
Fay hattı üzerinde olduğu için binaların çok yüksek katlı yapılması bir dezavantajdır.	2 (%2,15)	8 (%8,6)	7 (%7,53)	32 (%34,4)	44 (%47,3)	4,16
Yeni yapılan sitelerin çoğunda siteye ait yeşil alan bulunmamaktadır. Yeşil alan olarak ayrılan ortak mekanlar sert zeminle döşenmiştir. Site sakinlerinin kullanabileceği yeşil alanların olmaması dezavantajdır.	1 (%1,08)	5 (%5,38)	4 (%4,3)	31 (%33,3)	52 (%55,9)	4,37
Sitelerin çoğunun kapalı otoparkı bulunduğu için açık otopark kullanımına yer verilmemiştir. Kısa süreli parklar için araçlar site içine giremediği için site dışına cadde boyunca arabalarını park etmek zorunda kalması bir dezavantajdır.	3 (%3,23)	7 (%7,53)	11 (%11,8)	35 (%37,6)	37 (%39,8)	4,03
Sitelerin çoğunda bina ana giriş kapısının önüne araç girişi imkanı olmadığı için acil durumlarda ambulans girişi de engellenmiş olmaktır. Site içindeki bina girişlerine acil durumlarda araçların yaklaşamaması bir dezavantajdır.	2 (%2,15)	2 (%2,15)	9 (%9,68)	32 (%34,4)	48 (%51,6)	4,31
Yeni yerleşim alanı olduğu için fazla toplu taşıma hattının olmaması bir dezavantajdır.	1 (%1,08)	6 (%6,45)	11 (%11,8)	42 (%45,2)	33 (%35,5)	4,07
Konut fiyatlarının çok yüksek olması bir dezavantajdır.	2 (%2,15)	6 (%6,45)	9 (%9,68)	36 (%38,7)	40 (%43)	4,13
Hüseyin Avni Ulaş Mahallesi Batı Yerleşkesi'nin ana caddesine Çat yolundan bağlantı sağlayan ana kavşaktan sonraki ilk kavşağın çapının çok büyük olması trafik güvenliği açısından dezavantaj oluşturmaktadır.	4 (%4,3)	6 (%6,45)	20 (%21,5)	37 (%39,8)	26 (%28)	3,80
Sağlık Ocağı'nın olmaması bir dezavantajdır.	4 (%4,3)	6 (%6,45)	6 (%6,45)	46 (%49,5)	31 (%33,3)	4,01
Yapılaşmanın yeni olmasından dolayı inşaatlar devam ederken çeşitli güvenlik sorunlarının olması bir dezavantajdır.	1 (%1,08)	4 (%4,3)	5 (%5,38)	54 (%58,1)	29 (%31,2)	4,13

Tablo 3'de görüldüğü gibi uzmanlara göre en önemli dezavantaj 4,37 ortalama puan ile yeni yapılan sitelerin çoğunda siteye ait yeşil alan bulunmaması, yeşil alan olarak ayrılan ortak mekanların sert zeminle döşenmiş olması, site sakinlerinin kullanabileceği yeşil alanların olmamasıdır.

Tablo 4. Uzmanlara göre araştırma alanının kentsel doku ve peyzaj kalitesi yönünden fırsatları

FIRSATLAR	Kesinlikle Katılmıyorum	Katılmıyorum	Karasızım	Katılıyorum	Kesinlikle Katılıyorum	Ortalama Puan
Palandöken Dağı'nın yakınlığı kış turizmi ve doğa turizmi için yerleşkenin tercih edilmesinde fırsat sunmaktadır.	4 (%4,3)	20 (%21,5	28 (%30,1)	29 (%31,2)	12 (%12,9)	3,26
Gelişmekte olan bir bölge olmasından dolayı gayrimenkul ve ticari yatırımlar için fırsat olmaktadır.	2 (%2,15)	8 (%8,6)	11 (%11,8)	54 (%58,1)	18 (%19,4)	3,83
Yeni konut projeleri ve altyapı yatırımları, bölgenin cazibesini artırması yerleşkenin tercih edilmesinde fırsat oluşturmaktadır.	2 (%2,15)	6 (%6,45)	13 (%14)	54 (%58,1)	18 (%19,4)	3,86
Yeni eğitim ve sağlık tesislerinin açılması, yaşam kalitesini artırmaya yönelik bir fırsattır.	2 (%2,15)	4 (%4,3)	2 (%2,15)	58 (%62,4)	27 (%29)	4,11
Şehir Hastanesi ve Atatürk Üniversitesi'ne, birçok eğitim kurumuna yakın olması yerleşkenin tercih edilmesinde önemli bir fırsat oluşturmaktadır.	2 (%2,15)	5 (%5,38)	11 (%11,8)	51 (%54,8)	24 (%25,8)	3,97

Tablo 4'de görüldüğü gibi uzmanlara göre en önemli fırsat 4,11 ortalama puan ile araştırma alanında yeni eğitim ve sağlık tesislerinin açılmasının yaşam kalitesini artırmasıdır.

Tablo 5. Uzmanlara göre araştırma alanının kentsel doku ve peyzaj kalitesi yönünden tehditler

TEHDİTLER	Kesinlikle Katılmıyorum	Katılmıyorum	Karasızım	Katılıyorum	Kesinlikle Katılıyorum	Ortalama Puan
Hızlı yapılaşma ve sanayi faaliyetlerinin olması çevrenin kirlenmesinde tehdit oluşturmaktadır.	2 (%2,15)	9 (%9,68)	15 (%16,1)	43 (%46,2)	24 (%25,8)	3,83
Altyapı ve hizmetlerde yaşanabilecek gecikmeler yerleşkenin gelişmesini tehdit etmektedir.	2 (%2,15)	9 (%9,68)	15 (%16,1)	43 (%46,2)	24 (%25,8)	3,83
Yerleşkenin kurulduğu yerden fay hattının geçiyor olması deprem açısından önemli bir tehdit oluşturmaktadır.	2 (%2,15)	4 (%4,3)	8 (%8,6)	40 (%43)	39 (41,9)	4,18
Yerleşleşkenin kurulduğu yerden fay hattı geçtiği için binaları çok yüksek katlı tasarlanması önemli bir tehdit unsurudur.	2 (%2,15)	8 (%8,6)	19 (%20,4)	32 (%34,4)	32 (%34,4)	3,90
Erzurum kentinin hakim rüzgar yönü güney batıdır. Yerleşke kentin güney batısına kurulmuştur ve binaların kat yüksekliği fazla olduğu için hakim rüzgar akışı engellenmektedir. Kış aylarında hakim rüzgar yüksek binalar tarafından engellendiği için kirli hava kent merkezinde yığılıp kalmakta uzaklaşamamaktadır. Yerleşkede binaların yüksek katlı tasarlanması kış	4 (%4,3)	6 (%6,45)	6 (%6,45)	46 (%49,5)	31 (%33,3)	4,01

aylarında Erzurum kent merkezinin havasının daha kirli olması için tehdit oluşturmaktadır.						

Tablo 5'de görüldüğü gibi uzmanlara göre en önemli tehdit 4,18 ortalama puanla yerleşkenin kurulduğu yerden fay hattının geçiyor olmasının deprem açısından önemli bir tehdit oluşturmasıdır.
Anket uygulanan uzman kişilerin demografik özellikleri ile uzman değerlendirmeleri arasındaki ilişkiyi belirlemek için cinsiyet ve medeni durum için T Testi, eğitim düzeyi ve meslek için ANOVA Testi yapılmıştır. Cinsiyet ile tüm uzman değerlendirmeleri arasındaki ilişki önemsiz bulunmuştur. Yaş, medeni durum, eğitim düzeyi ve meslek ile arasında önemli ve çok önemli ilişkisi olan uzman değerlendirmeleri Tablo 6'da verilmiştir.

Tablo 6. Anket uygulan uzman kişilerin demografik özellikleri ile uzman değerlendirmeleri arasındaki ilişki

Demografik Özellikler	Uzman Değerlendirmeleri	Sig. (P Değeri)
Yaş	Yeni bir yerleşim alanı olduğu için kafe, restoran ve diğer ticaret alanlarının açılması ile hem yakın çevresindeki mahallelere hizmet sunması, hem de üniversite öğrencileri için yeni bir sosyal mekan oluşturması bir avantajdır.	0,043*
	Yeni yerleşim alanı olduğu için altyapı çalışmalarında eksiklikler ve yetersizliklerin olması bir dezavantajdır.	0,015*
	Yapılaşmanın yeni olmasından dolayı inşaatlar devam ederken çeşitli güvenlik sorunlarının olması bir dezavantajdır.	0,003**
	Gelişmekte olan bir bölge olmasından dolayı gayrimenkul ve ticari yatırımlar için fırsat olmaktadır.	0,035*
	Şehir Hastanesi ve Atatürk Üniversitesi'ne, birçok eğitim kurumuna yakın olması yerleşkenin tercih edilmesinde önemli bir fırsat oluşturmaktadır.	0,025*
	Hızlı yapılaşma ve sanayi faaliyetlerinin olması çevrenin kirlenmesinde tehdit oluşturmaktadır.	0,017*
	Altyapı ve hizmetlerde yaşanabilecek gecikmeler yerleşkenin gelişmesini tehdit etmektedir.	0,016*
	Yerleşkenin kurulduğu yerden fay hattının geçiyor olması deprem açısından önemli bir tehdit oluşturmaktadır.	0,033*
Medeni Durum	Yeni yerleşim alanı olduğu için altyapı çalışmalarında eksiklikler ve yetersizliklerin olması bir dezavantajdır.	0,015*
	Sitelerin çoğunun kapalı otoparkı bulunduğu için açık otopark kullanımına yer verilmemiştir. Kısa süreli parklar için araçlar site içine giremediği için site dışına cadde boyunca arabalarını park etmek zorunda kalması bir dezavantajdır.	0,014*
	Yeni yerleşim alanı olduğu için fazla toplu taşıma hattının olmaması bir dezavantajdır.	0,013*
	Yapılaşmanın yeni olmasından dolayı inşaatlar devam ederken çeşitli güvenlik sorunlarının olması bir dezavantajdır.	0,032*
	Hızlı yapılaşma ve sanayi faaliyetlerinin olması çevrenin kirlenmesinde tehdit oluşturmaktadır.	0,002**
	Yerleşleşkenin kurulduğu yerden fay hattı geçtiği için binaları çok yüksek katlı tasarlanması önemli bir tehdit unsurudur.	0,011*
Eğitim Düzeyi	Palandöken Dağı'na yakınlığı ile bilinen bir mahalle olması, doğal güzellikler ve kış sporlarına erişim imkanı sunar.	0,028*
	Yeni yerleşim alanı olduğu için altyapı çalışmalarında eksiklikler ve yetersizliklerin olması bir dezavantajdır.	0,008**
Meslek	Şehir merkezine yakın bir konumda yer alması, ulaşım açısından avantaj sağlar.	0,028*
	Üniversiteye yakın olması büyük bir avantajdır.	0,046*
	Yeni yerleşim alanı olduğu için altyapı çalışmalarında eksiklikler ve yetersizliklerin olması bir dezavantajdır.	0,028*
	Hızlı yapılaşma ve sanayi faaliyetlerinin olması çevrenin kirlenmesinde tehdit oluşturmaktadır.	0,024*

*Önemli ($p<0,05$) **Çok Önemli ($p<0,01$)

4. Tartışma / Discussion

Erzurum kentininin soğuk bir iklime sahip olmasından dolayı kapalı otopark önemli bir zorunluluk olduğu için araştırma alanında sitelerin çoğunun kapalı otoparkının bulunması en önemli avantaj olarak uzmanlar tarafından belirlenmiştir. Nitekim Hasanov ve Dursun (2024) Erzurum'da yeni gelişmekte olan alanlar için imar planlarında tanımlanmış olan yapılaşma koşullarının ve kentsel gelişme dinamiklerinin soğuk iklim şartları ile uyumluluğunun belirlenmesi ve iklime uygun kentsel tasarım modelleri uygulanması durumunda ortaya çıkacak mekânsal farklılıklarının tespit etmek için yaptıkları araştırmada karasal iklim koşullarına uygun bir kentsel tasarım ile iklim ve kentsel çevre arasındaki uyumsuzlukların giderilebileceği ve yaşam kalitesinin artırılabileceğini belirtmişlerdir. Bu bağlamda Erzurum'un batı koridorundaki gelişme alanlarından Yıldızkent semtinin yeni gelişen bölgelerinde otopark alanlarının genel olarak yeraltı bodrum katlarında tasarlandığını belirtmişlerdir.

Araştırma alanında yapılan sitelerin çoğunda siteye ait yeşil alan bulunmaması, yeşil alan olarak ayrılan ortak mekanlar sert zeminle döşenmiş olması, site sakinlerinin kullanabileceği yeşil alanların olmaması en önemli dezavantaj olarak değerlendirilmiştir. Tanrıkulu ve Aytuğ (2025)'a göre konut ve çevresinin fiziksel yapısının, toplumda değişen yaşam tarzları, teknolojik ilerlemeler, sosyal ihtiyaçlar ve çevre duyarlılığı gibi yeni dinamiklerle uyumlu hale getirilmesi; yeşil alanlara yakınlık, mahremiyetin korunması ve sosyalleşme fırsatlarının sunulması gibi mekânsal özelliklerin sağlanması, bireylerin yaşam memnuniyetini artırmakta, mutluluğunu pekiştirmekte ve bütüncül iyi oluş haline olumlu katkılar sunmaktadır (Çetin ve Karafakı, 2021; Petermans ve Pohlmeyer, 2014).

Araştırma alanında yeni eğitim ve sağlık tesislerinin açılmasının yaşam kalitesini artırması en önemli fırsat olarak değerlendirilmiştir. Nitekim Okumuş (2014)'e göre kentsel yaşam kalitesi ve kamusal alanlar bağlamında, sürdürülebilir kentsel dönüşüm projeleri ortaya koyabilmek adına artan nüfus yoğunluğuna karşın, kişilerin temel ihtiyaçlarını karşılayabilecek fonksiyonlara yer verilmeli; sosyal donatı alanlarına ilişkin standartlara uyulmalı; mevcut kullanıcı profili dikkate alınmalıdır.

Uzman değerlendirmelerine göre; yerleşkenin kurulduğu yerden fay hattının geçiyor olmasının deprem açısından önemli bir tehdit oluşturmaktadır. Gökçe vd. (2014)'e göre özellikle yerleşim alanlarının planlanması konusunda bölgede bulunan aktif fayların belirlenmesi büyük önem arz etmektedir.

5. Sonuç ve Öneriler / Conclusion and Recommendations

Erzurum kentinin yeni yerleşim alanlarından biri olan Hüseyin Avni Ulaş Mahallesi Batı Yerleşkesi'nin kentsel doku ve peyzaj kalitesi bakımından incelenmesi amacıyla gerçekleştirilen SWOT analizinde değerlendirmeye katılan uzmanların da belirttiği gibi soğuk iklime sahip yerleşimlerde kapalı otoparkların bulunması önemli avantajdır. Bu bağlamda yeni yerleşim alanlarında kapalı otoparklara yer verilmesi büyük bir zorunluluktur.

Yeni yerleşim alanlarında yeşil alanlara yer verilmeli, fazla sert zemin kullanımından kaçınılmalıdır. Konut ve çevrelerinde yeşil alanların varlığı bireylerin yaşam memnuniyetini artırmakta, mutluluğunu pekiştirmektedir.

Yeni yerleşim alanlarında kentsel yaşam kalitesini artırmak için eğitim ve sağlık tesislerinin kurulması önem arzetmektedir.

Yei yerleşkelerin kurulacağı yerlerde planlanma aşamasında bölgede bulunan aktif fayların belirlenmesi gerekmektedir.

Dipnot

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PEYZAJ MİMARLIĞI GÖRSEL KALİTE ANALİZİNDE: EYE TRACKİNG

Sena Nur Angın

Özet
Peyzaj mimarının görevi ekolojik ilkeler doğrultusunda, kullanıcının refah ve yaşam kalitesini arttıran mekânlar tasarlamaktır. Bu mekânları tasarlarken en önemli değerlendirme kriterlerinden biri mekânın görsel kalitesi ve estetik algısıdır. Bu doğrultuda, tasarlanan mekânların kullanıcı tarafından nasıl algılandığını nesnel ve derinlemesine değerlendirmek, peyzaj mimarlığı araştırmalarında giderek daha kritik bir gereklilik haline gelmektedir; çünkü mekânın görsel okunabilirliği ve peyzajın algısal bileşenleri, kullanıcıların duygusal tepkilerini etkileyen bir faktördür. Geleneksel yöntemler, anket ve görüşmeler yoluyla insan algısını ölçmeye çalışsa da, bireyin bilinçaltı düzeydeki fizyolojik dikkat süreçlerini belirlemede yetersiz kalmaktadır. Bu kısıtlılıklar, tasarımın kullanıcı deneyimi üzerindeki etkisini anlamayı güçleştirmektedir. Teknolojinin gelişmesi ile birlikte Eye tracking (Göz izleme) gibi nörobilim tabanlı cihazlarla kullanıcıların mekân üzerindeki görsel dikkatini ve odaklanma sürelerini objektif olarak değerlendirme fırsatı sunmuştur. Eye tracking, kişinin göz hareketlerini izlememize olanak sağlayan; odaklanma, bakış sürelerini kaydeden, fizyolojik tepkilerini ölçmemize yarayan nörobilim tabanlı bir araçtır. Cihaz sayesinde kişinin/katılımcının mekâna bakarken hangi unsura ne kadar süreyle baktığını; fiksasyon ve göz hareketleri ile tespit edilebilmektedir. Tasarımın estetik ve fonksiyonel boyutlarının analiz edilmesini mümkün kılmaktadır. Bu sayede subjektif kavramların arkasındaki mekanizmanın anlaşılmasını sağlar. Böylelikle peyzaj mimarlığında kullanılan sürprizli, çekici, vurgu, yönlendirme gibi tasarım kurgularının kullanıcıda beklenen hissi oluşturup oluşturmadığının tespitinde Eye tracking kullanılarak değerlendirilebilecektir. Tasarımın erken süreçlerinde kullanıcıların tepkilerinin ölçülmesi ve belirlenmesi projeyi güçlü hale getirerek kişinin sevdiği, beğendiği mekâna ulaşmasına imkân sunacaktır. Aynı zamanda peyzaj mimarlığı, kentsel tasarım vb. öğrenci eğitimlerinde; tasarımın algısal etkisini somut olarak görmek, geleceğin tasarımcılarının vizyonunu geliştireceği düşünülmektedir. Bu çalışma Eye tracking teknolojisinin peyzaj mimarlığı alanındaki potansiyelini ortaya koymayı, mevcut tasarım pratiği ile eğitimine dair yenilikçi bir bakış açısı getirmeyi hedeflemektedir.
Anahtar Kelimeler: Eye Tracking, Peyzaj Mimarlığı, Görsel Algı, Görsel Kalite

Eye Tracking in Landscape Architecture Visual Quality Analysis

Abstract
The task of a landscape architect is to design spaces that enhance the well-being and quality of life of the user in accordance with ecological principles. One of the most important evaluation criteria when designing these spaces is their visual quality and aesthetic perception. Accordingly, objectively and in-depth evaluating how users perceive the designed spaces is becoming an increasingly critical requirement in landscape architecture research; because the visual readability of the space and the perceptual components of the landscape are factors that influence users' emotional responses. Although traditional methods attempt to measure human perception through surveys and interviews, they are insufficient in determining the subconscious physiological attention processes of the individual. These limitations make it difficult to understand the impact of design on user experience. With the development of technology, neuroscience-based devices such as Eye tracking have provided an opportunity to objectively evaluate users' visual attention and focus durations on a space. Eye tracking is a neuroscience-based tool that allows us to track a person's eye movements; it records focus and gaze durations, and helps us measure physiological responses. Thanks to the device, it is possible to determine which element the person/participant looked at and for how long while looking at the space; It can be detected through fixation and eye movements. This makes it possible to analyze the aesthetic and functional dimensions of the design. This allows for an understanding of the mechanisms behind subjective concepts. Thus, Eye tracking can be used to evaluate whether design elements used in landscape architecture—such as surprising, attractive, emphatic, and directional elements—create the expected feeling in the user. Measuring and determining user reactions in the early stages of design strengthens the project, enabling individuals to access spaces they like and appreciate. Furthermore, it is believed that in landscape architecture, urban design, and similar fields of study, concretely observing the perceptual impact of design will enhance the vision of future

designers. This study aims to reveal the potential of Eye tracking technology in the field of landscape architecture and to bring an innovative perspective to existing design practice and education.
Keywords: Eye Tracking, Landscape Architecture, Visual Perception, Visual Quality

1. GİRİŞ

Yoğun kentleşme süreci ve artan yapılaşma, kentsel mekânların görsel niteliğini ve algısal değerlerini olumsuz yönde etkilemektedir. Bu durum, nitelik açıdan yetersiz kentsel çevrelerin, kullanıcıların mekânla kurduğu ilişkiyi zayıflatmakta ve mekânsal aidiyet duygusunun kaybolmasına neden olmaktadır.

Mekân kavramı, ele alındığı disiplin veya ölçeğe bakılmaksızın merkezinde insan faktörünün olduğu bir kavramdır. İnsan odaklı tasarım yaklaşımları, kişinin mekâna aidiyet hissini arttırmayı amaçlar ve bu durum mekân kalitesini etkiler. Bu kaliteyi etkileyen pek çok unsur vardır; bu unsurlar arasında "peyzaj tasarım" yalnızca biri olmasına rağmen dikkatle ele alınması gereken kritik bir faktördür (Angın 2022).

Bu bağlamda; mekân kalitesini ve kullanıcı deneyimini doğrudan etkileyen peyzaj tasarımı, insan odaklı yaklaşımın somut bir yansıması olarak öne çıkmaktadır. Ayrıca kentsel çevrede estetik, ekolojik, işlevsellik ve algısal değerlerin bütünleşmesini sağlamaktadır. Çünkü peyzaj mimarlığı, ekolojik ilkeler doğrultusunda insan-doğa etkileşimini gözeten, kullanıcıların refahını ve yaşam kalitesini artırmayı amaçlayan mekanlar tasarlamayı hedefleyen bir alan ve meslek disiplinidir. Bu bağlamda peyzaj tasarımı sadece işlevsel ve ekolojik gereklilikleri karşılamakla sınırlı değildir. Aynı zamanda kullanıcıların mekanla kurduğu görsel, estetik ve algısal ilişkiyi de şekillendirmektedir.

Görsel algının insan algısının çeşitli türleri içerisinde yaklaşık %80'inini oluşturduğu belirtilmiştir (Gholami vd. 2021, Guo vd. 2021, Zhou vd. 2023). Bu durum peyzajın görsel niteliğinin önemli olduğunu ortaya koymaktadır. Ayrıca peyzaj görsel kalitesinin fiziksel ve psikolojik iyileşme sağladığı, doğa koruma, planlama ve yönetim içinde önemli olduğu ifade edilmektedir (Li vd. 2022, Jovanovska vd. 2020, Jahani ve Saffariha 2020, Zhou vd. 2023). Bu nedenle, peyzaj mimarlığında görsel kalite ve estetik algı, tasarım sürecinin temel değerlendirme kriterlerinden biri olarak öne çıkmaktadır.

Görsel kalite; peyzajın biçimsel özellikleri, mekânsal organizasyonu, doğal ve yapay elemanları, doğal ve yapay eleman kompozisyonlarını vb. unsurların- kavramların kullanıcı üzerindeki algısal ve duyusal etkilerini kapsayan kavramdır. Başka bir ifade ile; planlama, yönetim ve tasarım çalışmalarında peyzajın farklı görsel özellikleri hakkında değerlendirme ve envanter analizlerini içeren bir kavramdır (Ak 2010; Asur ve Alphan 2018, Angın 2022).

Görsel kalite değerlendirmeleri peyzaj mimarlığında genellikle anketler ve görüşmeler yoluyla yapılmaktadır. Görsel kalite değerlendirmelerinin; bireyin eğitim ve sosyo-kültürel yapıları, psikolojik durumları, mekânsal deneyimleri ile iklim gibi çevresel koşullara bağlı olarak değişkenlik gösterebildiği ifade edilmektedir (Acar 2003, Ak 2010, Angın 2022). Daniel (2001) ise görsel kaliteyi bireyin algısal, bilişsel ve duyusal süreçlerinin peyzajın görünen özellikleriyle etkileşimi sonucu oluşan bir yapı olarak belirtmiştir (Özhancı 2014, Angın 2022). Kalın (2004) ise bu çok değişkenli yapı nedeniyle görsel kalitenin hem algısal hem de nesnel boyutlar içerdiğini belirtmektedir (Ak 2010, Angın 2022).

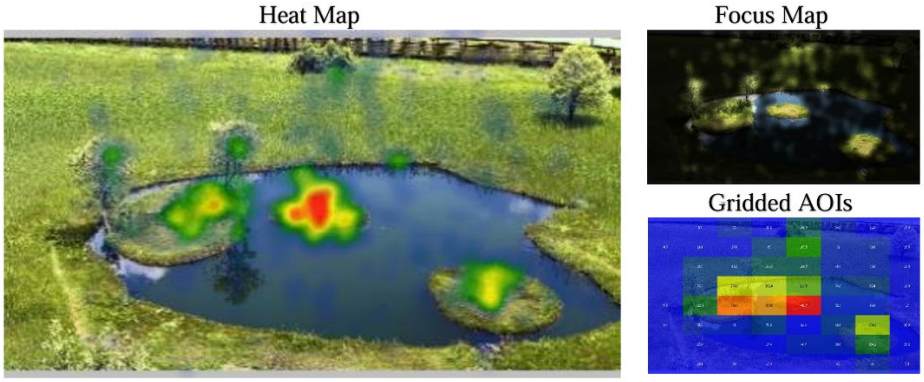
Görsel kalite değerlendirmelerinin öznel ve bağlamsal değişkenliklerden etkilenmesi, kullanıcıların görsel dikkat ve algı davranışlarını doğrudan ortaya koyabilen nesnel ölçümlere ihtiyacı arttırmaktadır. Teknolojinin gelişmesi ile birlikte Eye Tracking (Göz izleme) gibi nörobilim tabanlı cihazlar önemli bir değerlendirme aracı olarak ortaya çıkmaktadır.

2. Eye tracking (Göz İzleme)

"Gözler kalbin aynasıdır" ve "Gözler yalan söylemez" gibi ifadeler, bireyin bilişsel süreçlerine ilişkin bilgilerin gözler aracılığıyla dışa yansıdığına dair yaygın bir kabule işaret etmektedir. Zihnin dış dünyaya açılan penceresi olarak değerlendirilen gözler, bu yönü ile bilginin doğruluğunu ortaya koymada önemli bir göstergedir (Korkmaz 2021). Beynin duyuların merkezi olduğunu fark eden ilk düşünürlerden biri Alcmaeon'dur. Bir hayvanın gözünü inceleyerek göz ile beyin arasındaki bağlantıyı tespit etmiştir ve tüm duyuların beyine bağlı olduğunu ortaya koymuştur (Omur ve Görgülü Aydoğdu 2017). Bu bağlamda gözler hem insanın çevresini algılamasında hem de zihinsel süreçlerin anlaşılmasında önemli bir veri kaynağı olarak değerlendirilmektedir.

Eye tracking (göz izleme) yöntemi, göz bebeği hareketlerinin kızılötesi ışık teknolojisi kullanılarak takip edilmesiyle nitel veya nicel veriler elde edilmesini olanak sağlayan bir teknolojidir (Omur ve Görgülü Aydoğdu 2017). Başka bir ifade ile; odaklanılan alanlar, göz ardı edilen alanlar, ilk bakılan nokta, bakma

süreleri gibi önemli verilere ulaşılmasına olanak sağlayan cihazdır (Tunalı vd. 2016, Omur ve Görgülü Aydoğdu 2017, Duchowski 2007; Sennersten ve Lindley 2008, Angın 2022).
Göz izleme teknolojisinin gelişimine bakıldığında 19. yüzyılda doğrudan gözlemlerle yapılmıştır. Ancak kökeni 19.yüzyılın sonralarına dayandığı ve üretilen cihazların pahalı ve rahat olmadığı belirtilmiştir (Holmqvist vd. 2011, Korkmaz 2021, Angın 2022). 20. yüzyılın sonlarında Tobii, Applied Science Laboratories gibi şirketlerin kolay kullanılabilir ve daha ekonomik göz izleme sistemlerini geliştirmesiyle birlikte, bu teknolojiler erişilebilir hale gelmiş ve farklı meslek disiplinleri için kullanılabilir hale gelmiştir (Holmqvist vd. 2011, Korkmaz 2021).
Günümüzde göz izleme cihazları 3 farklı şekilde bulunmaktadır. Bunlar; bağımsız, gözlük tipi ve monitör tabanlıdır. Bağımsız göz izleme sistemleri; esnek kurulum sayesinde kişinin günlük yaşantısını etkilemeden çalışma ortamlarında etkileşimli araştırmalar yürütmesine olanak sağlamaktadır. Monitör tabanlı göz sistemleri testin yürütüldüğü bilgisayara entegre şekilde çalışmaktadır. Gözlük tipi göz izleme cihazlarında ise kullanıcının serbestçe hareket edebildiği gerçek ortam koşullarında veri kaydedilmektedir (Consort World 2015, İlhan 2021).
Peyzaj projeleri/tasarımları; kullanıcıların çok sayıda görsel uyarana maruz kaldığı, doğal ve yapay unsurların bir arada bulunduğu mekânlardır. Bu çok yönlü görsel deneyimin, kullanıcıların algısal tepkilerini ve mekânla iletişimini anlamak açısından doğru bir şekilde analiz edilmesi gerekmektedir. Eye tracking teknolojisi, kişinin göz hareketlerini izleyerek; odaklanma, bakış sürelerini kaydeden, fizyolojik tepkileri ölçmeye yarayan nörobilim tabanlı bir araçtır. Cihaz sayesinde kişilerin mekâna bakarken hangi unsura ne kadar süreyle baktığını, hangi alanlara bakmadıklarını ve görsel dikkatin nasıl yönlendiğini nesnel verilerle ortaya koymaktadır. Böylece tasarımın estetik ve fonksiyonel boyutlarının analiz edilmesini mümkün kılınmakta ve subjektif kavramların arkasındaki mekanizmanın anlaşılmasını sağlanmaktadır. Ayrıca peyzaj mimarlığında kullanılan sürprizli, çekici, vurgu, yönlendirme gibi tasarım kurgularının kullanıcıda beklenen hissi oluşturup oluşturmadığının tespitinde Eye Tracking kullanılarak değerlendirilebilecektir.
Geleneksel yöntemler, anketler ve görüşmeler yoluyla kullanıcı algısı ölçülmeye çalışılsa da, kişilerin bilinçaltı düzeydeki dikkat ve algı süreçlerini ölçmede yetersiz kalmaktadır. Eye tracking teknolojisi ile nesnel bir veri elde edilmesine olanak sağlamaktadır. Eye tracking cihazında kullanılan bazı terimler vardır. Bunlar;
"Fiksasyon (Fixation): Anlamı odaklanma olup, belirli bölgelerde bakışın sabitlenmesidir.
Sakkad (Saccade): Bir noktadan başka bir noktaya yapılan göz hareketleri
Bakış Süresi (Gaze Duration): Kişinin bir noktaya baktığı süredir. Bazen "dwell", "glance" ve ya "fixation cycle" terimleri de kullanılmaktadır.
İlgi Bölgesi (Area of interest): Uygulama yapan kişinin tanımladığı ilgi çekeceğini düşündüğü görsel çevre alanıdır.
Tarama Yolu (Scan Path): Odaklanma alanlarının sırayla gösterilmesi (ilk baktığı noktadan son baktığı nokta)" (Angın 2022).
Uygulanan Eye tracking testi sonucunda, yol haritaları, zaman istatistikleri, sıcaklık haritaları, kullanıcı videoları ve Mouse hareketleri verileri elde edilmektedir (Şekil 1) (Carpenter 1988; Allik vd. 2003, Karatekin 2007, Demirdöğen Yıldırım 2019, Angın 2022).



Şekil 1. Angın (2022) Doktora tezi kapsamında 48 kişiye uyguladığı Eye tracking sonucundan bir örnek
Son yıllarda görsel peyzaj kalite çalışmalarında, kişilerin tercihlerini, algılarını, dikkatlerini ve beğenilerini anlamak ve belirlemek amacıyla Eye tracking cihazı kullanılmıştır (Dupont vd. 2016, Sun vd. 2018, Franěk vd. 2019, Zheng vd. 2021, Huang vd. 2022; Song vd. 2022, Angın 2022, Pilarczyk vd. 2026).

Böylece kullanıcıların yaklaşımı nesnel verilerle desteklenmektedir. Eye tracking cihazının kullanımı ile tasarımın estetik, işlevsel ve deneyimsel boyutlarını anlamak ve geliştirmek mümkün olacaktır.

3.Sonuç

Eye tracking teknolojisi peyzaj tasarımında kullanıcı algısını nesnel ve detaylı bir şekilde ölçmeye olanak sağlayan bir cihazdır. Bu sayede mekânın estetik, işlevsel ve deneyimsel boyutlarının kullanıcı üzerindeki etkisi daha iyi değerlendirilebilir. Ayrıca peyzaj mimarlığında kullanılan sürprizli, çekici, vurgu, yönlendirme gibi tasarım kurgularının kullanıcıda beklenen hissi oluşturup oluşturmadığının tespitinde de önemlidir. Eğitim ve araştırma süreçlerinde ise öğrenciler ve araştırmacılar için peyzaj tasarımının algısal etkilerini somut olarak gözlemleme ve analiz etme fırsatı sunmaktadır. Böylelikle geleceğin tasarımcılarının vizyonu gelişecek ve deneyimsel öğrenme süreci desteklenecektir. Bu bağlamda Eye tracking teknolojisinin mimarlık, peyzaj mimarlığı, kentsel tasarım vb. meslek disiplinlerinde tasarımın teorik ve pratiğe dayalı yönlerini geliştirmek ve algısal boyutun değerlendirilmesi açısından önemli bir araç olduğunu görülmektedir.

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ERZURUM'UN GASTRONOMİ KÜLTÜRÜNÜN TANITIMINDAKİ ROLÜNE YÖNELİK RESTORAN ÇALIŞANLARININ ALGILARI

Ahmet Çavuş[202], Barış Turan[203]

Özet
Bu çalışma, Erzurum'da yerel yemek sunan işletmelerde çalışan personelin Erzurum'un gastronomik kültürüne yönelik algılarını incelemeyi amaçlamaktadır. Araştırma nicel yöntemle yürütülmüş ve veri toplama aracı olarak anket formu kullanılmıştır. Araştırmaya restoranlarda çalışan 380 katılımcı dâhil edilmiştir. Elde edilen veriler frekans ve betimleyici istatistiklerle analiz edilmiştir. Bulgular, şehir dışından gelen müşteri oranının yüksek olduğunu ve yerel yemeklerin ziyaretçiler tarafından yoğun biçimde tercih edildiğini ortaya koymaktadır. Katılımcılar, sundukları ürünlerin Erzurum mutfağını başarılı bir şekilde temsil ettiğini ve şehrin tanıtımına katkı sağladığını belirtmiştir. Bununla birlikte, Erzurum'a ait yemeklerin basında yeterince tanıtılmadığı düşüncesi dikkat çekmektedir. Bu durum, gastronomi tanıtım faaliyetlerinin özellikle medya ayağında geliştirilmesi gerektiğini göstermektedir. Erzurum gastronomisinin güçlü bir turistik çekicilik unsuru olduğunu ancak tanıtım süreçlerinde stratejik eksiklikler bulunduğunu göstermektedir. Elde edilen bulgular doğrultusunda medya tanıtımının artırılması, coğrafi işaretli ürünlerin marka değerinin öne çıkarılması ve çalışanların gastronomi eğitimi ile desteklenmesi önerilmektedir.
Anahtar Kelimeler: Mutfak Kültürü, Erzurum, Restoran Çalışanları Algısı, Destinasyon Tanıtımı, Gastronomi

Perceptions of Restaurant Employees Regarding the Role of Erzurum's Gastronomic Culture in Destination Promotion

Abstract
This study aims to examine employees' perceptions of establishments serving local cuisine in Erzurum regarding the city's gastronomic culture. The research was conducted using a quantitative method, and a questionnaire form was utilized as the data collection tool. A total of 380 participants employed in restaurants were included in the study. The collected data were analyzed using frequency and descriptive statistics. The findings reveal that the proportion of customers coming from outside the city is high and that local dishes are widely preferred by visitors. Participants stated that the products they serve successfully represent Erzurum's cuisine and contribute to the promotion of the city. However, it is noteworthy that respondents believe Erzurum's local dishes are not sufficiently promoted in the media. This indicates the need to strengthen gastronomic promotion efforts, particularly in the media dimension. The study demonstrates that Erzurum's gastronomy is a strong touristic attraction but that strategic shortcomings exist in its promotional processes. In line with the findings, it is recommended to enhance media-based promotional activities, highlight the brand value of geographically indicated products, and support employees through gastronomy-related training.
Keywords: Culinary Culture, Erzurum, Restaurant Employees' Perceptions, Destination Promotion, Gastronomy

1. Giriş

Gastronomi, tarihsel süreç içerisinde insanlığın beslenme alışkanlıklarının gelişimiyle paralel olarak şekillenmiş ve zamanla yalnızca temel bir fizyolojik ihtiyaç olmaktan çıkarak sosyal yaşamın, kültürel kimliğin ve toplumsal etkileşimin önemli bir parçası hâline gelmiştir. Gastronomi kavramı, Fransız sözlüğünde "iyi yemek yeme sanatı" olarak tanımlanmış; bazı araştırmacılar (Hjalager ve Corigliano, 2000; Santich, 2004) gastronomiyi yalnızca yeme eylemiyle sınırlı görmeyerek, yiyeceğin hazırlanışı, sunumu, estetik boyutu ve kültürel bağlamıyla birlikte ele alınması gereken çok yönlü bir alan olarak değerlendirmiştir. Gastronominin bilimsel bir disiplin olarak ele alınması özellikle 19. ve 20. yüzyıllarda hız kazanmıştır. Brillat-Savarin'in (2009) çalışmaları, gastronomiyi hem bir sanat hem de bilimsel bir yorumlama alanı olarak konumlandırmış;

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bu yaklaşım gastronominin akademik alanda tartışılmasının önünü açmıştır. Günümüz literatüründe gastronomi; kimya, fizik, antropoloji, sosyoloji, ekonomi ve turizm gibi farklı disiplinlerle ilişkili, çok katmanlı ve disiplinler arası bir çalışma alanı olarak kabul edilmektedir (This, 2009).

Gastronominin kültürel bir değer olarak önem kazanması, aynı zamanda gastronomi odaklı seyahatlerin artmasına ve gastronomi turizminin gelişmesine zemin hazırlamıştır. Gastronomi turizmi, bir destinasyonun kültürel kimliğini yansıtan yerel yiyecek ve içecekleri deneyimlemeye yönelik seyahatleri ifade etmekte olup, ziyaretçilerin destinasyon tercihlerini etkileyen önemli bir unsur olarak öne çıkmaktadır (Hall ve Mitchell, 2000). Bir bölgenin özgün mutfak kültürü, turistlerin seyahat motivasyonlarını güçlendiren temel çekicilik unsurlarından biri olarak değerlendirilmektedir. Gastronomi bir toplumun kimliğini anlamada kritik bir araç olduğu gibi, aynı zamanda kültür, tarım ve turizmin birleştirmektedir (Du Rand ve Heath, 2006). Gastronomi turizmi, destinasyonlar açısından önemli bir rekabet avantajı yaratmaktadır. Yerel mutfak deneyimleri, turistlerin seyahat motivasyonları arasında üst sıralarda yer almakta; gastronomi hem ekonomik hem kültürel hem de tanıtım boyutuyla destinasyonlara çekicilik ve değer katmaktadır (Tikkanem, 2007; Karim ve Chi, 2010). Bu bağlamda gastronomi, yalnızca yeme-içme faaliyetleriyle sınırlı olmayan; destinasyon imajının güçlendirilmesi, yerel kimliğin korunması ve kültürel mirasın sürdürülebilirliği açısından stratejik bir unsur hâline gelmiştir. Türkiye ise önemli bir gastronomi turizmi destinasyonu olarak görülmektedir.

Türk mutfağının temelleri Orta Asya'ya dayanmakta; Anadolu'ya yerleşim süreci ve Osmanlı İmparatorluğu'nun geniş coğrafyası sayesinde önemli ölçüde zenginleşmiştir. Bu tarihsel birikim, Türk mutfağının dünyanın en köklü ve zengin mutfakları arasında yer almasını sağlamıştır. Aynı zamanda Türkiye, coğrafi işaretli gastronomik ürün sayısı bakımından da öne çıkan ülkeler arasında yer almakta; bu durum mutfak kültürünün ulusal ve uluslararası düzeyde tanınırlığını güçlendirmektedir. Türkiye'nin gastronomik zenginliğinin en belirgin özelliklerinden biri bölgesel mutfak çeşitliliğidir (Cömert ve Özkaya 2014). Türkiye'nin bölgesel farklılıklar gösteren gastronomik yapısı çerçevesinde, Erzurum mutfağı ise kendine özgü güçlü yerel kimliğiyle dikkat çekmektedir. Doğu Anadolu Bölgesi'nin önemli gastronomi merkezlerinden biri olan Erzurum'un mutfak kültürünün şekillenmesinde sert iklim koşulları, hayvancılık geleneği ve tarihsel üretim pratikleri belirleyici olmaktadır (Bayoğlu, 2014; Mil ve Denk, 2015). Erzurum'un sembolik gastronomik ürünleri arasında Cağ Kebabı, Kadayıf Dolması, Su Böreği, Lor Dolması, Civil Peyniri, Hıngel, Ekşili Dolma, Ayran Aşı Çorbası ve Ketesi öne çıkmaktadır. Cağ Kebabı'nın ise coğrafi işaret tesciline sahip olması ve özgün hazırlama tekniği ile kentin en güçlü gastronomik markalarından biri olarak görülmekte; Kadayıf Dolması geleneksel hamur işleri arasında önemli bir yere sahipken, Civil Peyniri de coğrafi işaretli ürünler arasında yer alarak Erzurum'un gastronomik marka değerini artırmaktadır (Çomaklı, 2011; Ertaş ve Karadağ, 2013; Serçeoğlu, 2014; Turan ve Akoğul, 2019).

Kentin sahip olduğu gastronomik kültür, Erzurum'un turizm potansiyeli üzerinde de önemli bir etkiye sahiptir. Kış turizmi, üniversite nüfusu ve şehir dışından gelen ziyaretçiler, kentin mutfak kültürünün tanınırlığını artıran temel unsurlar arasında yer almaktadır. Yerel yemek sunan işletmeler, söz konusu tanıtım sürecinde önemli bir işlev üstlenmektedir. Yöresel yemeklerin menülerde yer almasının yanı sıra, bu işletmelerde görev yapan çalışanların söz konusu ürünlere yönelik algı ve tutumları da tanıtımın etkililiğini belirleyen temel unsurlar arasında yer almaktadır. Bu çerçevede çalışma, Erzurum'da yerel yemek sunan işletmelerde çalışan personelin, kentin gastronomik kültürünün tanıtımındaki rolüne ilişkin algılarını ortaya koymayı amaçlamakta; gastronominin destinasyon tanıtımı ve yerel kimlik üzerindeki etkisini çalışan bakış açısıyla değerlendirmeyi hedeflemektedir.

2. Yöntem

Bu çalışma, Erzurum'da yerel yemek sunan işletmelerde çalışan personelin Erzurum'un gastronomik kültürüne yönelik algılarını incelemek amacıyla nicel araştırma yaklaşımı kullanılarak gerçekleştirilmiştir. İşletmelerin yerel yemek kültürüne ilişkin algıları tespit edilmeye çalışılmıştır. Araştırmada anket tekniği tercih edilmiş ve veri toplama aracı olarak Likert tipi ölçek içeren yapılandırılmış bir anket formu kullanılmıştır. Ölçekteki ifadelerin (12 madde) güvenirliği Cronbach Alpha katsayısı ile test edilmiş; elde edilen α=0.789 değeri ölçeğin güvenilir olduğunu göstermiştir (Hair vd., 2010).

Araştırmanın evreni, Erzurum'un Palandöken, Aziziye ve Yakutiye ilçelerinde yer alan yerel yemek satan işletmelerden oluşmaktadır. İlgili belediyelerden alınan bilgiler doğrultusunda örneklem çerçevesi belirlenmiş, örnek büyüklüğü tahmin formülü kullanılarak araştırma için gerekli örneklem sayısının 400 olduğu saptanmıştır. Yürütülen yüz yüze ve çevrimiçi anket uygulamalarında 380 form analiz için uygun bulunmuş ve veriler SPSS 22 programına aktarılmıştır. Araştırmanın verilerine ilişkin istatistiksel testler uygulanmıştır.

Frekans analizinde değişkenlerin dağılımları Ural ve Kılıç'ın (2005) frekans analizine ilişkin tanımı doğrultusunda değerlendirilmiştir.

3. Bulgular

Tablo 1. Demografik Bulgular (Çalışan ve İşletme)

Değişkenler	Gruplar	N (380)	Yüzde	Toplam Yüzde
Yaş	18-24	62	16,3	16,3
	25-31	94	24,7	41,1
	32-38	73	19,2	60,3
	39-45	71	18,7	78,9
	46-52	50	13,2	92,1
	53-64	28	7,4	99,5
	65 ve Üzeri	2	,5	100,0
Cinsiyet	Kadın	89	23,4	23,4
	Erkek	291	76,6	100
Eğitim Durumu	Okur yazar değil	16	4,2	4,2
	Okur yazar	7	1,8	6,1
	İlköğretim	28	7,4	13,4
	Ortaöğretim	56	14,7	28,2
	Lise	147	38,7	66,8
	Ön lisan	48	12,6	79,5
	Lisans	78	20,5	100,0
Medeni Durum	Evli	238	62,6	62,6
	Bekar	142	37,4	100
Aylık Gelir	2020 ve Altı	174	45,8	45,8
	2021-3999	116	30,5	76,3
	4000-5999	62	16,3	92,6
	6000-7999	21	5,5	98,2
	8000-9999	5	1,3	99,5
	10.000 ve üzeri	2	,5	100,0
İşletmedeki Görev	İşletme Sahibi	77	20,3	20,3
	İşletme Müdürü	10	2,6	22,9
	İşletme Çalışanı	293	77,1	100,0
İşletmenin Faaliyet Yılı	1-10 yıl	168	44,2	44,2
	11-20 yıl	122	32,1	76,3
	21-30 yıl	48	12,6	88,9
	31-40 yıl	23	6,1	95,0
	51+ yıl	19	5,0	100,0

Tablo 1, araştırmaya katılan 380 işletme çalışanı ve yöneticisinin demografik profiline ilişkin betimsel sonuçları göstermektedir. Veriler, katılımcıların büyük bölümünün 25-31 yaş (%24,7) ve 32-38 yaş (%19,2) aralığında yoğunlaştığını ortaya koymaktadır. Bu durum, Erzurum'daki yerel yemek işletmelerinde çalışanların çoğunlukla genç ve orta yaş gruplarında yer aldığını göstermektedir. Cinsiyet dağılımı incelendiğinde katılımcıların %76,6'sının erkek, %23,4'ünün kadın olduğu görülmektedir. Bu bulgu, bölgedeki gastronomi işletmelerinin iş gücü yapısının erkek ağırlıklı olduğunu ortaya koymaktadır. Eğitim düzeyine bakıldığında lise mezunlarının %38,7 ile en büyük grubu oluşturduğu, lisans mezunlarının ise %20,5 olduğu belirlenmiştir. Çalışanların önemli bir kısmının orta düzey eğitim seviyesinde olduğu ve bu durumun sektörün genel yapısıyla uyumlu olduğu söylenebilir. Gelir düzeyi değişkenine bakıldığında katılımcıların neredeyse yarısının 2020 TL ve altı gelir grubunda (%45,8) yer aldığı görülmektedir. Bu bulgu, Erzurum'daki yerel yemek işletmelerinde çalışanların düşük gelir grubunda yoğunlaştığını göstermektedir. İşletmede görev değişkeni incelendiğinde, katılımcıların %77,1'inin işletme çalışanı, %20,3'ünün işletme sahibi olduğu görülmektedir. Son olarak, işletmelerin faaliyet sürelerine ilişkin veriler işletmelerin önemli bir bölümünün 1-10 yıldır (%44,2) faaliyet gösterdiğini ortaya koymaktadır. Bu sonuç, Erzurum'daki gastronomi işletmelerinin görece genç bir yapıya sahip olduğunu göstermektedir.

Genel olarak tablo, araştırma örnekleminin genç, erkek ağırlıklı, orta eğitim düzeyine sahip ve çoğunlukla düşük gelir grubunda yer alan bireylerden oluştuğunu göstermektedir. Elde edilen bu demografik yapı, bulguların yorumlanmasında dikkate alınması gereken önemli bir bağlam sunmaktadır.

Tablo 2. Betimsel Bulgular

İfadeler		Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum	Ortalama	Standart Sapma
Erzurum dışındaki şehirlerden gelen daimî müşterilerimiz bulunmaktadır.	N	10	36	27	184	121	3,96	1,044
	%N	2,6	9,5	7,1	48,4	31,8		
Erzurum denince ilk akla gelen çekicilik unsurunun yemek kültürü olduğunu düşünüyorum.	N	17	81	36	173	71	3,51	1,177
	%N	4,5	21,3	9,5	45,5	18,7		
Erzurum dışından gelenlerin uğradıkları ilk yer çoğunlukla restoranlardır.	N	12	79	69	150	69	3,48	1,119
	%N	3,2	20,8	18,2	39,5	18,2		
Diğer illerdeki işletmelerin, Erzurum'un yiyeceklerine yönelik tanıtımı olumlu yönde gerçekleştirdiğini düşünüyorum.	N	12	62	64	172	62	3,56	1,088
	%N	3,2	16,3	16,8	45,3	17,6		
İşletmemize önemli sayıda ili dışından müşteriler gelmektedir.	N	9	28	35	165	141	4,05	1,008
	%N	2,4	7,4	9,2	43,4	37,1		
Erzurum'a ait yemeklerin basında yeteri kadar tanıtıldığını düşünüyorum.	N	41	116	51	110	60	3,07	1,306
	%N	10,8	30,5	13,4	28,9	15,8		
Sunduğumuz yerel ürünlerin Erzurum'un tanıtımına katkı sağladığını düşünüyorum.	N	6	18	20	209	124	4,11	,887
	%N	1,6	4,7	5,3	55,0	32,6		
Erzurum'a ait yemeklerin diğer şehirlerde yeterince tanındığını düşünüyorum.	N	4	52	55	173	94	3,78	1,035
	%N	1,1	13,7	14,5	45,5	24,7		
Erzurum'un tanıtımında yemek kültürünün önemli bir etkisinin olduğunu düşünüyorum.	N	2	54	27	191	104	3,88	1,017
	%N	,5	14,2	7,1	50,3	27,4		
Erzurum'a gelen misafirlerin fastfood yerine daha çok yerel yemekleri tercih ettiğini düşünüyorum.	N	5	19	58	174	122	4,01	,937
	%N	1,3	5,0	15,3	45,8	32,1		
Sunduğumuz yerel ürünlerin Erzurum mutfağını iyi bir şekilde temsil ettiğini düşünüyorum.	N	2	19	22	196	139	4,17	,853
	%N	,5	5,0	5,8	51,6	36,6		
Sunduğumuz ürünlerin lezzet, tat, görüntü vb. açılardan misafirlerimiz tarafından beğenildiğini düşünüyorum.	N	2	9	34	151	182	4,31	,839
	%N	,5	2,4	8,9	39,7	47,9		

Tablo 2, katılımcıların Erzurum gastronomisine ilişkin algılarını ortaya koyan ifadelere ait ortalama ve standart sapma değerlerini içermektedir. Bulgular genel olarak, yerel işletmelerin Erzurum'un gastronomik potansiyeline yönelik güçlü bir farkındalığa sahip olduğunu ve yerel mutfağın hem tanıtım hem de müşteri tercihleri açısından önemli bir unsur olarak görüldüğünü göstermektedir.

İlk olarak, "Erzurum dışındaki bölgelerden şehirlerden gelen daimî müşterilerimiz bulunmaktadır" ifadesinin 3,96 ortalamaya sahip olması, şehir dışından düzenli müşteri akışının hissedildiğini göstermektedir. Bununla birlikte, "İşletmemize önemli sayıda ili dışından müşteriler gelmektedir" ifadesinin 4,05 ortalaması da bu bulguyu desteklemekte ve işletmelerin müşteri profilinde şehir dışı ziyaretçilerin önemli yer tuttuğunu göstermektedir. Yerel mutfağın turistik çekiciliğine ilişkin ifadeler incelendiğinde, "Erzurum denince ilk akla gelen çekicilik unsurunun yemek kültürü olduğunu düşünüyorum" ifadesinin 3,51, "Erzurum dışından gelenlerin uğradıkları ilk yer çoğunlukla restoranlardır" ifadesinin 3,48 ortalamaya sahip olduğu görülmektedir. Bu sonuçlar, yerel mutfağın şehir imajı açısından önemli bir çekicilik unsuru olarak algılandığını ancak bu algının daha da güçlendirilebileceğini işaret etmektedir.

Erzurum gastronomisinin diğer illerdeki görünürlüğüne ilişkin değerlendirmeler orta düzeydedir. "Diğer illerdeki işletmelerin, Erzurum'un yiyeceklerine yönelik tanıtımı olumlu yönde gerçekleştirdiğini düşünüyorum" (3,56) ve "Erzurum'a ait yemeklerin diğer şehirlerde yeterince tanındığını düşünüyorum" (3,78) ifadeleri, tanıtıma yönelik düşüncenin tamamen yetersiz olmadığı ancak güçlü bir düzeye de ulaşmadığına işaret etmektedir. Bu bulgular, Erzurum mutfağının ulusal düzeyde daha etkili bir tanıtım stratejisine ihtiyaç duyduğunu göstermektedir. Basın yoluyla yapılan tanıtım ise katılımcıların en düşük düzeyde katılım gösterdiği alan olarak dikkat çekmektedir. "Erzurum'a ait yemeklerin basında yeteri kadar tanıtıldığını düşünüyorum" ifadesinin 3,07 ortalama ile tablodaki en düşük değeri alması, medya tabanlı tanıtım çalışmalarının yetersiz bulunduğunu ortaya koymaktadır. Bu durum, destinasyon pazarlaması açısından önemli bir eksikliğe işaret etmektedir.

Yerel ürünlerin destinasyon kimliğine katkısına yönelik ifadeler ise yüksek ortalamalarla değerlendirilmiştir. "Sunduğumuz yerel ürünlerin Erzurum'un tanıtımına katkı sağladığını düşünüyorum" (4,11) ve "Sunduğumuz yerel ürünlerin Erzurum mutfağını iyi bir şekilde temsil ettiğini düşünüyorum" (4,17) ifadeleri, işletmelerin kendilerini gastronomik kimliğin taşıyıcı aktörleri olarak gördüğünü göstermektedir. Ayrıca, "Erzurum'un tanıtımında yemek kültürünün önemli bir etkisinin olduğunu düşünüyorum" (3,88) ifadesi de yemek kültürünün şehir kimliği açısından güçlü bir konuma sahip olduğunu desteklemektedir. Müşteri memnuniyeti açısından en yüksek ortalama, 4,31 ile "Sunduğumuz ürünlerin lezzet, tat, görüntü vb. açılardan misafirlerimiz tarafından beğenildiğini düşünüyorum" ifadesinde görülmektedir. Bu bulgu, sunulan yerel lezzetlerin kalite açısından yüksek düzeyde algılandığını ve müşteri memnuniyetinin güçlü olduğunu göstermektedir. Benzer şekilde, "Erzurum'a gelen misafirlerin fastfood yerine daha çok yerel yemekleri tercih ettiğini düşünüyorum" ifadesinin 4,01 ortalaması, yerel mutfağın dışarıdan gelen ziyaretçiler için önemli bir tercih nedeni olduğunu ortaya koymaktadır.

Genel olarak tablo, Erzurum yerel mutfağının hem şehir içi hem de şehir dışı ziyaretçilerin ilgisini çektiğini, işletmelerin sunulan ürünlerin temsil gücüne ve kalite düzeyine yüksek güven duyduğunu ve gastronominin şehir tanıtımında önemli bir rol oynadığına inanıldığını göstermektedir. Bununla birlikte, basın ve diğer illerdeki tanıtım faaliyetlerinin yetersiz algılanması, Erzurum gastronomisinin ulusal ölçekte daha güçlü bir pazarlama stratejisiyle desteklenmesi gerektiğini ortaya koymaktadır.

4. Sonuç ve Öneriler

Araştırmanın sonuçları, Erzurum'daki yerel yemek işletmelerinde çalışan personelin, kentin gastronomik kültürünü turistik çekicilik ve şehir tanıtımı açısından önemli bir unsur olarak değerlendirdiğini göstermektedir. Bulgular, şehir dışından gelen müşterilerin yoğunluğuna ilişkin yüksek katılım oranlarıyla desteklenmekte; yerel yemeklerin ziyaretçiler ve işletmeler tarafından güçlü bir marka değeri olarak görüldüğünü ortaya koymaktadır. Katılımcılar, sundukları ürünlerin Erzurum mutfağını başarılı biçimde temsil ettiğini ve bu temsilin şehir tanıtımına anlamlı katkı sağladığını ifade etmektedir. Bununla birlikte, araştırmada basın ve medya aracılığıyla yapılan tanıtımın ve diğer illerde Erzurum gastronomisine yönelik çalışmaların yetersiz bulunduğu belirlenmiştir. Bu durum, Erzurum mutfağının ulusal ölçekte daha görünür kılınması gerektiğine işaret etmektedir.

Bu kapsamda, Erzurum gastronomisinin tanıtımında medya ve sosyal medya mecralarının daha etkin kullanılmasının önemli olduğu düşünülmektedir. Coğrafi işaretli ürünlerin (Cağ Kebabı, Civil Peyniri vb.) ön plana çıkarılması; ulusal gastronomi festivalleri ve tanıtım kampanyalarında bu ürünlere özel bir yer verilmesi gerekmektedir. Restoran çalışanlarının büyük kısmının orta eğitim düzeyine sahip olması nedeniyle gastronomi, sunum, iletişim ve destinasyon farkındalığı konularında eğitim programları düzenlenmesi hem işletme kalitesini hem de turist deneyimini artıracaktır. Ayrıca, kış turizmiyle öne çıkan Erzurum'da gastronominin turizm çeşitlendirme stratejileriyle bütünleştirilmesi, şehirde gastronomi temalı turların oluşturulması ve yerel ürünlerin satış-pazarlama kanallarının geliştirilmesi önerilmektedir. Diğer gastronomi şehirleriyle (Gaziantep, Hatay vb.) ortak etkinlikler düzenlenmesi, Erzurum gastronomisinin ulusal ölçekte görünürlüğünü güçlendirebilir. Tüm bu öneriler doğrultusunda gastronominin şehir kimliği, destinasyon imajı ve ekonomik katma değer açısından önemli bir potansiyel sunduğu söylenebilir.

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YERLİ TURİSTLERİN COĞRAFİ İŞARETLİ ÜRÜNLERE YÖNELİK ALGILARININ İNCELENMESİ: TRABZON İLİNDE BİR ARAŞTIRMA

Ahmet Çavuş[204], Barış Turan[205]

Özet
Bu araştırmanın amacı, Trabzon'u ziyaret eden yerli turistlerin coğrafi işaretli ürünlere yönelik algılarını incelemektir. Araştırma nicel yöntemle yürütülmüş ve Trabzon'u ziyaret eden yerli turistlerden anket tekniğiyle veri toplanmıştır. Elde edilen veriler istatistiksel analizlerle değerlendirilmiştir. Araştırma bulguları, yerli turistlerin coğrafi işaretli ürünlere yönelik algılarının genel olarak yüksek ve olumlu olduğunu göstermektedir. Katılımcılar, coğrafi işaretli ürünleri kalite, özgünlük ve lezzet açısından değerli bulmakta; bu ürünlerin destinasyonun tanıtımına ve turizm potansiyeline önemli katkılar sağladığını düşünmektedir. Demografik değişkenler açısından yapılan analizler, coğrafi işaretli ürün algısının cinsiyet, yaş, medeni durum ve eğitim düzeyine göre anlamlı farklılıklar gösterdiğini ortaya koymuştur. Buna karşılık, katılımcıların geldikleri bölgeye göre anlamlı bir farklılık tespit edilmemiştir. Araştırma sonuçları, coğrafi işaretli ürünlerin gastronomi turizmi ve destinasyon pazarlaması açısından önemli bir potansiyele sahip olduğunu ortaya koymaktadır.
Anahtar Kelimeler: Coğrafi işaretli ürünler, gastronomi turizmi, turist algısı, Trabzon, yerli turistler

An Examination of Domestic Tourists' Perceptions of Geographical Indication Products: A Study in the Province of Trabzon

Abstract
The aim of this study is to examine the perceptions of domestic tourists visiting Trabzon toward geographical indication products. The study was conducted using a quantitative research approach, and data were collected from domestic tourists through a questionnaire. The data were analyzed using statistical methods. The findings indicate that domestic tourists have generally high and positive perceptions of geographical indication products. Participants perceive these products as valuable in terms of quality, authenticity, and taste, and believe that they contribute significantly to destination promotion and tourism potential. The analyses reveal that perceptions of geographical indication products differ significantly according to gender, age, marital status, and education level, while no significant difference is observed based on the region of origin. Overall, the results demonstrate that geographical indication products represent an important potential for gastronomy tourism and destination marketing.
Keywords: Geographical indication products, gastronomy tourism, tourist perception, Trabzon, domestic tourists

GİRİŞ

Turizm sektörü, ekonomik büyümenin yanı sıra kültürel mirasın korunması ve bölgesel kalkınmanın desteklenmesi açısından stratejik bir öneme sahiptir. Geçmişte turist talepleri büyük ölçüde deniz, kum ve güneş ekseninde şekillenirken, günümüzde bu taleplerin kültürel değerler, yerel kimlik unsurları ve özgün deneyimlere yöneldiği görülmektedir. Bu değişim, destinasyonların bütüncül bir ülke imajı yerine, belirli yörelere özgü çekicilik unsurlarını ön plana çıkarmasını gerekli kılmıştır (Reitsamer, vd., 2016; Aydoğdu ve Duman, 2017). Nitekim, turizm sektöründe kültürel ve geleneksel değerlerin de yeniden önem kazandığı, turistlerin yerel olanı deneyimleme, koruma ve tüketme eğilimlerinin arttığı görülmektedir (Orhan, 2010).
Bir destinasyonu diğerlerinden ayıran en temel unsurlar arasında tarihi ve kültürel değerler, sanatsal faaliyetler, eğlence ve alışveriş olanakları ile mutfak kültürü yer almaktadır. Özellikle yerel mutfak unsurları, destinasyon çekiciliğini artıran önemli bir faktör olarak turizm pazarlamasında kullanılmaktadır (Kercher, Okumus ve Okumus 2008). Bu bağlamda gastronomi turizmi, ziyaretçilerin destinasyon seçiminde etkili olan ve davranışsal niyetlerini etkileyen başlıca turizm türlerinden biri hâline gelmiş ve bölgeler arası rekabet gücünü

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artıran stratejik bir unsur olarak öne çıkmıştır (Richards, 2003; Durlu Özkaya, vd., 2013; Aydoğdu ve Duman, 2017; Büyükyılmaz ve Oktay, 2025). Gastronomi turizmini ilgi çekici kılan ise, yerel mutfağın öne çıkan ve coğrafi işaret almış ürünleridir. Coğrafi işaretler, belirli bir ürünün kalitesi, ünü veya diğer özelliklerinin, köken aldığı coğrafi alanla doğrudan ilişkili olduğunu gösteren işaretlerdir. Bu işaretler, ürünün ait olduğu coğrafyaya özgü doğal ve beşerî unsurları tüketiciye aktarmakta; kalite, güvenilirlik ve özgünlük algısını güçlendirmektedir (Yıldız, 2008). Coğrafi işaretli ürünler, benzerlerinden ayırt edici özellikleri sayesinde tüketiciler tarafından daha güvenilir bulunmakta ve tercih edilmektedir (İloğlu, 2014; Tekelioğlu ve Demirer, 2008).

Türkiye, sahip olduğu farklı iklim kuşakları, zengin tarımsal çeşitlilik ve köklü kültürel birikimi sayesinde coğrafi işaret potansiyeli yüksek ülkeler arasında yer almaktadır. Coğrafi işaretli ürünlerin korunması; üreticilerin desteklenmesi, pazarlama olanaklarının artırılması, istihdamın geliştirilmesi ve bölgesel kalkınmanın sağlanması açısından önemli katkılar sunmaktadır (Gökovalı, 2007). Ayrıca coğrafi işaretler, gastronomi turizmi aracılığıyla destinasyonların marka değerini artıran önemli bir araç olarak değerlendirilmektedir (Tekelioğlu, 2019). Trabzon ili, doğal güzellikleri, tarihsel mirası ve kendine özgü mutfak kültürüyle Karadeniz Bölgesi'nin öne çıkan turizm destinasyonlarından biridir. Yöreye özgü ürünler, Trabzon'un gastronomik kimliğini güçlendirmekte ve destinasyonun çekiciliğini artırmaktadır. Bu noktada, turistlerin coğrafi işaretli ürünlere yönelik algılarının belirlenmesi hem destinasyon pazarlaması hem de sürdürülebilir turizm politikaları açısından önem taşımaktadır. Turist algıları, yalnızca satın alma davranışlarını değil, destinasyon memnuniyetini ve tekrar ziyaret niyetini de etkilemektedir (İloğlu, 2014; Teuber, 2011).

Bu çalışmanın amacı, Trabzon'u ziyaret eden yerli turistlerin coğrafi işaretli ürünlere yönelik algılarını incelemektir. Araştırmada, turistlerin coğrafi işaretli ürünlere ilişkin farkındalıkları, algıları ve satın alma davranışları sosyo-demografik özellikler çerçevesinde ele alınmakta; elde edilen bulguların gastronomi turizmi ve destinasyon pazarlamasına katkı sunması hedeflenmektedir.

YÖNTEM

Bu araştırmanın amacı, Trabzon'u ziyaret eden yerli turistlerin coğrafi işaretli ürünlere yönelik algılarını belirlemektir. Bu genel amaç doğrultusunda araştırmada aşağıdaki sorulara yanıt aranmıştır: (S1) Yerli turistlerin coğrafi işaretli ürünlere yönelik algı ve farkındalık düzeyleri nasıldır?, (S2) Yerli turistlerin coğrafi işaretli ürün algıları sosyo-demografik özelliklerine göre farklılık göstermekte midir?

Araştırma, nicel araştırma yaklaşımı benimsenerek tasarlanmıştır. Veri toplama sürecinde, bireylerin algı, tutum ve davranışlarını ölçmeye olanak tanıyan anket yöntemi kullanılmıştır. Araştırmanın evrenini, Trabzon'u ziyaret eden yerli turistler oluşturmaktadır. Evrenin tamamına ulaşmanın güçlüğü nedeniyle örneklem belirlemede rastgele örnekleme yöntemi tercih edilmiştir. Araştırmaya, Trabzon'u ziyaret eden ve ankete gönüllü olarak katılan 401 yerli turist dâhil edilmiştir. Bu yöntem, turizm araştırmalarında hareketli ve sınırlı süreli evrenler için yaygın olarak kullanılmaktadır.

Veri Toplama Aracı

Araştırmada kullanılan veri toplama aracı, Literatür taraması yolu ile Duman vd. (2019) ve Toklu vd. (2016) çalışmalarından uyarlanmış olan yapılandırılmış bir anket formudur. Anket formu iki bölümden oluşmaktadır: (1) Katılımcıların sosyo-demografik özelliklerini belirlemeye yönelik sorular, (2) Coğrafi işaretli ürünlere yönelik algı, farkındalık ve satın alma davranışlarını ölçmeye yönelik ifadeler. Algı ve davranışlara ilişkin ifadeler Likert tipi ölçek kullanılarak hazırlanmıştır. Ölçek toplam 29 maddeden oluşmaktadır. Ölçeğin iç tutarlılığını belirlemek amacıyla Cronbach's Alpha güvenirlik analizi yapılmıştır. Analiz sonucunda, 29 maddeli ölçeğin Cronbach's Alpha değeri 0,933 olarak hesaplanmış olup, bu değer ölçeğin yüksek düzeyde güvenirliğe sahip olduğunu göstermektedir (Hair vd., 2010).

Veri Analizi

Elde edilen veriler istatistiksel analiz teknikleri kullanılarak değerlendirilmiştir. Öncelikle tanımlayıcı istatistikler aracılığıyla katılımcıların sosyo-demografik özellikleri ve genel algı düzeyleri belirlenmiştir. Ardından, coğrafi işaretli ürün algısının satın alma davranışı ve sosyo-demografik değişkenler açısından farklılaşıp farklılaşmadığını incelemek amacıyla uygun istatistiksel testler (Frekans, T-testi, Anova) uygulanmıştır. Bulgular, araştırmanın amaç ve soruları doğrultusunda yorumlanmıştır.

Bulgular

Tablo 1. Katılımcıların Demografik Bulguları

Değişkenler	Gruplar	N	%
Cinsiyet	Erkek	146	36,4
	Kadın	255	63,6
Yaş	18-25 arası	124	30,9
	26-30 arası	147	36,7
	31-35 arası	92	22,9
	36-40 arası	26	6,5
	41 ve üzeri	12	3,0
Medeni Durumu	Evli	174	43,4
	Bekar	227	56,6
Eğitim Durumu	İlköğretim	10	2,5
	Lise	70	17,5
	Ön lisans	106	26,4
	Lisans	157	39,2
	Lisansüstü	58	14,5
Hangi bölgeden şehre gelinmiş	Akdeniz	30	7,5
	Karadeniz	115	28,7
	Marmara	59	14,7
	Ege	37	9,2
	Güneydoğu Anadolu	31	7,7
	İç Anadolu	49	12,2
	Doğu Anadolu	80	20,0
Trabzon'a geliş amacı	Dinlenme/Gezi	274	68,3
	Sağlık	26	6,5
	İş	91	22,7
	Diğer	10	2,5
	Toplam	**401**	**100,0**

Tablo 1 incelendiğinde, araştırmaya katılan yerli turistlerin çoğunluğunun kadın, 26–30 yaş aralığında, bekâr ve lisans mezunu olduğu görülmektedir. Katılımcıların önemli bir kısmının Karadeniz ve Doğu Anadolu bölgelerinden Trabzon'a geldiği belirlenmiştir. Trabzon'a geliş amacı ağırlıklı olarak dinlenme/gezi olup, bu durum araştırma grubunun turistik deneyime açık bir profilden oluştuğunu göstermektedir. Bu demografik yapı, coğrafi işaretli ürün algısının değerlendirilmesi açısından uygun bir örneklem sunmaktadır.

Tablo 2. Katılımcıların Coğrafi İşaretli Ürün Algısı

İfadeler	Ort.	Ss.
Coğrafi işaretli ürün ile ilgili fikrim var	4,43	0,98
Coğrafi işaretli ürünün belirli bir coğrafyaya özel olduğunu düşünüyorum	4,61	0,75
Coğrafi işaretli ürünün yapımı özenlidir	4,62	0,76
Coğrafi işaretli ürün el yapımı ve çok zahmetlidir	4,44	0,83
Coğrafi işaretli ürün sağlıklıdır	4,23	0,95
Coğrafi işaretli ürün lezzetlidir	4,44	0,78
Coğrafi işaretli ürün kalitelidir	4,43	0,80
Coğrafi işaretli ürünün bölge ekonomisine katkısı vardır	4,64	0,64
Coğrafi işaretli ürün pahalıdır	4,15	1,05
Coğrafi işaretli ürünlerin bulunması zordur	4,02	1,21
Coğrafi işaretli ürün tüketiyorum	4,33	0,99
Gittiğim şehirlerde coğrafi işaretli ürünleri diğer ürünlere tercih ederim	4,43	0,94
Coğrafi işaretli ürünleri alırken tadına dikkat ediyorum	4,58	0,81
Coğrafi işaretli ürünleri alırken fiyatına dikkat ediyorum	4,43	0,96
Coğrafi işaretli ürünleri alırken kalitesine dikkat ediyorum	4,68	0,7
Coğrafi işaretli ürünleri alırken paketine dikkat ediyorum	4,46	0,87
Coğrafi işaretli ürün kullanımı bölgenin turizm potansiyelini arttırır	4,69	0,62
Coğrafi işaretli ürün kullanımı bölgenin tanıtımına katkı sağlar	4,77	0,53
Coğrafi işaretli ürün alırken ambalajında en çok besin değeri/kalorisine dikkat ederim	3,84	1,25
Coğrafi işaretli ürün alırken ambalajında en çok markasına dikkat ederim	4,11	1,09
Coğrafi işaretli ürün alırken ambalajında en çok tazeliğine dikkat ederim	4,72	0,61
Trabzon'un coğrafi işaretli ürünlerini biliyorum	4,09	0,77
Trabzon ziyaretinden dönerken hediye olarak coğrafi işaretli bir ürün götüreceğim	4,75	1,21
Trabzon'u ziyaret edecek kişilere buranın coğrafi işaretli ürünlerini önereceğim	4,52	0,9

Seyahatlerimden önce gittiğim bölgelerdeki coğrafi işaretli ürünleri araştırırım	4,57	0,83
Gittiğim yerlerde mutlaka coğrafi işaretli ürün tadarım	4,66	0,69

Tablo 2'de yer alan bulgular, katılımcıların coğrafi işaretli ürünlere yönelik algılarının yüksek düzeyde olumlu olduğunu göstermektedir. Özellikle ürünlerin bölgeye özgü olması, kaliteli, özenli üretilmiş ve bölge ekonomisine katkı sağlaması ifadeleri en yüksek ortalamalara sahiptir. Ayrıca coğrafi işaretli ürünlerin bölgenin tanıtımına ve turizm potansiyeline katkı sağladığı yönündeki algının oldukça güçlü olduğu görülmektedir. Katılımcılar Trabzon'un coğrafi işaretli ürünleri hakkında bilgi sahibi olduklarını ve dönüşlerinde coğrafi işaretli bir ürün götüreceklerini ifade etmiştir. Bu bulgular, coğrafi işaretli ürünlerin destinasyon pazarlamasında önemli bir araç olarak algılandığını ortaya koymaktadır.

Tablo 3. Coğrafi İşaretli Ürün Algısı Ölçeği Puanına Ait Normallik Dağılım Analizi

	Kolmogorov-Smirnov			Skewness (Çarpıklık)	Kurtosis (Basıklık)
	Test İstatistiği	Sd	p		
Coğrafi İşaretli Ürün Algısı	0,140	401	0,000	-0,910	0,007

Normallik analizi sonuçlarına göre Kolmogorov-Smirnov testinin anlamlı çıkmasına rağmen, çarpıklık (-0,910) ve basıklık (0,007) değerlerinin kabul edilebilir sınırlar içerisinde olduğu görülmektedir. Bu durum, veri setinin yaklaşık normal dağılım gösterdiğini ve parametrik testlerin uygulanmasının uygun olduğunu göstermektedir (George ve Mallery, 2010).

Tablo 4. Coğrafi İşaretli Ürün Algısı Ölçeği Puanının Cinsiyete Göre Karşılaştırılması

Cinsiyet	Coğrafi İşaretli Ürün Algısı			t(334,95)	p
	n	Ort.	SS		
Erkek	146	4,41	0,49	2,316	0,021*
Kadın	255	4,29	0,56		
Bağımsız örneklem t testi, *p≤0.05, **p≤0.01					

Tablo 4'e göre, coğrafi işaretli ürün algısı cinsiyete göre istatistiksel olarak anlamlı bir farklılık göstermektedir (p<0,05). Erkek katılımcıların algı düzeylerinin kadınlara kıyasla daha yüksek olduğu belirlenmiştir. Bu bulgu, cinsiyet değişkeninin coğrafi işaretli ürün algısı üzerinde etkili bir faktör olduğunu ortaya koymaktadır.

Tablo 5. Coğrafi İşaretli Ürün Algısı Ölçeği Puanının Yaş Gruplarına Göre Karşılaştırılması

Yaş	Coğrafi İşaretli Ürün Algısı			F(3, 397)	p
	n	Ort.	SS		
18-25 arası	124	4,03	0,51	24,039	0,000***
26-30 arası	147	4,41	0,49		
31-35 arası	92	4,52	0,49		
36 ve üzeri	38	4,58	0,45		
Tek Yönlü Varyans Analizi (ANOVA), *p≤0.05, **p≤0.01					

Tablo 5 sonuçları, coğrafi işaretli ürün algısının yaş gruplarına göre anlamlı farklılık gösterdiğini ortaya koymaktadır (p<0,001). Yaş arttıkça algı düzeyinin yükseldiği görülmektedir. Bu durum, ileri yaş gruplarının yerel ve coğrafi işaretli ürünlere daha fazla önem verdiğini ve bu ürünlere yönelik farkındalıklarının daha yüksek olduğunu göstermektedir.

Tablo 6. Coğrafi İşaretli Ürün Algısı Ölçeği Puanının Medeni Duruma Göre Karşılaştırılması

Medeni durum	Coğrafi İşaretli Ürün Algısı			t(399)	p
	n	Ort.	SS		
Evli	174	4,45	0,53	3,952	0,000***
Bekar	227	4,24	0,52		
Bağımsız örneklem t testi, *p≤0.05, **p≤0.01					

Tablo 6 incelendiğinde, evli katılımcıların coğrafi işaretli ürün algı düzeylerinin bekâr katılımcılara göre istatistiksel olarak anlamlı biçimde daha yüksek olduğu görülmektedir (p<0,001). Bu sonuç, medeni durumun coğrafi işaretli ürün algısı üzerinde önemli bir değişken olduğunu göstermektedir.

Tablo 7. Coğrafi İşaretli Ürün Algısı Ölçeği Puanının Eğitim Durumuna Göre Karşılaştırılması

Eğitim	Coğrafi İşaretli Ürün Algısı	F (3, 397)	p

	n	Ort.	SS		
Lise ve altı	80	4,21	0,55	3,180	0,024*
Ön lisans	106	4,44	0,52		
Lisans	157	4,31	0,52		
Lisansüstü	58	4,37	0,56		
Tek Yönlü Varyans Analizi (ANOVA), *p≤0.05, **p≤0.01					

Tablo 7'ye göre, coğrafi işaretli ürün algısı eğitim düzeyine göre anlamlı farklılık göstermektedir (p<0,05). Ön lisans mezunlarının algı düzeylerinin diğer gruplara kıyasla daha yüksek olduğu dikkat çekmektedir. Bu bulgu, eğitim düzeyinin coğrafi işaretli ürün algısını etkileyen faktörlerden biri olduğunu göstermektedir.

Tablo 8. Coğrafi İşaretli Ürün Algısı Ölçeği Puanının Gelinen Bölgeye Göre Karşılaştırılması

Gelinen Bölge	Coğrafi İşaretli Ürün Algısı			F(6, 394)	p
	n	Ort.	SS		
Akdeniz	30	4,24	0,70	0,767	0,596
Karadeniz	115	4,31	0,55		
Marmara	59	4,36	0,52		
Ege	37	4,34	0,65		
Güneydoğu Anadolu	31	4,51	0,40		
İç Anadolu	49	4,30	0,49		
Doğu Anadolu	80	4,35	0,48		
Tek Yönlü Varyans Analizi (ANOVA), *p≤0.05, **p≤0.01					

Tablo 8 sonuçlarına göre, katılımcıların geldikleri bölge ile coğrafi işaretli ürün algıları arasında istatistiksel olarak anlamlı bir farklılık bulunmamaktadır (p>0,05). Bu durum, coğrafi işaretli ürün algısının bölgesel kökenden bağımsız olarak benzer düzeylerde olduğunu ve genel bir farkındalık düzeyine ulaştığını göstermektedir.

Sonuç ve Öneriler

Bu araştırma, Trabzon'u ziyaret eden yerli turistlerin coğrafi işaretli ürünlere yönelik algılarının yüksek düzeyde olduğunu ortaya koymuştur. Bulgular, katılımcıların coğrafi işaretli ürünleri kaliteli, güvenilir, özgün ve bölge ekonomisine katkı sağlayan ürünler olarak algıladıklarını göstermektedir. Özellikle coğrafi işaretli ürünlerin destinasyonun tanıtımına ve turizm potansiyeline katkı sağladığı yönündeki algının oldukça güçlü olduğu belirlenmiştir. Bu durum, coğrafi işaretli ürünlerin gastronomi turizmi kapsamında destinasyon çekiciliğini artıran önemli bir unsur olduğunu ortaya koymaktadır.

Demografik değişkenlere göre yapılan karşılaştırmalar incelendiğinde, coğrafi işaretli ürün algısının cinsiyet, yaş, medeni durum ve eğitim düzeyi açısından anlamlı farklılıklar gösterdiği tespit edilmiştir. Erkek, evli, ileri yaş gruplarında yer alan ve eğitim düzeyi görece yüksek katılımcıların algı düzeylerinin daha yüksek olduğu görülmektedir. Buna karşın, katılımcıların geldikleri bölgeye göre algı düzeylerinde anlamlı bir farklılık bulunmaması, coğrafi işaretli ürünlere yönelik farkındalığın ülke genelinde benzer bir düzeye ulaştığını göstermektedir. Bu sonuç, coğrafi işaretli ürünlerin bölgesel değil, ulusal ölçekte tanınan ve kabul gören bir değer hâline geldiğine işaret etmektedir.

Araştırmadan elde edilen bulgular doğrultusunda, destinasyon yöneticileri ve yerel paydaşlar için çeşitli öneriler geliştirilebilir. Öncelikle, Trabzon'un coğrafi işaretli ürünlerinin destinasyon pazarlama stratejilerinde daha etkin biçimde kullanılması önerilmektedir. Özellikle gastronomi temalı tanıtım faaliyetlerinde bu ürünlerin ön plana çıkarılması, turistlerin destinasyona yönelik algılarını güçlendirebilir. Ayrıca, coğrafi işaretli ürünlerin erişilebilirliğinin artırılması ve satış noktalarının çeşitlendirilmesi, turistlerin satın alma davranışlarını olumlu yönde etkileyebilir.

Gelecek araştırmalarda, coğrafi işaretli ürün algısının yabancı turistler üzerindeki etkisinin incelenmesi, farklı destinasyonlar arasında karşılaştırmalı çalışmalar yapılması ve nitel yöntemlerle turist deneyimlerinin derinlemesine analiz edilmesi önerilmektedir. Bu tür çalışmalar, coğrafi işaretli ürünlerin turizm sektörü içindeki rolünü daha kapsamlı biçimde ortaya koyacaktır.

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TÜRKİYE TURİZMİNİN DİJİTAL AKLI: YAPAY ZEKÂ ÇAĞINDA YENİ REKABET DİNAMİKLERİ

Umut Güleryüz[206], Erkan Denk[207]

Özet
Bu çalışma, yapay zekâ (YZ) teknolojilerinin turizm endüstrisi ve bu endüstriye bağlı bağlı alt sektörleri (Konaklama, yeme-içme ve seyahat, vb.) üzerindeki etkilerini analiz ederek, Türkiye turizminin dijital dönüşüm sürecindeki YZ temelli konumunu ve rekabet gücünü incelemeyi amaçlamaktadır. 2019–2025 yılları arasındaki dönemi irdeleyen bu araştırma, pandemi sonrası süreçte hız kazanan dijitalleşme dalgasının Türkiye turizmine olan yansımalarını ortaya koymayı hedeflemektedir. Nitel araştırma yaklaşımı çerçevesinde tasarlanan çalışma, ikincil veriler üzerinde detaylı ve titiz şekilde yürütülen doküman analizi yöntemiyle tasarlanmıştır. Veriler tüm otoritelerce saygınlığı olan kurum ve kuruluşlarca düzenlenen başta Dünya Turizm Örgütü (UNWTO), Dünya Seyahat ve Turizm Konseyi (WTTC), OECD, T.C. Kültür ve Turizm Bakanlığı raporları ve istatistikleri, çeşitli sektörel değerlendirme analizleri ve güncel akademik kaynaklardan derlenmiştir. MAXQDA 2022 analiz programı yardımıyla gerçekleştirilen analizlerde "Operasyonel Verimlilik", "Misafir Deneyimi", "Dijital Pazarlama" ve "Sürdürülebilirlik" ana temaları altında bulgular şekillendirilmiştir. Sonuç olarak; yapay zekâ destekli dijital altyapı yatırımlarını güçlendiren destinasyonların kriz dönemlerinde daha esnek ve rekabetçi bir yapıya ulaştığı ve daha hızlı çözümlerle toparlanabildiği belirlenmiştir. Türkiye bu kapsamda örnek olarak gösterilebilecek destinasyonlar arasında yer almaktadır. 2024 yılında turizm gelirlerinde tarihî bir rekor kıran ülke, belirtilen ana temalardan sağlanan alanlarda YZ tabanlı uygulamaların etkisiyle önemli bir atılım gerçekleştirmiştir. İlave olarak, destinasyonlar arası dijital dengesizlikler, veri yönetimi eksiklikleri ve siber güvenlik riskleri turizm endüstrisinin zayıf yönleri arasında yer aldığı belirlenmiştir. Türkiye, dijital çağda turizm endüstrisinde başarısını ve rekabet gücünü koruyup sürdürebilmesi için YZ destekli yönetim modellerini yaygınlaştırmalı, kamu ile özel sektör iş birliğini güçlendirmeli ve dijital beceri ekosisteminin geliştirilmesinde geç kalmamalıdır. Bu yaklaşım, Türkiye'nin küresel turizmde dijital liderlik hedeflerine ulaşmasında stratejik bir yönelim olarak değerlendirilmektedir.
Anahtar Kelimeler: Turizm, Yapay Zekâ (YZ), Dijital Dönüşüm, Rekabet Gücü, Türkiye

The Digital Mind of Turkish Tourism: New Competitive Dynamics in the Age of Artificial Intelligence

Abstract
This study aims to examine the AI-based position and competitiveness of Turkish tourism in the digital transformation process by analyzing the effects of artificial intelligence (AI) technologies on the tourism industry and its sub-sectors (Accommodation, food and beverage and travel, etc.). This research, which examines the period between 2019 and 2025, aims to reveal the reflections of the digitalization wave, which accelerated in the post-pandemic period, on Türkiye's tourism. The study, designed within the framework of a qualitative research approach, was designed with the document analysis method carried out in detail and meticulously on secondary data. The data are prepared by institutions and organizations that are respected by all authorities, especially the World Tourism Organization (UNWTO), World Travel and Tourism Council (WTTC), OECD, T.R. Ministry of Culture and Tourism reports and statistics were compiled from various sectoral evaluation analyzes and current academic sources. In the analyzes carried out with the help of the MAXQDA 2022 analysis program, the findings were shaped under the main themes of "Operational Efficiency", "Guest Experience", "Digital Marketing" and "Sustainability". In conclusion; It has been determined that destinations that strengthen artificial intelligence-supported digital infrastructure investments have reached a more flexible and competitive structure during crisis periods and can recover with faster solutions. Türkiye is among the destinations that can be cited as an example in this context. The country, which broke a historical record in tourism revenues in 2024, has made a significant breakthrough with the influence of AI-based applications in the areas provided by the main themes mentioned. Additionally, digital imbalances between destinations, data management deficiencies and cyber security risks have been determined to be among the weaknesses of the tourism industry. In order to maintain its success and competitiveness in the

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tourism industry in the digital age, Turkey should disseminate AI-supported management models, strengthen public and private sector cooperation, and not be late in developing the digital skills ecosystem. This approach is considered as a strategic orientation for Turkey to achieve its digital leadership goals in global tourism.
Keywords: Tourism, Artificial Intelligence (AI), Digital Transformation, Competitiveness, Türkiye

1. Giriş / Introduction

21.yüzyılın ikinci çeyreğine girerken küresel turizm endüstrisi, teknolojik dönüşümün en yoğun hissedildiği alanlardan biri hâline gelmiştir. Dijitalleşme, büyük veri, nesnelerin interneti (IoT), artırılmış gerçeklik (AR) ve özellikle yapay zekâ (YZ) teknolojileri, turizm işletmelerinin yönetim biçimlerini, turist davranışlarını ve destinasyon rekabet dinamiklerini köklü biçimde dönüştürmektedir (Buhalis & Leung, 2022; Sigala, 2023). Turizm endüstrisi artık yalnızca hizmet temelli bir ekonomik yapı olmaktan çıkarak, veri odaklı, öngörü temelli ve kişiselleştirilmiş deneyimlerin merkezde olduğu dijital bir ekosisteme evrilmiştir. Bu dönüşüm; destinasyon yönetimi, pazarlama stratejileri, misafir ilişkileri yönetimi, kaynak optimizasyonu, sürdürülebilirlik politikaları ve rekabet stratejileri üzerinde doğrudan etkiler yaratmaktadır.

Küresel ölçekte dijitalleşmenin turizm üzerindeki etkisi 2019 yılından itibaren hızla artmış, ancak COVID-19 pandemisi bu dönüşümü dramatik biçimde tetiklemiştir. Bütün dünyayı etkileyen pandemi, turizm sektörünü hem ekonomik hem de operasyonel açıdan ciddi biçimde sarsarken, aynı zamanda sektörün dijital çözümlere yönelmesini zorunlu hâle getirmiştir (Gössling, Scott & Hall, 2021). Temassız hizmet anlayışı, çevrimiçi iletişim, dijital sağlık sertifikasyon sistemleri ve veri temelli karar alma süreçleri, turizmde yeni bir paradigma doğurmuştur. Otel işletmeleri, destinasyon yönetim organizasyonları (DMO'lar) ve seyahat acenteleri; rezervasyon sistemlerinden misafir etkileşimlerine kadar pek çok alanda yapay zekâ tabanlı sistemlere yönelmiştir. Chatbot'lar, dinamik fiyatlandırma algoritmaları, talep tahmin modelleri, görüntü işleme destekli güvenlik uygulamaları ve kişiselleştirilmiş öneri motorları bu dönemde yaygın biçimde kullanılmaya başlanmıştır (Tussyadiah, 2020; Hunkenschroer & Luetge, 2022). Buhalis (2020), pandeminin "temassız hizmet dönemini" başlatarak turizmde dijital dönüşümü kalıcı hâle getirdiğini ve yapay zekânın bu süreçte merkezî bir role sahip olduğunu belirtmektedir.

Türkiye açısından bakıldığında, 2019–2025 yılları arası dönem hem ekonomik toparlanma hem de dijital dönüşüm bağlamında kritik bir evreyi temsil etmektedir. Türkiye, 2019 yılında 51,7 milyon yabancı ziyaretçiyle tarihî bir rekora ulaşmış; ancak 2020'de pandemi nedeniyle bu sayı 16 milyonun altına düşmüştür (A.A, 2021). Buna karşın, 2024 yılı itibarıyla ülke turizmi yeniden güçlü bir yükseliş trendine girmiş ve 56,7 milyar ABD doları gelirle tüm zamanların en yüksek seviyesine ulaşmıştır (WTTC, 2023). Bu toparlanma, yalnızca turizm talebinin yeniden artmasıyla değil, aynı zamanda dijitalleşmeye dayalı yeni yönetim ve pazarlama modellerinin etkili biçimde uygulanmasıyla mümkün olmuştur. Dijital altyapı yatırımları, veri analitiği tabanlı tanıtım politikaları ve yapay zekâ destekli misafir deneyimi yönetimi, Türkiye'nin turizmdeki rekabet gücünü yeniden tanımlamıştır (OECD, 2023).

Tüm bu gelişmeler ışığında, bu çalışmanın temel amacı Türkiye turizminin dijital dönüşüm sürecinde yapay zekânın rekabet dinamikleri üzerindeki etkilerini incelemek ve bu dönüşümün sürdürülebilir kalkınma hedefleriyle nasıl ilişkilendiğini ortaya koymaktır. Çalışma, 2019–2025 dönemini kapsayarak pandemi öncesi, pandemi dönemi ve pandemi sonrası süreçleri bütüncül biçimde ele almakta; nitel bir araştırma yaklaşımı çerçevesinde Türkiye'nin dijital performansını Akdeniz bölgesindeki diğer destinasyonlarla karşılaştırmaktadır.

2. Yöntem / Methodology

Bu çalışma, nitel araştırma yaklaşımı çerçevesinde tasarlanmış olup kavramsal ve betimleyici bir analiz niteliği taşımaktadır. Araştırmanın temel amacı, 2019–2025 yılları arasında Türkiye turizminde yapay zekâ (YZ) ve dijital dönüşüm uygulamalarının gelişimini incelemek, bu sürecin sektörel rekabet, sürdürülebilirlik ve destinasyon yönetimi üzerindeki etkilerini değerlendirmektir. Çalışma, pandemi öncesi ve sonrası dönemi kapsayarak küresel eğilimlerle Türkiye'nin mevcut durumu arasında karşılaştırmalı bir bakış açısı geliştirmeyi hedeflemektedir.

Araştırma, nitel paradigma temelinde yürütülmüş olup, ikincil veri kaynaklarına dayalı doküman analizi ve içerik analizi yöntemleri benimsenmiştir. Nitel araştırma yaklaşımı, turizm sektöründe teknolojik dönüşümün çok boyutlu yapısını anlamayı, veriler arasında tematik ilişkiler kurmayı ve mevcut eğilimleri derinlemesine yorumlamayı sağlamaktadır.

Bu kapsamda araştırma, hem kavramsal bir çerçeve oluşturmayı hem de betimleyici bir değerlendirme sunmayı amaçlamaktadır. Çalışma, literatürde yer alan akademik araştırmalar, ulusal ve uluslararası kurum raporları, resmi istatistikler ve sektörel değerlendirmelerden elde edilen veriler üzerine inşa edilmiştir.
Araştırmanın veri seti, hem ulusal hem de uluslararası düzeyde güvenilir, güncel ve yetkin kaynaklardan elde edilmiştir. Veriler, 2019–2025 yılları arasını kapsayacak şekilde seçilmiş ve dijital dönüşümün turizm sektöründeki yansımalarını açıklamaya yönelik olarak sınıflandırılmıştır.
Başlıca veri kaynakları aşağıda özetlenmiştir:
Uluslararası Kuruluş Raporları: Dünya Turizm Örgütü (UNWTO, 2024), Dünya Seyahat ve Turizm Konseyi (WTTC, 2023), OECD (2023), Dünya Ekonomik Forumu (WEF, 2025) değerlendirme raporları.
Ulusal Kaynaklar: T.C. Kültür ve Turizm Bakanlığı (2024) istatistikleri, Türkiye İstatistik Kurumu (TÜİK) verileri, e-Vize, GoTürkiye ve Turizm Databank.
Akademik Literatür: COVID-19 sonrası turizm (Gössling vd., 2020), dijital dönüşüm (Buhalis, 2020; Sigala, 2020), yapay zekâ uygulamaları (Tussyadiah, 2020; Buhalis & Leung, 2022; Bilge, 2023) ve dijital pazarlama (Ercan, 2020) üzerine güncel çalışmalar.
Ayrıca, sektörde uygulanan somut yapay zekâ örnekleri (THY'nin yapay zekâ destekli asistanı, Protel'in otel yönetim yazılımlarındaki enerji ve atık yönetimi sistemleri, dijital pazarlama uygulamaları) sektörel raporlar üzerinden incelenmiştir.
Veri toplama sürecinde, doküman analizi yöntemi temel alınmıştır. 2019–2025 dönemine ait raporlar, akademik yayınlar ve istatistiksel veriler sistematik olarak taranmıştır.
Dokümanlar, geçerlilik, güvenilirlik, güncellik ve tematik uygunluk kriterlerine göre seçilmiş; konu, yıl ve kaynak türüne göre kodlanmıştır. UNWTO ve WTTC raporları, pandeminin turizm sektörü üzerindeki etkilerini sayısal olarak ortaya koyduğu için karşılaştırmalı analizlerde referans olarak kullanılmıştır.
Örneğin, WTTC (2023) verilerine göre, küresel turizm gelirleri 2019'da 10 trilyon USD iken, 2020'de pandemi nedeniyle 5 trilyon USD'ye düşmüştür. Bu tür göstergeler, dijitalleşmenin toparlanma sürecindeki rolünü değerlendirmek için kullanılmıştır.
Verilerin analizi, içerik analizi yöntemiyle gerçekleştirilmiştir. Bu süreçte, dokümanlardan elde edilen veriler temalar hâlinde kodlanmış, benzer kavramlar bir araya getirilerek kategoriler oluşturulmuş ve anlamlı ilişkiler yorumlanmıştır.
Analiz süreci dört aşamada yürütülmüştür:
Kodlama: Veriler "dijital dönüşüm", "yapay zekâ", "rekabet gücü", "sürdürülebilirlik", "turist deneyimi" ve "veri yönetimi" gibi temalar altında kodlanmıştır.
Kategori Oluşturma: Benzer temalar bir araya getirilerek ana temalar ve alt kategoriler oluşturulmuştur.
Yorumlama: Kategoriler, Türkiye'nin dijitalleşme düzeyi ve uluslararası karşılaştırmalar bağlamında yorumlanmıştır.
Modelleme: Türkiye'nin dijital turizm ekosistemindeki güçlü ve zayıf yönleri, fırsatlar ve tehditleri ortaya koyan kavramsal bir çerçeve geliştirilmiştir.

3. Bulgular / Findings

Bu bölümde, 2019–2025 döneminde Türkiye turizminde yapay zekâ (YZ) destekli dijital dönüşüm uygulamalarının sektöre etkileri detaylı biçimde ele alınmaktadır. Bulgular, doküman ve içerik analizi sonuçlarına dayanarak temalar hâlinde sunulmuş, Türkiye'nin uluslararası turizm rekabet gücü, sürdürülebilirlik performansı ve misafir deneyimi açısından değerlendirilmiştir.

3.1. Küresel ve Türkiye Turizminde Pandemi Sonrası Dijitalleşme

Analizler, pandemi sonrası dijitalleşmenin turizm sektöründe hız kazandığını göstermektedir. WTTC (2023) ve UNWTO (2024) verilerine göre, dijital altyapı ve yapay zekâ kullanımını etkin biçimde benimseyen ülkeler, pandemi sonrası turizm gelirlerini daha hızlı toparlamıştır. Örneğin, Akdeniz ülkeleri İspanya, Fransa ve İtalya, yapay zekâ destekli rezervasyon sistemleri, akıllı şehir altyapıları ve dijital pazarlama stratejileri ile turizmde esneklik kazanmış, gelirlerinde %30–35 civarında artış sağlamıştır. Türkiye de bu eğilimi yansıtarak 2024 yılında tüm zamanların en yüksek turizm gelirine ulaşmıştır (T.C. Kültür ve Turizm Bakanlığı, 2025; WTTC, 2023).
Pandemi döneminde, fiziksel temasın sınırlandırılması, temassız hizmetlerin ve dijital çözümlerin önemini artırmıştır. Chatbotlar, sanal asistanlar, dinamik fiyatlandırma algoritmaları ve kişiselleştirilmiş öneri sistemleri, turist deneyimini destekleyen temel yapay zekâ uygulamaları olarak öne çıkmıştır (Tussyadiah, 2020; Hunkenschroer & Luetge, 2022).

3.2. Yapay Zekâ Uygulamalarının Tematik Analizi

MAXQDA 2022 programı ile gerçekleştirilen içerik analizi, Türkiye'deki yapay zekâ uygulamalarının dört ana tema çerçevesinde yoğunlaştığını göstermektedir:

Operasyonel Verimlilik: Rezervasyon yönetimi, kaynak optimizasyonu, enerji ve atık yönetimi gibi süreçlerde YZ uygulamaları verimliliği artırmaktadır.

Misafir Deneyimi: Chatbotlar, kişiselleştirilmiş öneri sistemleri ve sanal asistanlar, turist memnuniyetini ve deneyim kalitesini yükseltmektedir.

Dijital Pazarlama: Yapay zekâ destekli analizler, hedef kitleye özel kampanyaların tasarlanmasını ve destinasyon markalaşmasını güçlendirmektedir.

Sürdürülebilirlik: YZ tabanlı enerji ve atık yönetim sistemleri, çevresel sürdürülebilirlik performansını artırmaktadır.

Kelime frekansı, kelime bulutu ve etkileşimli tematik ağlar, bu temaların birbirleriyle ilişkili olduğunu ve dijital dönüşüm sürecinde bütüncül bir etki yarattığını göstermektedir.

3.2.1. Yapay Zekanın Operasyonel Verimliliğe Etkileri

Turizm sektörü, yapay zekâ ve büyük veri teknolojilerinin getirdiği devrim niteliğindeki dönüşümle birlikte yeni bir döneme girmiştir. Bu teknolojiler; misafir deneyimlerinin kişiselleştirilmesi, operasyonel süreçlerin optimize edilmesi ve pazarlama stratejilerinin yeniden yapılandırılması yoluyla işletmelere önemli avantajlar sunmaktadır (Gretzel vd, 2015; Buhalis ve Leung, 2022). Yapay zekâ uygulamalarının son yıllarda hızla artması, sektörde olumlu algı ve yüksek düzeyde kabul oluşmasına katkı sağlamıştır (Hanh, 2024).

Yapay zekâ, turizmde misafir memnuniyetini artırmak için güçlü bir araç olarak karşımıza çıkmaktadır. Buhalis ve Deimezi'nin (2024) çalışmasına göre, destinasyonlarda akıllı teknolojilerin uygulanması kayıp bagaj, uzun kuyruklar, gecikmeler ve hizmet yetersizliği gibi olumsuzlukları azaltarak memnuniyet seviyesini yükseltmektedir. Yapay zekâ destekli sohbet robotları, 7/24 kesintisiz destek sağlayarak misafir etkileşimlerini olumlu yönde etkilemekte ve hizmet kalitesini geliştirmektedir (Prahadeeswaran, 2023).

3.2.2. Yapay Zekanın Misafir Deneyimine Katkıları

Yapay zekânın kullanım alanları günümüzde oldukça çeşitlidir ve tıp, inşaat, mimarlık, pazarlama, eğlence ve turizm gibi birçok sektörde farklı amaçlarla uygulanmaktadır. Tıp bilimlerinde yapay zekâ, hastalara tanı koyma, tedavi önerileri sunma ve insan müdahalesinin zor olduğu cerrahi operasyonları gerçekleştirme gibi işlevlerde etkin olarak kullanılmaktadır (Demirhan vd, 2010; Kunt vd, 2021). İnşaat ve mimarlık alanlarında yapay zekâ, projelerin dayanıklılığını analiz etme ve uygun inşa teknikleri önerme süreçlerinde önem taşımaktadır (Bingöl vd., 2020). Pazarlama sektöründe ise yapay zekâ, yeni misafirlere ulaşma, hedef kitleyle iletişim kurma, karar verme süreçlerine destek olma, fiyatlandırma politikalarını belirleme, tanıtım ve marka iletişimi ile satış sonrası hizmetlerde etkin olarak kullanılmaktadır (Akçetin vd., 2017; Bayuk ve Demir, 2019). Turizm ve yapay zekâ ilişkisi, diğer alanlara kıyasla daha geç bir tarihte ortaya çıkmıştır. Turizm sektöründe yapay zekâ üzerine yapılan çalışmalar halen sınırlı olmakla birlikte, bu alandaki akademik araştırmalara duyulan ihtiyaç giderek artmaktadır (Sezgin ve Karagöz, 2021; Yalçın Kayıkçı ve Kutluk Bozkurt, 2018).

3.2.3. Yapay Zekanın Dijital Pazarlamaya Etkileri

Yapay zekâ teknolojileri, Türkiye turizmi ve ilişkili sektörlerde giderek yaygınlaşmakta ve hem operasyonel süreçlerin verimliliğini artırmakta hem de misafir deneyimini geliştirmektedir (Atar, 2020). Özellikle yiyecek-içecek sektöründe, Yemek sepetinin 2023 yılında başlattığı *"ChatGPT Destekli Menü"* uygulaması, ürün açıklamalarının zenginleşmesini sağlayarak kullanıcıların bilinçli seçimler yapmasına imkân tanımaktadır.

Turizm işletmeleri, yapay zekâ destekli sohbet robotları (chatbot) aracılığıyla misafirlerle 7/24 iletişim kurmakta ve kişiselleştirilmiş tavsiyeler sunmaktadır (Bilge, 2023; Başer ve Olcay, 2022). Ayrıca yapay zekâ, pazarlama faaliyetlerinde potansiyel misafir segmentlerini analiz ederek kişiselleştirilmiş kampanyalar oluşturmakta ve arama motoru optimizasyonunu desteklemektedir (Ercan, 2020). Yapay zekâ teknolojileri, turizm sektöründeki pazarlama faaliyetlerinin planlanması ve uygulanmasında da önemli bir rol oynamaktadır. Yapay zekâ, işletmelerin büyük veriyi analiz ederek potansiyel misafir segmentlerini belirlemesine ve onlara yönelik kişiselleştirilmiş pazarlama stratejileri oluşturmasına yardımcı olmaktadır. Örneğin, yapay zekâ destekli içerik yazma araçları, arama motorları için optimize edilmiş içerikler oluşturarak tur operatörlerinin daha fazla organik trafik çekmesine olanak tanımaktadır. Bu sayede, kaynaklar daha etkili bir şekilde tahsis edilebilmekte ve işletmelerin dijital görünürlüğü artırılabilmektedir (Bilge, 2023).

3.2.4. Yapay Zekanın Turizm Endüstrisinde Sürdürülebilirliğe Etkileri

Turizm endüstrisinde Yapay zekâ, sürdürülebilirliğin çevresel, ekonomik ve sosyal boyutlarını bütüncül biçimde etkileyen en önemli dönüşüm araçlarından biridir. Pandemi sonrası dönemde hız kazanan dijitalleşme, yapay zekâ destekli sistemlerin kaynak verimliliği ve krizlere karşı direnç oluşturmadaki rolünü belirginleştirmiştir (Gössling vd., 2020; WTTC, 2023). Yapay zekâ tabanlı enerji, atık ve talep yönetimi uygulamaları, konaklama işletmelerinde karbon ayak izinin azaltılmasına ve operasyonel verimliliğin artırılmasına katkı sağlamaktadır (OECD, 2023; Buhalis & Leung, 2022). Türkiye'de Protel gibi yazılımların mutfak atık yönetimi ve üretim tahmininde kullanılması, çevresel sürdürülebilirliğe yönelik somut bir uygulama örneği sunmaktadır (Bilge, 2023).

Bununla birlikte, yapay zekâ destekli destinasyon kapasite planlaması ve talep tahmin modelleri, aşırı turizm baskısını azaltarak doğal ve kültürel kaynakların korunmasına imkân tanımaktadır (Sigala, 2020). Ekonomik sürdürülebilirlik açısından yapay zekâ, dinamik fiyatlandırma ve operasyonel optimizasyon yoluyla işletmelerin kriz dönemlerinde daha hızlı toparlanmasını desteklemektedir (WTTC, 2023). Ancak destinasyonlar arası dijital altyapı eşitsizlikleri ve veri yönetimi eksiklikleri, sürdürülebilir dijital dönüşümün önündeki temel yapısal riskler arasında yer almaktadır (Ercan, 2020). Bu bağlamda yapay zekâ, turizmde sürdürülebilir rekabetin ve dengeli destinasyon yönetiminin temel bileşenlerinden biri olarak değerlendirilmektedir.

4. Tartışma / Discussion

Küresel ölçekte yapılan araştırmalar, yapay zekânın turizmdeki rekabet gücü üzerindeki etkilerini açık biçimde ortaya koymaktadır. WTTC (2023) raporuna göre, dijitalleşme kapasitesi yüksek ülkeler pandemi sonrası dönemde turizm gelirlerinde ortalama %35 daha hızlı toparlanmıştır. İspanya, Fransa ve İtalya gibi Akdeniz destinasyonları, yapay zekâ tabanlı destinasyon yönetimi, akıllı şehir altyapıları ve veri temelli dijital pazarlama stratejileriyle öne çıkmıştır. Türkiye de bu ülkelerle benzer bir yönelim izleyerek, "GoTürkiye" dijital platformu aracılığıyla tanıtım, analiz ve destinasyon yönetimi süreçlerinde dijital entegrasyonu güçlendirmiştir (UNWTO, 2024). Bu yaklaşım, Türkiye'nin turizm markasını dijital düzlemde güçlendirmiş, ülkeyi veri temelli destinasyon yönetimi anlayışına yaklaştırmıştır.

Ancak Türkiye turizminin dijital dönüşüm süreci bazı zorluklarla da karşı karşıyadır. Destinasyonlar arasındaki dijital altyapı farkı, özellikle kıyı bölgeleri ile iç bölgeler arasında belirgindir. Kıyı destinasyonları teknolojik olarak daha hızlı adapte olurken, iç destinasyonlarda internet erişimi, veri toplama kapasitesi ve yapay zekâ tabanlı sistemlerin kullanımı sınırlı kalmaktadır. Ayrıca turizm işletmelerinin bir kısmı hâlâ manuel süreçlere bağımlı olup, veri analitiği ve yapay zekâ destekli karar destek sistemlerinden yeterince yararlanmamaktadır (Ercan, 2020). Bu durum, Türkiye'nin dijital rekabet gücünün ulusal ölçekte homojen bir biçimde dağılmasını engellemektedir.

Yapay zekâ destekli dönüşümün bir diğer boyutu, turizm sektöründe insan–makine etkileşiminin yeniden tanımlanmasıdır. YZ, sadece operasyonel verimliliği değil, aynı zamanda misafir memnuniyetini ve deneyim kişiselleştirmesini de doğrudan etkilemektedir. Ziyaretçilerin geçmiş tercihleri, seyahat alışkanlıkları ve çevrimiçi davranışları analiz edilerek, kişiye özel tatil önerileri ve dinamik fiyatlandırma modelleri geliştirilmektedir (Sezgin & Karagöz, 2021). Bu gelişmeler, "deneyim ekonomisi" kavramının dijital dönüşümle birleştiği yeni bir turizm paradigmasını ortaya koymaktadır.

Yapay zekânın turizmdeki bu çok boyutlu etkisi, aynı zamanda sürdürülebilirlik hedefleriyle de yakından ilişkilidir. OECD (2025) raporu, akıllı enerji yönetimi, karbon ayak izi izleme, atık azaltma ve destinasyon kapasite planlamasında yapay zekâ teknolojilerinin kullanımının, turizmde çevresel sürdürülebilirliği güçlendirdiğini vurgulamaktadır. Türkiye'de bu doğrultuda geliştirilen "Akıllı Şehir–Akıllı Destinasyon" stratejileri, turizmin yalnızca ekonomik değil, aynı zamanda ekolojik ve sosyal boyutlarda da dengeli biçimde gelişmesini hedeflemektedir (TÜROFED, 2023). Böylece yapay zekâ, turizmde hem rekabet hem de sürdürülebilirlik ekseninde stratejik bir kaldıraç işlevi görmektedir.

Sonuç ve Öneriler / Conclusion and Recommendations

Bu çalışma, yapay zekâ destekli dijital dönüşümün turizm sektöründe yalnızca teknik bir yenilik olarak ele alınamayacağını; rekabetçilik, dayanıklılık ve sürdürülebilirlik üzerinde doğrudan etkili olan yapısal bir unsur hâline geldiğini ortaya koymaktadır. Bulgular, yapay zekâ temelli uygulamaların veri odaklı karar alma süreçlerini güçlendirdiğini, turist deneyimlerinin kişiselleştirilmesini mümkün kıldığını ve destinasyon yönetiminde daha bütüncül bir yönetişim anlayışını desteklediğini göstermektedir. 2019–2025 dönemini

kapsayan değerlendirmeler, yapay zekâ destekli dijital altyapıya yatırım yapan destinasyonların, özellikle COVID-19 sonrası dönemde, krizlere karşı daha esnek ve uyarlanabilir bir yapı sergilediğini ortaya koymaktadır. Bu destinasyonların toparlanma sürecini görece daha kısa sürede tamamlaması, yapay zekânın operasyonel bir araçtan öte, kriz yönetimi ve uzun vadeli istikrar açısından stratejik bir kapasite unsuru olduğunu göstermektedir. Bu bağlamda Türkiye, dijital turizm uygulamaları ve yapay zekâ entegrasyonu bakımından önemli bir potansiyele sahip olmakla birlikte, bu potansiyelin henüz tüm destinasyonlara eşit biçimde yansıtılamadığı görülmektedir.

Çalışma aynı zamanda, destinasyonlar arasındaki dijital altyapı farklılıklarının, bütünleşik veri yönetimi eksikliklerinin ve artan siber güvenlik risklerinin Türkiye turizminin dijital dönüşüm sürecini sınırlayan temel unsurlar olduğunu ortaya koymaktadır. Özellikle iç ve gelişmekte olan destinasyonlarda yapay zekâ tabanlı uygulamaların sınırlı kalması, dijital rekabet gücünün ulusal ölçekte dengeli biçimde yayılmasını engellemektedir. Bu durum, yapay zekâ uygulamalarının Türkiye turizminde henüz kurumsal ve standart bir yönetişim pratiği hâline gelemediğini göstermektedir. Bu bulgular, çalışmanın kapsadığı dönem ve veri seti çerçevesinde değerlendirilmelidir.

Araştırma bulguları, Türkiye turizminin küresel rekabet gücünü sürdürülebilir biçimde koruyabilmesi için yapay zekâ destekli yönetim modellerinin kurumsal düzeyde yaygınlaştırılmasının artık bir tercih değil, zorunluluk hâline geldiğini göstermektedir. Bu kapsamda dijital turizm politikalarının güçlendirilmesi, yapay zekâ odaklı bir turizm inovasyon ekosisteminin oluşturulması ve sektörel dijital okuryazarlığın artırılması öncelikli politika alanları olarak değerlendirilmelidir.

Kamu ve özel sektör arasındaki iş birliği mekanizmalarının güçlendirilmesi ve veri temelli destinasyon yönetimi anlayışının yaygınlaştırılması, bölgesel dijital kapasite farklılıklarının azaltılmasına katkı sağlayacaktır. Özellikle dijital altyapı yatırımlarının gelişmekte olan destinasyonları önceleyecek biçimde planlanması, dijital dönüşüm sürecinin daha dengeli ve kapsayıcı ilerlemesi açısından kritik öneme sahiptir.

Bununla birlikte, yapay zekâ uygulamalarının yalnızca verimlilik ve maliyet avantajı sağlayan araçlar olarak ele alınması, turizmin uzun vadeli sürdürülebilirlik hedefleri açısından yetersiz kalacaktır. Yapay zekânın çevresel sürdürülebilirlik ve sosyal kapsayıcılık hedefleriyle bütünleşik biçimde kullanılması, dijital dönüşümün sektörel faydasını artıracaktır. Bu çerçevede, yapay zekâ destekli turizm yönetişimi, Türkiye'nin küresel turizm sisteminde dijital liderlik hedeflerine ulaşmasında stratejik bir politika aracı olarak değerlendirilebilir.

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KIRMIZI PANCAR VE MOR HAVUÇ SUYU KATILARAK ZENGİNLEŞTİRİLMİŞ DONDURMA

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Özet
Bu çalışmada sade dondurma ile birlikte %8 (200mL) kırmızı pancar suyu (RB1) ile mor havuç suyu (PC1) ve %15 (400mL) kırmızı pancar suyu (RB2) ile mor havuç suyu (PC2) katılarak dondurmanın görünüşünü daha cazip hale getirmek, besin değerini ve antioksidan kapasitesini artırmak hedeflenmiştir. Kontrol dondurma örneklerinin kurumadde oranı en yüksek (%33,90) düzeyde bulunmuştur. En düşük kurumadde oranı (%27,53) ise RB2 örneklerinde tespit edilmiştir. Dondurma örneklerinin kül oranı %2,28 ile 3,86 arasında değişmiştir. En düşük pH değeri RB2 örneklerinde, en yüksek pH değeri PC2 örneklerinde tespit edilmiştir. En düşük hacim artışı değeri (%28,58) RB2 örneklerde belirlenirken, en yüksek hacim artışı değeri (%38,38) sade (kontrol) dondurma örneklerinde saptanmıştır. En kısa ilk erime süresi (19 dak.) kontrol örneklerinde, en uzun ilk erime süresi değeri (43 dak.) PC2 örneklerinde bulunmuştur. En düşük viskozite ölçüm değeri PC2 örneklerinde, en yüksek viskozite değeri sade dondurma örneklerinde tespit edilmiştir. Kırmızı pancar suyu katılmış dondurma örneklerinin DPPH değerinin (%38,03) sade dondurma (%15,03) ve PC1 ve PC2 örneklerinden (%24,76-%26,91) önemli düzeyde ($p<0,01$) yüksek olduğu tespit edilmiştir. Dondurmaya katılan kırmızı pancar ve mor havuç suyu dondurmanın L* renk değerini azatmış, a*, C* ve h* renk değerlerini artırmıştır. Bilhassa sade dondurma örneklerinde çok düşük düzeyde olan veya bulunmayan asetik asit, 2-3bütandiol, bütanol, oktanol, hekzanoik asit, oktanol asit ve benzaldehit aroma bileşenleri mor havuç ve kırmızı pancar suyu ilavesi ile bu aroma bileşenlerinin yüksek oranda bulunmasına sebep olmuştur. Panelistler, kırmızı pancar ve mor havuç suyu ilaveli dondurmaları kontrole göre daha çok beğenmişlerdir.
Anahtar Kelimeler: Dondurma, mor havuç (MH), kırmızı pancar (KP), aroma bileşikleri, viskozite

Abstract
In this study, it was aimed to make the ice cream look attractive, increase its nutritional value and antioxidant capacity by adding 8% (200mL) red beet juice (RB1) and purple carrot juice (PC1) and 15% (400mL) red beet juice (RB2) and purple carrot juice (PC2) to plain ice cream. The dry matter ratio of control ice cream samples was found to be at the highest level (33.90%). The lowest dry matter ratio (27.53%) was determined in RB2 samples. The ash ratio of ice cream samples varied between 2.28% and 3.86%. The lowest pH value was determined in RB2 samples, and the highest pH value was determined in PC2 samples. While the lowest volume increase value (28.58%) was determined in RB2 samples, the highest volume increase value (38.38%) was determined in plain (control) ice cream samples. The shortest first dropping time (19 min.) was found in control samples, the longest first dropping time (FDT) (43 min.) was found in PC2 samples. The complete melting times (CMT) of the ice cream samples varied between 38.00 minutes and 109.00 minutes. The lowest viscosity measurement was found in PC2 samples, and the highest viscosity value was found in plain ice cream samples. It was found that the DPPH value of ice cream samples with red beet juice added (38.03%) was significantly ($p<0.01$) higher than plain ice cream (15.03%) and PC1 and PC2 samples (24.76%-26.91%). Red beet and purple carrot juice added to ice cream decreased the L* color value of ice cream and increased the a*, C* and h* color values. Especially actic acid, 2-3 butanediol, butanol, octanol, hexanoic acid, octanol acid and benzaldehyde aroma components, which were at very low levels or absent in plain ice cream samples, caused the presence of these aroma components at high levels with the addition of purple carrot and red beet juice. Panelists liked ice creams with red beet and purple carrot juice more than the control.
Keywords: Ice cream, purple carrot (PC), red beet (RB), aroma compounds, viscosity

1.Giriş

Havuç hem karotenoidler hem de fenolik bileşiklerin yanısıra antioksidanlar bakımından zengin bir kök sebzesidir. Havucun karotenoid içeriği genotipler arasında farklı olmakla birlikte, genellikle turuncu havuçlar α- ve β- karoten; sarı havuçlar lutein, kırmızı havuçlar likopen ve mor-siyah havuçlarda antosiyaninler bakımından zengindir. Turuncu havuçların içerdiği beta-karoten karaciğer tarafından A vitaminine dönüştürülerek, gözün loş ışıkta görmesini sağlayan rodopsini oluşturmakta ve retinanın ışığı duyarlı alanının

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etkinliğini arttırmak suretiyle göz sağlığını korumaktadır. A vitamini ayrıca solunum, idrar ve bağırsak yollarının yüzey astarlarını korumakta ve beyaz kan hücrelerinin enfeksiyona karşı savaşmasına yardımcı olarak bağışıklık sistemini düzenlemektedir. Mor havuçlar ise renklerini antosiyaninlerden almakta, bu pigmentler vücuttaki serbest radikalleri tutan antioksidan özellik göstermektedir. Ayrıca havuçtaki antosiyaninler kanın pıhtılaşmasını yavaşlatmakta ve kalp hastalığının önlenmesine yardımcı olmaktadır. Kırmızı renkli havuçlardaki likopenin domates salçasında olduğu gibi %40'ı biyo-yarayışlı olduğu bulunmuştur (Horovitz ve Simon, 2004). Kırmızı havucun rengi likopenden oluşmaktadır. Ayrıca likopen provitamin A aktivitesine sahip olmamakla birlikte, en güçlü antioksidanıdır (Di Mascio vd., 1989).

Kırmızı havuçların likopen içeriğinin araştırıldığında, tipik domates bulunan miktar kadar (30 ppm) veya daha fazla olduğu (50-100) bulunmuştur. Kırmızı havuç çeşitlerinde havuç tipine göre değişen miktarlarda α-karoten, β -karoten ve lutein bulunmaktadır. Mor havuçların renklerini vücuttaki zararlı serbest radikallerin ayrılması için kuvvetli bir antioksidant olarak görev alan ve antosiyanin olarak adlandırılan fitokimyasal madde oluşturmaktadır. Antosiyaninler kalp hastalığını; anti-enflamatuar olarak ve lipid oksidasyonunun azaltılması yoluyla önleyebilmektedir (Arscott ve Tanumihardjo, 2010). Farklı siyah havuç çeşitleri ile yapılan çalışmada toplam fenolik madde miktarının çeşitlere göre değişmekle birlikte 17,9-97,9 mg (GAE)/100 g olduğu; antosiyaninlerin içeriğinin ise 1,5- 17,7 mg/100 g arasında değiştiği tespit edilmiştir (Montilla vd.,2011).

Mazza ve Kay (2009) ise siyah havuçların antosiyanin içeriğinin 1750 mg/kg'a kadar çıktığını belirtmişlerdir. Antosiyaninlerin ayrıca kardiyovasküler hastalıkların önlenmesi, antikarsinojenik aktivite, diyabetin kontrolü ve görmenin iyileştirilmesi gibi insan sağlığı için önemli etkilerinin olduğu da bildirilmiştir (He ve Giusti, 2010).

Ülkemizde kış aylarının en çok tüketilen sebzelerinden olan kırmızı pancar (Beta vulgaris var. Conditiva) ıspanakgiller (Chenopodiaceae) familyasına aittir. Anavatanı Akdeniz Bölgesi olan sebze, organik maddece zengin, killi, derin topraklarda ve ılıman iklimlerde yetişebilmektedir. Kök kısmı koyu kırmızı olan pancar, açık yeşilden koyu yeşile değişebilen renkte koyu kırmızı damarları olan yapraklara sahiptir (Neelwarne ve Halagur, 2013). 2019 yılı verilerine göre, ülkemizde 9.917 ton kırmızı pancar üretilmiştir (Anonymous, 2021). Kırmızı pancar genellikle taze olarak tüketilmekte olup bunun yanı sıra gıda endüstrisinde turşu, şalgam ve doğal gıda boyası üretiminde de kullanılmaktadır. Kırmızı pancar, A, B3, B6, B9 ve C vitaminlerini ve ayrıca bakır, çinko, demir, fosfor, kalsiyum, magnezyum, manganez, sodyum ve potasyum minerallerini içermektedir (Ceclu ve Nistor, 2020). Kırmızı pancar, temel olarak sakaroz az miktarda früktoz ve glikoz şekerlerini içermektedir. Kırmızı pancar, zengin fitokimyasal yapısı ile antioksidan, antikanserojen, antiinflamatuvar, antimikrobiyal ve antiviral özelliklere sahip olmanın yanı sıra, gastrointestinal sistem ve kardiyovasküler hastalıklara karşı koruyucu etki göstermektedir (Babarykin vd., 2019; Ceclu ve Nistor, 2020). Sebzede sitrik asit başta olmak üzere fumarik, malik ve şikimik organik asitleri bulunmaktadır. Kırmızı pancar, mineral, betalain, flavonol, flavan-3-ol, karotenoid ve fenolik bileşen içeriği ile inflamasyon, kanser, gastrointestinal sistem ve kardiyovasküler hastalıklara karşı koruyucu ve tedavi edici özelliklerinden dolayı fonksiyonel bir gıda maddesi olarak tüketilmesi gereken bir sebzedir.

Kırmızı pancar fitokimsalları akciğer, cilt, karaciğer, kolon ve yemek borusunda oluşabilen kanser türlerine karşı koruyucu etki göstermektedir (Ceclu ve Nistor, 2020). Sebze içeriğindeki betanin, kafeik asit ve p-kumarik asit bileşenleri, organizmadaki tümörlerin %30'unda kanser hücrelerinin gelişimini engellemektedir (Lechner ve Stoner, 2019). Kırmızı pancarın özellikle yapraklarında bulunan lutein ve zeaksantin karotenoidleri, yaşa bağlı görme kalitesini artırmaktadır. Kırmızı pancarın kök ve özellikle yaprakları, fosfor, kalsiyum, magnezyum ve potasyum mineralleri bakımından zengindir. Sebze potasyum içeriği ile günlük beslenme sırasında alınan sodyumun zararlarını azaltmaktadır. Aynı zamanda organizmada, sıvı elektrolit dengesini sağlamakta, kan basıncını düşürerek felç riskini azaltmaktadır (Who, 2012). Kalsiyum mineralinin yetişkinler için günlük alınması gereken miktarı (1000 mg/gün) dikkate alındığında, 100 g kırmızı pancar yaprağı tüketimi ile günlük kalsiyum ihtiyacının yaklaşık 1/10'u karşılanmaktadır (Who, 2016).

1.A. Mor Havucun Gıdalara Katılması ile İlgili Çalışmalar

Yapılan çalışmada araştırmacılar (Aslan vd., 2023) mor havuç tozunu (Daucus carota L.), cips formülasyonuna buğday unu yerine beş farklı oranda (%0, 10, 20, 30 ve 40) katmışlardır. Mor havuç tozu katılarak üretilen cips örneklerinin toplam fenolik madde miktarı ve antioksidan aktivite değeri, yüksek ikame oranı ile birlikte önemli düzeyde artırdığı belirlenmiştir. Mor havuç tozu ikamesi ile cips örneklerinin L* değerlerinde azalma, a* ve b* değerlerinde ise bir artış belirlenmiştir. Kontrol cips örnekleri ile kıyaslandığında, mor havuç tozu iilaveli cips örneklerinin çap, kalınlık, sertlik ve kırılganlık değerleri artmıştır.

Duyusal değerlendirme sonucuna göre, mor havuç tozunun %10 seviyesine kadar ikame edilmesi panelistler tarafından kabul edilebilir bulunmuştur.

Likopen içeren kırmızı havuç ile yapılan kekle beslenen insanlarda, likopen ve β- karotenin havuçtan alındığı bulunmuştur. Bununla birlikte havuç içeren veya içermeyen domates salçalı kek ile beslenen insanlarda likopen absorbsiyonunun havuç lifinden negatif etkilendiği buna karşın domates ile karşılaştırıldığında kırmızı havuçtan alınan likopenin %44 biyo-yarayışlı olduğu ve insan serumunda 20 mg'dan fazla likopen bulunduğu tespit edilmiştir (Horovitz ve Simon, 2004).

Öztan (2006) yaptığı çalışmada yüksek fenolik içerikleri ile ilgili olarak, taze olarak sıkılmış nar suyu, ticari nar suyu, nar ekşisi, mor havuç, mor havuç suyu konsantresi ve şalgam suyu analiz edilmiştir. Örneklerin toplam fenolik madde miktarı 1,052-15,5 mg GA/g aralığında bulunmuştur. Toplam flavonoid madde miktarı ise 0,05-1,5 mg EK/g arasında bulunmuştur. Toplam antosiyanin madde miktarı ise 0,022-7,5 mg Ant/g arasında belirlenmiştir. Toplam fenolik madde miktarı oldukça yüksek olan mor havuç suyu konsantresinin antioksidan aktivitesi de ölçülen tüm metodlarda oldukça yüksek olarak tespit edilmiştir.

Mor havuçlar önemli bir fenolik bileşik kaynağıdır ve püskürterek kurutma, mor havuçları daha stabil hale getirmek için en avantajlı yöntemdir. Mor havuç püresi tozunda optimum koşullar altında bağımlı değişkenler %81,20 DPPH temizleyici antioksidan aktivite, gallik asit eşdeğeri olarak 5332,87 ppm toplam fenolik içerik ve siyanidin-3-glukozit olarak 449,71 ppm toplam antosiyanin içerdiği belirlenmiştir (Demircan ve Velioğlu,2023).

1.B. Kırmızı Pancarın Gıda Bileşeni Olarak Kullanılması İle İlgili Çalışmalar

Yapılan çalışmada (Akarca ve Tomar,2020), kırmızı havuç (Daucus carota L. var. atrorubens Alef.), kırmızı pancar (Beta vulgaris var. cruenta Alef.) ve mor lahana (Brassica oleracea L. var. capitata f. rubra) sebzeleri ile üretilen kombucha çaylarının fiziksel, kimyasal, mikrobiyolojik ve duyusal özelliklerini saptamışlardır. Duyusal analizler sonucunda ise, tüm duyusal kriterler açısından en çok tercih edilen örneğin kırmızı pancar, en az tercih edilen örneğin ise; mor lahana ile üretilen örnekler olduğu belirlenmiştir.

Turp vd. (2016) yaptıkları çalışmada doğal bir renk maddesi ve antioksidan olarak pancar tozunun farklı oranlarda sosis üretiminde kullanımını araştırmışlardır. Sosis formülasyonlarında artan oranlarda pancar tozu kullanımı, örneklerin işlem veriminde artışa neden olmuştur. Pancar tozu sahip olduğu yoğun kırmızımsı renk ile sosis örneklerinin renk özellikleri üzerinde önemli düzeyde etki göstermiştir.

Hacıbektaşoğlu (2019) yaptıkları çalışmada, kırmızı pancar (Beta vulgaris L.) kullanılarak, başta çocuklar ve diyabet hastaları olmak üzere her tüketicinin beğenebileceği, kırmızı pancarın tatlılığından dolayı şeker oranı azaltılmış, besin değeri yüksek, fonksiyonel dondurma üretmişlerdir. Bu amaçla Kontrol (K) (kırmızı pancar ilavesiz + %15 şeker), %5 şeker + %15 kırmızı pancar (P1), %10 şeker + %15 kırmızı pancar (P2), %15 şeker + %15 kırmızı pancar ilaveli (P3) toplam dört çeşit dondurma üretilmiştir. En yüksek titrasyon asitliği kontrol örneğinde (%0.21) belirlenirken, kırmızı pancar içeren örneklerde istatistiksel olarak farklılık bulunmamıştır. En düşük kurumadde P2 örneğinde (%22,06) ve en yüksek değer kontrol örneğinde (%33,70) tespit edilmiştir. En yüksek kül değeri P1 örneğinde (%0,95), en düşük P3 örneğinde (%0,82) belirlenmiştir. Overrun (hacim artışı) değerleri en düşük P2 örneğinde (%23.08), en yüksek ise kontrolde (%39,18) bulunmuştur. Şeker oranının artması genel olarak ilk damlama süresini artırmış, tam erime süresini kısaltmıştır. Viskozite değerleri şeker ilavesiyle azalırken 20 ve 50 rpm'de belirlenen en yüksek viskozite değerleri P1 örneğinde sırasıyla 11729,58 cp ve 6425.60 cp olarak saptanmıştır. Fenolik madde ve antioksidan aktivite açısından dondurma örnekleri arasındaki farklılık $p<001$ düzeyinde önemli bulunmuştur. En düşük fenolik madde kontrol örneğinde (329.69 GAE mg/L) ve en yüksek fenolik madde P1 örneğinde (558,55 GAE mg/L) tespit edilmiştir. En düşük DPPH değeri kontrol örneğinde (%13,66 inhibisyon) görülürken, en yüksek P2 örneğinde (%27,98 inhibisyon) belirlenmiştir. En düşük toplam antioksidan değeri P2 örneğine (2350,92 mg AAE/L) aitken, en yüksek kontrol örneğinde (4376,13 AAE mg/L) belirlenmiştir. Şeker oranının artmasına bağlı olarak fruktoz ve glukoz değerlerinde azalma görülürken, sakaroz değerinde artış olmuştur. Duyusal açıdan değerlendirildiğinde, en yüksek genel kabul edilebilirlik puanı P2(%10 şeker + %15 kırmızı pancar) örneğinde saptanmıştır. Yapılan bu araştırma sonuçları genel olarak değerlendirildiğinde; %15 kırmızı pancar (Beta vulgaris L.) %10 şeker ilaveli besin değeri daha yüksek, daha az şekerli yeni bir fonksiyonel dondurma üretilebileceği ortaya konulmuştur.

2. Yöntem

2.1. pH Değeri

Tampon çözeltiler (pH 7,0 veya 10,0) yardımıyla ayarlanan pH metre ile (Mettler Toledo markalı) dondurma miksi örneklerine ait karışımların pH değerleri 20±1 ℃' de tespit edilmiştir (Demirci ve Gunduz, 1994).

2.2. Titrasyon Asitliği
Alkali titrasyon yöntemine göre titrasyon asitliği % laktik asit cinsinden belirlenmiştir (Kurt vd.,2012).

2.3. Kuru Madde Oranı
Önceden temizlenmiş, kurutulmuş ve darası alınmış kuru madde kaplarına hassas bir şekilde yaklaşık olarak 5'er gram örnek tartılmış ve 100±5 °C 'deki etüvde 3 saat süreyle kurutulduktan sonra soğumaya bırakılmıştır. Örnekler sabit ağırlığa gelinceye kadar kurutma işlemine devam edilmiştir. Kurutmadan önceki ağırlık ve kurutmadan sonraki ağırlık farkından % kuru madde miktarı hesaplanmıştır (Kurt vd., 2012).

2.4. Hacim Artışı (%)
Darası belirlenmiş ölçülü silindir içerisine belirli hacme kadar dondurma, boşluk kalmayacak şekilde doldurulmuş ve analitik terazide tartılmıştır. Aynı dondurma numunesi bir beher içerisine konularak su banyosunda eritilmiştir. Eriyen karışım, temizlenmiş ölçülü silindire aynı hacme kadar aktarılıp tekrar tartılmış vehacim artışı oranı (%) = [(Dondurmanın hacmi- Erimiş Dondurmanın Hacmi) / Erimiş Dondurmanın Hacmi] x 100 formülü ile tespit edilmiştir (Jimenez-Florez ve ark.,1993).

2.5. İlk Damlama Süresinin Belirlenmesi
10 g dondurma örneği darası alınmış kaplar üzerindeki tel süzgüye konularak 24±1°C' de erimeye bırakılmıştır. Dondurmaların erimeye başladığı ve ilk damlaların düştüğü süre belirlenmiştir (Cotrell ve ark., 1979).

2.6. Son Erime Süresinin Belirlenmesi
10 g dondurma örneği darası alınmış kaplar üzerindeki tel süzgüye konularak 24±1°C' de erimeye bırakılmıştır. Dondurma örneklerinin tamamen eridiği süre belirlenmiştir (Cotrell ve ark., 1979).

2.7. Viskozite
Dondurma karışımlarının viskoziteleri, dijital Brookfield viskozimetre (Model DV-II) kullanılarak belirlenmiştir (Brookfield Engineering Laboratories, USA) (Soukoulis ve ark. 2014). Viskozite ölçümlerinde 4 nolu başlık kullanılmış olup ölçümler 20 ve 50 rpm kayma hızında gerçekleştirilmiştir.

2.8. Renk ölçümü
Renk ölçümü, Hunter renk sistemine göre ölçülmüş olup bu sistemde L renk değeri 0- 100 arasında olup aydınlık ve karanlığın ölçüsüdür.0 siyaha,100 beyaza karşılık gelirken a ve b renk değerlerinin ise belirli sınırları yoktur. a' nın pozitif (+) değerleri kırmızılığı, negatif (-) değerleri de yeşilliği, b'nin pozitif (+) değerleri sarılığı, negatif (-) değerleri de maviliği ifade etmektedir. Hunter renk değerleri (L, a* ve b*) renk ölçüm 17 cihazı kullanılarak yüzeyden ölçüm yapılarak tespit edilmiştir. Renk okumaları yapılmadan önce cihaza ait standart kalibrasyon plakası ile (L*= 97,79, a*= -0,44 ve b*= +2,04) olacak şekilde kalibre edilmiştir (Mc Guire 1992).

2.9. Antioksidan Aktivitesi
Serbest bir radikal olan DPPH (2-2-Diphenyl-2- picrylhydrazyl)'in numune içerisinde bulunan antioksidan maddeler tarafından yok edilmesine dayanır. Analiz sırasında deney tüpüne 50 µl örnek konulup santrifüj yardımıyla süpernatant elde edilmiş ve üzerine 450 µl tris HCL ve 1 ml DPPH (0,2mM DPPH) çözeltisi eklendikten sonra tüpler 30 dk. 37oC'de karanlık ortamda bekletilmiştir. Spektrofotometrede 517 nm absorbans ölçümü yapılıp aşağıda verilen formülle antioksidan aktivitesi belirlenmiştir (Aqıl et al. 2006).
% İnhibisyon = [(Abs kontrol – Abs örnek) / Abs kontrol] × 100

2.10. Dondurma Örneklerinde Aroma Bileşenlerinin Tespiti
Dondurma örneklerinin aroma bileşikleri, Condurso et al. (2008) tarafından tarif edildiği gibi tespit edilmiştir. Uçucu bileşiklerin tanımlanması, GC-ME (Gaz Kromatografisi - Kütle Spektrometresi) ile yapılmıştır. Mobil fazın enjeksiyonu, 260 ° C'lik enjektör sıcaklığı (2mL / dak mobil faz akış hızı); fırın sıcaklığı başlangıçta 45 ° C'ye ayarlanıp, sıcaklık rampası 10 ° C / dak hızında 80 ° C'ye yükseltilerek programlandıktan sonra 240 °

C'ye kadar çıkartılmıştır. CP-Wax 52 CB kolonu (60m uzunluğunda, 0.25mm iç çap, 0.25µm film kalınlığı) ve 30-200 m / z aralığında bir kütle spektrometrisi detektörü (MSD) kullanılıp C8-C40 alkan standartları da aynı kromatografi ve kütle spektrometrisi koşulları altında kromatografiye enjekte edilmiştir. Standart ve numunelerden elde edilen alıkonulma süreleri karşılaştırılarak uçucu bileşiğin cinsi tespit edilmiştir.

2.11. Kül Miktarı (%)

Porselen krozeler etüvde kurutulduktan sonra desikatörde soğutulup darası alındıktan sonra 4-5 g numunelerden eklenerek tartılmış, 550°C 'ye kadar kül rengi elde edilinceye kadar 4 saat yakılıp desikatöre koyulmuştur. Soğuyan krozeler tartılıp sonrasında ilk tartımla arasındaki farkla birlikte kül miktarı hesaplanamıştır (Kurt vd 2007).

%Kül Miktarı = ((M2−M1) / M) × 100

Bu eşitlikte;

M2; Yakmadan sonraki kroze + kül ağırlığı (g)

M1; Sabit tartıma getirilen krozenin ağırlığı (g)

M; Tartılan numune ağırlığı (g)

Bulgular

Tablo 1.Dondurma örneklerinin bazı fiziksel ve kimyasal analizleri ile antioksidan analiz sonuçları

Örnek	% Kuru madde	% Kül	pH	% Hacim artışı	Tam erime süreleri (dak)	İlk damlama süreleri (dak)	Viskozite (20 rpm) (Pa.s)	Viskozite (50 rpm) (Pa.s)	Antioksi-dan aktivitesi (%DPPH)
K	33,90	2,91	6,56	38,38	38,00	19,0	12,76	7,04	15,74
H1	30,95	3,86	6,67	31,57	62,00	28,0	9,08	4,66	24,77
H2	28,40	2,28	6,70	30,21	109,0	43,0	6,90	3,94	26,92
P1	30,83	3,82	6,55	29,15	104,5	37,5	8,70	4,60	36,13
P2	27,53	2,30	6,33	28,58	99,00	33,5	7,40	4,25	38,03

K: sade dondurma (kontrol) H1: 200 ml (%8) mor havuç suyu H2: 400 ml (%15) mor havuç suyu P1: 200 ml (%8) kırmızı pancar suyu P2: 400 ml (%15) kırmızı pancar suyu

4. Tartışma

1.Dondurmaya katılan kırmızı pancar ve mor havuç suyu dondurmanın kurumadde oranını düşürmüş ve kül oranını da sebze sularının miktarına göre değiştirmiştir.

2.Dondurmaya katılan kırmızı pancar ve mor havuç suyu dondurmanın hacim artışını azaltmıştır. Buna karşılık, kırmızı pancar ve mor havuç suyu dondurmanın ilk damlama ve son erime sürelerini uzatarak dondurma yapısını daha kararlı hale getirmiştir.

3.Dondurmaya katılan kırmızı pancar ve mor havuç suyu ilavesi dondurmanın vizkozitesini (akışkanlığını) azaltmıştır.

4.Dondurmaya katılan kırmızı pancar ve mor havuç suyu ilavesi dondurmanın antioksidan aktivitesini(%DPPH) önemli düzeyde artırmıştır.

5.Dondurmaya katılan kırmızı pancar ve mor havuç suyu dondurmanın L* renk değerini azatmış, a*, C* ve h* renk değerlerini artırmış, bu artış dondurma örneklerinin daha beğenilir olmasını sağlamıştır.

6.Dondurma örneklerine mor havuç suyu ve kırmızı pancar suyu ilavesi sade dondurma örneklerinin aroma bileşimine önemli katkılarda bulunmuştur. Bilhassa sade dondurma örneklerinde çok düşük düzeyde olan veya bulunmayan asetik asit, 2-3 bütandiol, bütanol, oktanol, hekzanoik asit, oktanol asit ve benz aldehit aroma bileşenlerinin yüksek oranda bulunmasına sebep olmuştur.

7.Panelistler yaptıkları duyusal değerlendirmede kırmızı pancar ve mor havuç suyu ilaveli dondurmaları kontrole göre daha yüksek seviyede beğenmişlerdir.

8.Araştırmanın tüm sonuçları dikkate alındığında kontrol örneğine göre; besin değeri daha yüksek, kırmızı pancar ve mor havuç suyu katkılı, duyusal olarak beğenilen fonksiyonel bir dondurma üretilebileceği sonucuna varılmıştır.

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SOĞUK İKLİM KENTLERİNDE ENERJİ ETKİN VE ADAPTİF KENTSEL TASARIM YAKLAŞIMI: ERZURUM ÖRNEĞİ

Elif Ayda Şahin, Süleyman Toy

Özet
Soğuk iklim kentlerinde enerji tüketiminin büyük ölçüde ısıtma gereksiniminden kaynaklanması, iklim değişikliğinin etkileriyle birlikte kentsel enerji sistemlerini önemli bir araştırma konusu hâline getirmiştir. Yerleşim düzenine ilişkin tasarım kararları; sokak dokusu, yoğunluk, açık alan dağılımı gibi kentsel morfolojik bileşenler üzerinden güneş enerjisinden yararlanma potansiyelini doğrudan etkilemektedir. Doğu Anadolu Bölgesi'nde yer alan ve sert iklim koşullarıyla karakterize edilen Erzurum kenti, uzun kış mevsimi ve yüksek güneşlenme potansiyeline karşın bu potansiyelin kentsel ölçekte etkin biçimde değerlendirilemediği ve enerji verimliliği açısından yapısal sorunlar barındıran önemli bir örnek alan niteliğindedir. Bu çalışmanın esas amacı, soğuk iklim şartlarında iklim değişikliğine uyum sağlayabilen ve enerji etkinliği artırmaya yönelik bir kentsel tasarım modeli geliştirilmesidir. Bu çalışma; yapı yoğunluğu, yönlenme, açık yeşil alan oranı gibi morfolojik parametrelerin iklimsel veriler ve yeni nesil güneş teknolojileriyle birlikte değerlendirilmesi halinde, kentsel ölçekte enerji performansının anlamlı biçimde artırılabileceği varsayımına dayanmaktadır. Bu çerçevede Erzurum kenti araştırma alanı olarak seçilmiştir. Araştırma kapsamında, farklı kentsel doku karakterine sahip örnek alanlar üzerinden morfolojik ve mikroklimatik analizler yürütülmektedir. Bina yönlenmesi ve yoğunluk başta olmak üzere, güneşlenme süreleri gibi temel parametreler CBS tabanlı mekânsal analizler ve simülasyon araçları kullanılarak değerlendirilmektedir. Analiz sonuçlarına dayanarak, kentsel ölçekte enerji performansını artırmaya yönelik farklı tasarım senaryoları değerlendirilmekte; yenilenebilir enerji sistemleri destekleyici bir bileşen olarak ele alınmaktadır. IPCC iklim projeksiyonları çerçevesinde öngörülen sıcaklık ve enerji talebi değişimleri göz önünde bulundurularak uyarlanabilir bir kentsel enerji modeli kurgulanmaktadır. Çalışma kapsamında simülasyon destekli analizler aracılığıyla, farklı morfolojik ve iklimsel varsayımlara dayalı oluşturulan alternatif kentsel enerji modeli senaryoları, Analitik Hiyerarşi Süreci (AHP) yöntemiyle enerji verimliliği, çevresel etki ve uygulanabilirlik ölçütleri açısından karşılaştırılmaktadır. Sonuç olarak bu çalışma; soğuk iklim koşullarında enerji etkinliği ve iklim uyumunu birlikte ele alan, enerji etkinliği yalnızca yapı ölçeğinde değil, kentsel sistem bütünlüğü içinde değerlendiren kentsel sistem odaklı bütüncül bir tasarım çerçevesi sunmayı hedeflemektedir. Önerilen yaklaşımın, enerji odaklı kentsel tasarım ve planlama süreçlerinde iklimsel veriler, kentsel morfoloji ve enerji performansı arasındaki ilişkinin bütüncül biçimde değerlendirilmesine katkı sağlayarak, karar verme süreçleri için bilimsel ve yöntemsel bir çerçeve sunması amaçlanmaktadır.
Anahtar Kelimeler: Enerji Etkin Tasarım, Adaptif Kentsel Tasarım, İklim Değişikliği, Soğuk İklim Kentleri, Kentsel Morfoloji

AN ENERGY EFFICIENT AND ADAPTIVE URBAN DESIGN APPROACH FOR COLD CLIMATE CITIES: THE CASE OF ERZURUM

Abstract
In cold climate cities, the fact that energy consumption is largely driven by heating demand has, together with the impacts of climate change, made urban energy systems an important field of research. Urban design decisions related to settlement patterns—such as street layout, building density, and the distribution of open spaces as components of urban morphology— directly affect the potential for utilizing solar energy. Located in the Eastern Anatolia Region and characterized by harsh climatic conditions, the city of Erzurum represents a significant case study, as despite its long winter season and high solar potential, this potential cannot be effectively utilized at the urban scale, leading to structural problems in terms of energy efficiency. The main aim of this study is to develop an energy-efficient urban design model that can adapt to climate change under cold climate conditions. The study is based on the assumption that evaluating morphological parameters such as building density, orientation, and the ratio of open and green spaces together with climatic data and next-generation solar technologies can significantly improve urban-scale energy performance. Within this framework, Erzurum has been selected as the study area.Within the scope of the research, morphological and microclimatic analyses are conducted on sample areas representing different urban fabric characteristics. Key parameters, including building orientation, density, and solar exposure durations, are evaluated using GIS-based spatial analyses and simulation tools. Based on the analysis results, different urban design scenarios

aimed at improving energy performance at the urban scale are examined, with renewable energy systems considered as supportive components of the overall framework. An adaptive urban energy model is developed by taking into account projected changes in temperature and energy demand in line with IPCC climate projections. Within the study, alternative urban energy model scenarios based on different morphological and climatic assumptions are generated through simulationsupported analyses and compared using the Analytic Hierarchy Process (AHP) based on energy efficiency, environmental impact, and feasibility criteria. In conclusion, this study aims to present a holistic, urban-system-oriented design framework that integrates energy efficiency and climate adaptability in cold climate conditions, addressing energy performance not only at the building scale but also within the overall urban system. The proposed approach is intended to contribute a scientific and methodological framework for decision-making processes by enabling a comprehensive evaluation of the relationship between climatic data, urban morphology, and energy performance in energy-oriented urban design and planning processes.
Keywords: Energy-Efficient Design, Adaptive Urban Design, Climate Change, Cold Climate Cities, Urban Morphology

1. Giriş

Günümüz kentlerinde, nüfusun artması, yapılaşmanın yoğunlaşması ve ekonomik faaliyetlerin bir araya gelmesiyle birlikte mekansal sistemlerde enerji talebi artmıştır. Küresel ölçekte toplam enerji tüketiminin önemli bir bölümü kentsel alanlarda gerçekleşmekte; bu tüketimin büyük kısmı ise bina ölçeğinde ortaya çıkmaktadır. İklim değişikliğinin etkilerinin giderek belirginleştiği günümüzde, kentlerin enerji üretim ve tüketim biçimleri, sürdürülebilirlik ve çevresel dayanıklılık açısından kritik bir tartışma alanı oluşturmaktadır. Bu bağlamda, enerji etkin kentsel tasarım yaklaşımları, yalnızca teknik çözümler değil; aynı zamanda mekânsal, morfolojik ve iklimsel verilerle bütünleşik stratejiler geliştirilmesini gerekli kılmaktadır.

Soğuk iklim koşullarına sahip kentlerde enerji tüketimi, yılın büyük bölümünde devam eden ısıtma gereksinimi nedeniyle diğer iklim bölgelerine kıyasla daha yüksek seviyelere ulaşmaktadır. Düşük dış hava sıcaklıkları, uzun kış mevsimleri ve yüksek ısı kayıpları, bina ve kentsel ölçeklerde enerji performansını olumsuz yönde etkilemektedir. Bu durum, özellikle yetersiz yalıtım performansına sahip mevcut yapı stokunun hâkim olduğu kentlerde daha belirgin hâle gelmektedir. Soğuk iklim kentlerinde enerji etkinliğinin artırılması, yalnızca yapı kabuğuna yönelik müdahalelerle sınırlı kalmamakta; kentsel morfoloji, sokak geometrisi, yapı yoğunluğu ve yönlenme gibi mekânsal bileşenlerin de bütüncül biçimde ele alınmasını gerektirmektedir.

Kentsel morfoloji, güneşlenme potansiyeli, rüzgâr rejimi ve mikroklimatik koşullar üzerinde doğrudan belirleyici bir etkiye sahiptir. Yapı yoğunluğu ve kat sayısı, sokak kanyon oranları (H/W), yol ve yapı yönlenmeleri ile açık–yeşil alan dağılımı, kentsel ölçekte güneş enerjisinden yararlanma düzeyini şekillendiren temel parametreler arasında yer almaktadır. Bu parametrelerin iklimle uyumlu biçimde tasarlanmaması, özellikle soğuk iklim koşullarında kentsel alanlarda güneş kazançlarının sınırlanmasına ve enerji kayıplarının artmasına neden olmaktadır. Buna karşılık, güneş yönelimini destekleyen morfolojik düzenlemeler ve dengeli sokak kanyonu geometrileri, ısıtma odaklı enerji tüketiminin azaltılmasında önemli bir potansiyel sunmaktadır.

Doğu Anadolu Bölgesi'nde yer alan Erzurum kenti, yüksek rakımı, uzun ve sert kış koşulları ile Türkiye'nin tipik soğuk iklim kentlerinden biridir. Kent, sahip olduğu yüksek güneşlenme potansiyeline rağmen, mevcut kentsel dokunun iklimsel verilerle uyumsuzluğu nedeniyle bu potansiyeli kentsel ölçekte etkin biçimde değerlendirememektedir. Farklı dönemlerde gelişen kentsel alanlarda morfolojik süreksizliklerin görülmesi, güneşlenme, yönlenme ve mikroklimatik konfor açısından önemli sorunları beraberinde getirmektedir. Bu durum, Erzurum'u enerji etkin ve iklime duyarlı kentsel tasarım yaklaşımlarının test edilebileceği önemli bir örnek alan hâline getirmektedir.

Bu çalışmanın temel amacı, soğuk iklim koşullarında enerji etkinliğini artıran ve iklim değişikliğine uyum sağlayabilen adaptif bir kentsel tasarım modeli geliştirmektir. Çalışma, kentsel morfoloji ile güneş enerjisi potansiyeli arasındaki ilişkinin, CBS tabanlı mekânsal analizler ve çok ölçütlü karar verme yöntemleri aracılığıyla ortaya konulabileceği varsayımına dayanmaktadır. Bu doğrultuda Erzurum kentinde farklı kentsel doku karakterlerine sahip örnek alanlar seçilmiş; morfolojik, iklimsel ve enerjiye ilişkin parametreler birlikte değerlendirilmiştir. Elde edilen bulgular ışığında, yenilenebilir enerji sistemleriyle desteklenen, iklime duyarlı ve uyarlanabilir bir kentsel tasarım çerçevesi önerilmektedir.

2. Yöntem

Bu çalışma, soğuk iklim koşullarında kentsel morfolojinin enerji etkinlik potansiyelini ortaya koymayı amaçlayan, çok aşamalı ve bütüncül bir araştırma yöntemi üzerine kurgulanmıştır. Araştırma süreci; çalışma

alanlarının belirlenmesi, morfolojik ve iklimsel analizlerin gerçekleştirilmesi, enerji odaklı tasarım senaryolarının oluşturulması ve alternatiflerin çok ölçütlü karar verme yöntemiyle değerlendirilmesi aşamalarından oluşmaktadır.

Çalışma Alanının Belirlenmesi
Araştırma alanı olarak, Doğu Anadolu Bölgesi'nde yer alan ve belirgin soğuk iklim özellikleri gösteren Erzurum kenti seçilmiştir. Kent genelinde farklı kentsel doku karakterlerini temsil edebilmek amacıyla, morfolojik açıdan çeşitlilik gösteren yedi adet 1 km² büyüklüğünde örnek alan tanımlanmıştır. Bu alanlar; yapı yoğunluğu, kat sayısı, sokak dokusu ve gelişim biçimleri açısından birbirinden farklı özellikler sergileyen kentsel bölgelerden seçilmiştir. Böylece, farklı morfolojik yapıların enerji etkinlik üzerindeki etkilerinin karşılaştırmalı olarak analiz edilmesi amaçlanmıştır.

Veri Toplama ve Mekânsal Analizler
Araştırma kapsamında kullanılan veriler; bina ayak izleri, kat sayıları, yol ağı, açık–yeşil alanlar ve topografik bilgilerden oluşmaktadır. Tüm mekânsal veriler, CBS (Coğrafi Bilgi Sistemleri) tabanlı analizler gerçekleştirmek üzere QGIS yazılımı ortamında işlenmiştir. Morfolojik analizler çerçevesinde; bina sayısı ve yoğunluğu, bina taban alanları, kat sayısı dağılımları, yol genişlikleri ve sokak kanyon oranları (H/W) hesaplanmıştır. Ayrıca, yol ve yapı yönlenmeleri incelenerek güneşlenme potansiyeli üzerindeki etkileri değerlendirilmiştir.
Mikroklimatik davranışı etkileyen temel morfolojik göstergelerin belirlenmesi amacıyla, sokak kanyon geometrileri ve gölgeleme ilişkileri analiz edilmiş; dar ve kapalı sokak kesitlerinin kış dönemi güneş kazançları üzerindeki etkileri yorumlanmıştır. Bu aşamada elde edilen bulgular, kentsel mekânın enerji performansına ilişkin mevcut durumun ortaya konulmasına yönelik bir temel oluşturmuştur.

Enerji Odaklı Tasarım Senaryolarının Oluşturulması
Morfolojik ve iklimsel analiz sonuçları doğrultusunda, kentsel ölçekte enerji performansını artırmaya yönelik alternatif tasarım senaryoları geliştirilmiştir. Bu senaryolar; güneş yönelimini destekleyen yapı ve yol düzenlemeleri, dengeli sokak kanyon oranları ve açık alanların etkin kullanımı gibi pasif tasarım ilkeleri temel alınarak kurgulanmıştır. Ayrıca, fotovoltaik sistemler ve bina bütünleşik güneş enerjisi uygulamaları gibi yenilenebilir enerji sistemleri, kentsel tasarımın destekleyici bileşenleri olarak ele alınmıştır. Çalışmada, iklim değişikliğinin uzun vadeli etkilerini dikkate almak amacıyla, IPCC iklim projeksiyonları doğrultusunda öngörülen sıcaklık artışları ve enerji talebi değişimleri de değerlendirme sürecine dâhil edilmiştir. Bu kapsamda, farklı iklimsel varsayımlara uyum sağlayabilecek adaptif bir kentsel enerji modeli oluşturulmuştur.

Çok Ölçütlü Değerlendirme (AHP Yöntemi)
Oluşturulan alternatif tasarım senaryolarının karşılaştırılmasında, Analitik Hiyerarşi Süreci (AHP) yöntemi kullanılmıştır. AHP yöntemi, farklı morfolojik ve enerjiye ilişkin kriterlerin tek bir karar çerçevesi altında değerlendirilmesine olanak tanıyan, çok ölçütlü bir karar verme yaklaşımıdır. Bu çalışma kapsamında; yapı yoğunluğu ve kat sayısı, sokak kanyon oranları (H/W), yol yönelimi ve güneşlenme potansiyeli, morfolojik düzenlilik ve güneş enerjisi uygulanabilirliği olmak üzere beş temel kriter tanımlanmıştır.
Her bir kriter, enerji etkinlik üzerindeki göreli önemine göre ağırlıklandırılmış; belirlenen örnek alanlar bu kriterler doğrultusunda puanlanarak toplam AHP skorları hesaplanmıştır. Elde edilen sonuçlar, soğuk iklim koşullarında enerji etkin ve adaptif kentsel tasarım açısından en uygun alanların belirlenmesine yönelik nesnel bir değerlendirme sunmuştur.

3. Bulgular
Bu bölümde, Erzurum kentinde seçilen yedi adet 1 km² büyüklüğündeki analiz alanı için gerçekleştirilen morfolojik ve enerji odaklı değerlendirmelerin sonuçları sunulmaktadır. Bulgular; kentsel morfolojinin güneşlenme potansiyeli, mikroklimatik davranış ve enerji etkinlik üzerindeki etkilerini ortaya koymak amacıyla, alan bazlı analizler ve AHP değerlendirme sonuçları çerçevesinde ele alınmıştır.

Morfolojik Analiz Bulguları
Yapılan analizler, Erzurum kentindeki çalışma alanlarının morfolojik özellikleri bakımından belirgin farklılıklar sergilediğini ortaya koymuştur. Yüksek yapı yoğunluğuna ve kapalı sokak kanyonlarına sahip alanlarda, kış dönemi güneşlenme sürelerinin sınırlı olduğu ve gölgeleme etkisinin arttığı belirlenmiştir.

Özellikle dar sokak kesitleri ve yüksek katlı yapılaşmanın baskın olduğu alanlarda, sokak kanyon oranlarının (H/W) yükseldiği ve pasif güneş kazançlarının azaldığı gözlemlenmiştir.
Buna karşılık, daha düzenli yol ağına sahip, geniş sokak profilleri ve kontrollü yapı yükseklikleri ile karakterize edilen alanlarda, güneşlenme potansiyelinin daha dengeli olduğu tespit edilmiştir. Güney ağırlıklı yapı ve yol yönlenmesine sahip alanlar, kış döneminde güneş kazançları açısından daha avantajlı sonuçlar üretmiştir. Açık ve yeşil alan oranının görece yüksek olduğu bölgelerde ise, mikroklimatik koşulların daha elverişli olduğu ve gölgeleme–havalandırma dengesinin daha iyi sağlandığı görülmüştür.

Alan Bazlı Değerlendirme Sonuçları
Alan bazlı değerlendirmeler, farklı kentsel morfoloji tiplerinin enerji etkinlik açısından farklı performanslar sergilediğini ortaya koymuştur. Tarihî ve son derece kompakt yapılaşma karakterine sahip alanlarda, ısı korunumu açısından belirli avantajlar bulunmakla birlikte, dar sokak kesitleri ve düzensiz yönlenmeler nedeniyle güneş enerjisinden yararlanma potansiyelinin sınırlı olduğu belirlenmiştir. Benzer şekilde, yüksek katlı ve yoğun yapılaşmanın baskın olduğu bazı alanlarda, sokak ölçeğinde uzun süreli gölgeleme etkisi gözlemlenmiş ve bu durum enerji etkinlik açısından dezavantajlı bir tablo ortaya koymuştur.
Buna karşılık, orta yoğunluklu ve planlı kentsel dokuya sahip alanlar, güneş enerjisi uygulamaları açısından daha yüksek bir potansiyel sunmuştur. Özellikle geniş çatı yüzeyleri, düzenli yol ağı ve dengeli sokak kanyon oranlarına sahip bölgelerde, fotovoltaik ve bina bütünleşik güneş enerjisi sistemlerinin uygulanabilirliğinin daha yüksek olduğu tespit edilmiştir. Bu alanlar, adaptif kentsel tasarım müdahaleleri için öncelikli bölgeler olarak öne çıkmıştır.
AHP Değerlendirme Sonuçları Morfolojik ve enerjiye ilişkin parametrelerin birlikte değerlendirildiği AHP analizi sonuçları, çalışma alanları arasında belirgin bir sıralama ortaya koymuştur. Yapı yoğunluğu ve yükseklik, sokak kanyon oranları (H/W), yol yönlenmesi ve güneşlenme potansiyeli, morfolojik düzenlilik ve güneş enerjisi uygulanabilirliği kriterleri doğrultusunda yapılan değerlendirmede, Üniversite Yerleşkesi ve Yıldızkent alanlarının en yüksek toplam AHP skorlarına sahip olduğu belirlenmiştir.
Bu alanlar, kontrollü yapı yükseklikleri, düzenli kentsel morfoloji ve güneşlenmeye elverişli yönlenme özellikleri sayesinde, soğuk iklim koşullarında enerji etkin kentsel tasarım açısından en uygun alanlar olarak değerlendirilmiştir. Orta düzeyde skor elde eden alanlar, adaptif tasarım müdahaleleri ile iyileştirilebilir potansiyel sunarken; düşük skor alan bölgeler ise mevcut morfolojik yapı nedeniyle daha kapsamlı kentsel dönüşüm gereksinimi göstermektedir.

Genel Bulguların Değerlendirilmesi
Elde edilen bulgular, kentsel morfolojinin enerji performansı üzerindeki belirleyici rolünü açık biçimde ortaya koymaktadır. Güneşlenme potansiyelini destekleyen yönlenme kararları, dengeli sokak kanyon geometrileri ve kontrollü yapı yoğunluğu, soğuk iklim kentlerinde enerji etkinliği artıran temel mekânsal bileşenler olarak öne çıkmaktadır. AHP yöntemi ile gerçekleştirilen çok ölçütlü değerlendirme, bu bileşenlerin kentsel ölçekte nesnel biçimde karşılaştırılmasına olanak sağlamış ve enerji etkin kentsel tasarım açısından öncelikli alanların belirlenmesini mümkün kılmıştır.

4. Tartışma
Bu çalışmada elde edilen bulgular, soğuk iklim koşullarında kentsel morfolojinin enerji etkinlik üzerindeki belirleyici rolünü açık biçimde ortaya koymaktadır. Erzurum kentinde gerçekleştirilen morfolojik ve AHP tabanlı değerlendirmeler, yapı yoğunluğu, sokak kanyon geometrisi ve yönlenme kararlarının, kentsel ölçekte güneş enerjisinden yararlanma potansiyelini doğrudan etkilediğini göstermektedir. Bu sonuçlar, enerji etkinliğinin yalnızca yapı ölçeğinde değil, kentsel mekânın bütüncül organizasyonu içerisinde ele alınması gerektiğini vurgulayan mevcut literatürle örtüşmektedir.
Yüksek yoğunluklu ve kapalı sokak kanyonlarının baskın olduğu alanlarda, kış dönemi güneşlenme sürelerinin sınırlı kalması ve uzun süreli gölgeleme etkisinin ortaya çıkması, soğuk iklim kentlerinde sıkça karşılaşılan bir durumdur. Benzer biçimde, Steemers (2003) ve Ratti ve arkadaşları (2005), kompakt kentsel dokuların belirli ölçülerde ısı korunumu sağlasa da, aşırı yoğunluk ve yetersiz yönlenme koşullarında güneş kazançlarının önemli ölçüde azalabildiğini ortaya koymaktadır. Bu bağlamda, Erzurum'daki bazı analiz alanlarında gözlemlenen düşük enerji performansı, literatürde tanımlanan iklim– morfoloji uyumsuzluğu ile paralellik göstermektedir.
Buna karşılık, orta yoğunluklu, planlı ve düzenli kentsel morfolojiye sahip alanların daha yüksek AHP skorları elde etmesi, güneş yönelimini destekleyen tasarım kararlarının enerji etkinlik açısından kritik olduğunu

göstermektedir. Özellikle Üniversite Yerleşkesi ve Yıldızkent alanlarında elde edilen sonuçlar, kontrollü yapı yükseklikleri, dengeli sokak kanyon oranları ve düzenli yol ağının, soğuk iklim koşullarında güneş enerjisinden yararlanmayı artırdığını ortaya koymaktadır. Bu durum, Hammarby Sjöstad (Stockholm) örneğinde bilinen, kompakt ancak iklimle uyumlu morfolojik düzenlemeler ve güneye yönelimli cephelerle ısı kayıplarının azaltılmasına yönelik yaklaşımlarla benzerlik göstermektedir.

Hammarby Sjöstad modelinde, bölgesel ısıtma sistemleri, atık ısı geri kazanımı ve yenilenebilir enerji uygulamalarının, kentsel morfoloji ile bütünleşik biçimde ele alınması, adaptif ve geri beslemeli bir enerji sisteminin kentsel ölçekte uygulanabilirliğini göstermektedir. Bu çalışmada önerilen adaptif kentsel tasarım yaklaşımı da, benzer biçimde, yenilenebilir enerji sistemlerini tekil çözümler olarak değil; kentsel mekânın morfolojik yapısıyla birlikte değerlendirmeyi hedeflemektedir. Bu yönüyle çalışma, uluslararası iyi uygulama örnekleriyle kavramsal bir uyum sergilemektedir.

Türkiye bağlamında değerlendirildiğinde, ODTÜ Güneş Evleri Projesi, pasif ve aktif güneş sistemlerinin mimari ölçekte entegrasyonuna yönelik öncü bir örnek sunmaktadır. Ancak bu tür uygulamaların büyük ölçüde yapı ölçeğinde kaldığı, kentsel ölçekte morfolojik bütünlükle yeterince ilişkilendirilemediği görülmektedir. Bu çalışmada geliştirilen yaklaşım, yapı ölçeğinde elde edilen enerji kazanımlarının, kentsel doku ölçeğine taşınması gerektiğini vurgulayarak literatürdeki bu boşluğa katkı sunmaktadır.

AHP yöntemi kullanılarak gerçekleştirilen çok ölçütlü değerlendirme, farklı morfolojik göstergelerin enerji etkinlik açısından nesnel biçimde karşılaştırılmasına olanak sağlamıştır. Bu yöntem sayesinde, soğuk iklim koşullarında hangi kentsel morfoloji tiplerinin enerji etkin tasarım açısından öncelikli olduğu sayısal olarak ortaya konulmuştur. Elde edilen sonuçlar, adaptif kentsel tasarım müdahalelerinin, yalnızca mevcut sorunları tanımlamakla kalmayıp, geleceğe yönelik iklim senaryolarına uyum sağlayabilecek esnek bir tasarım çerçevesi sunabileceğini göstermektedir.

5. Sonuç ve Öneriler

Bu çalışma, soğuk iklim koşullarına sahip kentlerde enerji etkinliğinin artırılmasında kentsel morfolojinin belirleyici rolünü ortaya koymayı amaçlamış ve Erzurum kenti örneğinde çok ölçekli bir değerlendirme sunmuştur. CBS tabanlı morfolojik analizler ve Analitik Hiyerarşi Süreci (AHP) yöntemi birlikte kullanılarak, farklı kentsel doku karakterlerine sahip alanların enerji etkinlik potansiyelleri karşılaştırmalı olarak değerlendirilmiştir. Elde edilen bulgular, kentsel enerji performansının yalnızca yapı ölçeğinde değil, kentsel mekânın bütüncül organizasyonu içerisinde ele alınması gerektiğini açık biçimde göstermektedir.

Araştırma sonuçları, yapı yoğunluğu ve kat sayısı, sokak kanyon oranları (H/W), yol ve yapı yönlenmeleri ile morfolojik düzenliliğin, soğuk iklim koşullarında güneş enerjisinden yararlanma düzeyini doğrudan etkilediğini ortaya koymuştur. Özellikle dengeli sokak kanyon geometrilerine, kontrollü yapı yüksekliklerine ve düzenli yol ağına sahip alanların, güneşlenme potansiyeli ve yenilenebilir enerji uygulamaları açısından daha avantajlı olduğu belirlenmiştir. AHP değerlendirmesi sonucunda Üniversite Yerleşkesi ve Yıldızkent alanlarının, enerji etkin ve adaptif kentsel tasarım açısından en yüksek potansiyele sahip bölgeler olduğu saptanmıştır.

Bu bulgular doğrultusunda, soğuk iklim kentlerinde enerji etkinliği artırmaya yönelik kentsel tasarım müdahalelerinin; orta yoğunluklu ve kontrollü yükseklikli yapılaşma, güneş yönelimini destekleyen yol ve yapı düzeni, dengeli sokak kanyon oranları ve açık–yeşil alanların etkin kullanımı gibi temel morfolojik ilkeler çerçevesinde ele alınması gerektiği sonucuna varılmıştır. Yenilenebilir enerji sistemlerinin, özellikle fotovoltaik ve bina bütünleşik güneş enerjisi uygulamalarının, bu morfolojik çerçeve ile bütünleşik biçimde planlanması, kentsel ölçekte enerji performansını artıran önemli bir strateji olarak öne çıkmaktadır.

Çalışma kapsamında geliştirilen adaptif kentsel tasarım yaklaşımı, IPCC iklim projeksiyonları doğrultusunda öngörülen sıcaklık ve enerji talebi değişimlerine uyum sağlayabilecek esnek bir model sunmaktadır. Bu yönüyle çalışma, enerji etkinliğini statik bir hedef olarak değil, iklim değişikliği karşısında uyarlanabilir bir süreç olarak ele almakta ve geleceğe yönelik kentsel tasarım kararları için yol gösterici bir çerçeve önermektedir.

Gelecek çalışmalarda, önerilen kentsel tasarım modelinin bina ölçeğinde enerji simülasyonları ile desteklenmesi, farklı yenilenebilir enerji teknolojilerinin (BIPV, BIPVT, ısı depolama sistemleri vb.) performanslarının nicel olarak karşılaştırılması ve modelin farklı soğuk iklim kentlerinde test edilmesi önerilmektedir. Ayrıca, sosyo-ekonomik verilerin ve kullanıcı davranışlarının değerlendirme sürecine dâhil edilmesi, enerji etkin ve adaptif kentsel tasarım yaklaşımlarının uygulanabilirliğini artıracaktır.

Sonuç olarak bu çalışma, soğuk iklim kentlerinde kentsel morfoloji, güneş enerjisi potansiyeli ve enerji etkinlik arasındaki ilişkiyi bütüncül bir bakış açısıyla ele alarak, enerji odaklı kentsel tasarım ve planlama süreçlerine bilimsel ve yöntemsel bir katkı sunmaktadır.

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SOĞUK İKLİM ESTETİĞİ ve KAMUSAL HEYKELLER: ERZURUM KENT MERKEZİNDE MEKÂN, BELLEK VE KİMLİK

Gülümser Beyaztaş Özlütürk[210], Mustafa Bulat[211]

Özet

Kentleşme sürecinin hızlanması, günümüzde yaşanabilir kent ortamlarının oluşturmasını şehir planlaması ve estetik tartışmalarının merkezine yerleştirmiştir. Kentlerin yalnızca temel ihtiyaçları karşılayan mekanlar olmaktan öteye geçmesi, görsel düzenlemeler ve estetik donatıların önemini artırmaktadır. Bu bağlamda, kamusal heykeller, kent estetiğinin belirleyici unsurlarından biri olarak öne çıkmakta; bireylerin psikolojik ve fizyolojik iyi oluşlarına katkıda bulunurken aynı zamanda kent kimliğini şekillendiren ve toplumsal belleği görünür kılan kültürel göstergeler olarak işlev görmektedir

Bu çalışma, Erzurum kent merkezinde yer alan kamusal heykellerin estetik boyutunu, soğuk iklim koşullarının mekânsal algı üzerindeki etkileriyle birlikte ele almaktadır. Erzurum'un sert iklimi ve özgün coğrafi yapısı, kamusal alanlarda konumlanan heykellerin algılanışını farklılaştırmakta; bu heykeller, kent estetiğinin sürekliliğini sağlayan ve mekanın belleğini güçlendiren unsurlar olarak değerlendirilmektedir. Heykellerin kent imajına katkısı, yalnızca görsel düzenleme düzeyinde kalmamakta; kent sakinlerinin gündelik yaşam deneyimlerinde estetik bir farkındalık yaratma sürecine dönüşmektedir. Böylece kamusal heykeller, kent estetiğini güçlendirmenin ötesinde, toplumsal aidiyet duygusunu pekiştiren ve kültürel kimliği görünür kılan kurucu öğeler haline gelmektedir.

Araştırmada, kamusal heykellerin kent estetiği ve kimlik inşasındaki rolü sanat tarihi ve estetik kuramları ışığında incelenmiş; Erzurum özelinde mekan, bellek ve kimlik kavramlarıyla ilişkilendirilmiştir. Bulgular, kamusal heykellerin kent belleğini somutlaştırarak toplumsal aidiyet duygusunu pekiştirdiğini, soğuk iklim estetiği bağlamında ise şehri anlamlı kıldığını göstermektedir. Bu bağlamda Erzurum kent merkezindeki kamusal heykeller, yaşanabilir kent kavramını estetik boyutunu güçlendiren ve kültürel kimliği görünür kılan kurucu unsurlar olarak değerlendirilmiştir.

Sonuç olarak, Erzurum kenti örneği üzerinden kamusal heykellerin kent estetiği ve kimlik inşasındaki işlevleri, soğuk iklim estetiği bağlamında yeniden değerlendirilmiş; bu perspektif, kentlerin yaşana bilirliğini güçlendirmede estetik unsurların kurucu ve belirleyici bir rolü üstlendiğini ortaya koymuştur.

Anahtar Kelimeler: Kent Estetiği, Kamusal Heykel, Kent Kimliği, Toplumsal Bellek, Erzurum

Abstract

The acceleration of the urbanization process has placed the creation of livable urban environments at the center of urban planning and aesthetic discussions. The fact that cities go beyond being places that meet only basic needs increases the importance of visual arrangements and aesthetic equipment. In this context, public sculptures stand out as one of the determining elements of urban aesthetics; While contributing to the psychological and physiological well-being of individuals, they also function as cultural indicators that shape urban identity and make social memory visible

This study deals with the aesthetic dimension of public sculptures in the city center of Erzurum, together with the effects of cold climatic conditions on spatial perception. Erzurum's harsh climate and unique geographical structure differentiate the perception of sculptures located in public spaces; These sculptures are considered as elements that ensure the continuity of urban aesthetics and strengthen the memory of the space. The contribution of sculptures to the image of the city is not only at the level of visual arrangement; It turns into a process of creating an aesthetic awareness in the daily life experiences of city residents. Thus, public sculptures become constitutive elements that not only strengthen urban aesthetics, but also reinforce the sense of social belonging and make cultural identity visible.

In the research, the role of public sculptures in urban aesthetics and identity construction was examined in the light of art history and aesthetic theories; In Erzurum, it has been associated with the concepts of space, memory and identity. The findings show that public sculptures reinforce the sense of social belonging by embodying the urban memory and make the city meaningful in the context of cold climate aesthetics. In this context, public sculptures in the city center of Erzurum were evaluated as the founding elements that strengthen the aesthetic dimension of the concept of livable city and make cultural identity visible.

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As a result, the functions of public sculptures in urban aesthetics and identity construction were re-evaluated in the context of cold climate aesthetics through the example of the city of Erzurum; This perspective has revealed that aesthetic elements play a founding and decisive role in strengthening the livability of cities.
Keywords: Urban Aesthetics, Public Sculpture, Urban Identity, Social Memory, Erzurum

1. Giriş

Soğuk iklim Estetiği, yalnızca doğanın sunduğu görsel ve duygusal deneyimlerle sınırlı kalmayıp, kent mekanlarının biçimlenişinde ve toplumsal belleğin inşasında da belirleyici bir rol üstlenmektedir. Erzurum, sert kış koşulları ve uzun süreli kar örtüsüyle Türkiye'nin en karakteristik soğuk iklim kentlerinden biri olarak, kamusal heykel sanatının farklı malzeme ve ifade olanaklarıyla buluştuğu özgün bir örnek teşkil etmektedir. Kent merkezinde yer alan heykeller, yalnızca estetik birer nesne değil ; aynı zamanda mekanın kimliğini pekiştiren, toplumsal hafızayı canlı tutan ve kültürel aidiyet duygusunu güçlendiren semboller olarak işlev görmektedir.



Görsel 1. «Atatürk Ve Erzurum Kongresi Anıtı» ,23 Temmuz 1965,3.5 Metre ,Bronz, Erzurum

Atatürk ve Erzurum Kongresi Anıtı, 23 Temmuz 1965 tarihine Erzurum Kongresi'nin 46. Yıldönümü vesilesiyle açılmıştır. Heykeltıraş Hakkı Atamulu tarafından bronz malzeme ile figüratif anlayışta tasarlanan anıt hem tarihsel bir olayı hem de ulusal bir lideri simgelemesi bakımından toplumsal belleğin mekanda cisimleşmiş halidir (İşte Atatürk, 2023).

Anıtın kaidesinde yer alan rölyef, Mustafa Kemal Atatürk'ün Erzurum Kongre'sinde 54 delegeye hitaben yaptığı konuşmayı betimlemekte; üst bölümdeki heykel ise Atatürk'ün askeri üniformasıyla, bir alinde kılıç ve diğer elinde buruşturulmuş Sevr Antlaşması ile tasvir etmektedir. Bu ikonografi, yalnızca tarihsel bir anlatıyı değil, aynı zamanda ulusal kimliğin direniş ve bağımsızlık ekseninde şekillendiği bir sembolü temsil eder.

Kamusal alanda konumlandırılan bu heykel, Erzurum'un kent kimliğini güçlendiren bir odak noktasıdır. Anıt çevresindeki açık meydan, bayraklar ve doğal peyzaj unsurlarıyla birlikte, bireylerin kolektif hafızasında yer eden bir mekan yaratır. Bu bağlamda heykel, fiziksel bir nesne olmanın ötesinde, mekanın anlamlandırılması ve toplumsal kimliğin inşası süreçlerinde etkin bir rol üstlenmektedir (Assmann, 2011; Nora,1989).



Görsel 2. «Aziziye Anıtı»,1975

Erzurum özelinde kamusal heykeller, kamusal alanı yalnızca metaforik bir kavram olarak değil, doğrudan somut mekan olarak tanımlar. Bu nedenle, bir heykelin şehir merkezine ya da kırsal bir alana yerleştirilmesi, yalnızca estetik bir tercih değil, aynı zamanda sosyal, politik ve kültürel süreçlerin iç içe geçtiği bir eylemdir (Mimarlık Dergisi, n.d.).



Görsel 3.100.Yıl Anıtı, Atatürk'ün Doğumunun 100.Yılı Anısına 23 Temmuz 1981 Tarihinde Prof.Dr. Ferit Özşen Tarafından Yapılmıştır.

Atatürk'ün doğumunun 100. Yılı anısına inşa edilen 100. Yıl Anıtı, tarihsel bir hatırlatma işlevi görmekle kalmayıp, aynı zamanda kamusal alanda estetik ve simgesel bir odak noktası olarak konumlanmaktadır. Anıtın merkezinde yer alan büyük kırmızı form hem bir kitap hem de bir bayrak metaforunu çağrıştırmakta; bu biçimsel tercih, Türkiye Cumhuriyeti'nin temel değerleri olan bilgi, bağımsızlık ve ulusal kimlik kavramlarını görsel düzlemde birleştirmektedir.

Anıtın taş kaidesinde yer alan kabartma rölyefler, tarihsel sahneleri ve kültürel figürleri betimleyerek kolektif belleğin mekânsal temsiline olanak tanımaktadır. Bu rölyefler, bireylerin geçmişle kurduğu ilişkiyi somutlaştırmakta ve kamusal mekanda tarihsel sürekliliğin görsel bir anlatımını sunmaktadır. Anıt çevresinde konumlandırılmış çok sayıda direği ve uluslarası semboller(bayrak), yapının yalnızca ulusal değil, aynı zamanda evrensel bir barış ve birlik mesajı taşıdığını göstermektedir.

Bu bağlamda 100. Yıl Anıtı, kamusal mekanda sanatın dönüştürücü gücünü ortaya koymakta; bireylerin mekanla kurduğu duygusal ve düşünsel bağları güçlendirmektedir. Görsel iletişim unsurları aracılığıyla sağlanan estetik deneyim hem bireysel hem de toplumsal düzeyde psikolojik bir rahatlama ve aidiyet hissi yaratmaktadır. Anıt, kent kimliğinin oluşumuna katkı sunarken, aynı zamanda kamusal alanın demokratikleşmesine ve kültürel çeşitliliğin görünür kılınmasına hizmet etmektedir.



Görsel 4. Mustafa Bulat, «Hareket» Atatürk Üniversitesi Bilim Ve Gençlik Anıtı,
paslanmaz çelik, Metal,1993

Kamusal alanda gerçekleştirilen sanat eserleri ve tasarım uygulamalarının, mekanlarda kişiler arası iletişimi ve insan-çevre etkileşimini olumlu yönde etkilediği görülmektedir. Sanatın kamusal mekanlarda varlığı, bireylerin bu mekanları daha verimli kullanmalarına, üretkenliklerinin artmasına ve psikolojik açıdan daha olumlu deneyimler yaşamalarına katkı sağlamaktadır. Bu bağlamda, sanat ve tasarımın kamusal alanlarda uygulanması, toplumsal iletişimi güçlendirmekte; mekan estetiğini zenginleştirmekte ve görsel iletişim aracılığıyla bireylerde psikolojik rahatlama yaratmaktadır. Mekan, bellek ve kimlik arasındaki bu etkileşim, kamusal heykel sanatının yalnızca görsel bir düzenleme değil, aynı zamanda kültürel süreklilik ve toplumsal temsil aracı olduğunu göstermektedir.

Kentler, tarihsel, kültürel ve coğrafi nitelikleriyle kimlik kazanan sosyal mekanlardır. Özellikle kamusal alanlar, bu kimliği görünür kılan ve kentleri yalnızca yerleşim değil aynı zamanda yaşam alanlarına dönüştüren en önemli unsurlar arasında yer almaktadır. Nitekim kent, insan topluluklarının belirli mekanlarda yaşam alanları oluşturması sonucunda ortaya çıkan bir olgu olarak tanımlanabilir. Bu bağlamda, kamusal alanlarda bulunan sanat eserleri ve mimari öğeler, kentlerin belleğinde önemli metaforlar olarak değerlendirilebilir.



Görsel 5. Mustafa Bulat & Serap Bulat, Atatürk Üniversitesi Giriş Kapısı, «Çift Başlı Kartal Figürü» 450x380x250 Cm, Alüminyum Döküm,1995

Atatürk Üniversitesi'nin simgesel giriş kapısı, Erzurum kentinin akademik ve kültürel kimliğini yansıtan önemli bir yapı örneğidir. Merkezde konumlanan çift başlı kartal figürü, tarihsel güç ve koruyuculuk metaforlarıyla kent belleğinde yer edinmiş bir karşılama hem de mekânsal aidiyet duygusu sunan bu yapı, üniversitenin kurumsal kimliğiyle kent estetiği arasında güçlü bir bağ kurmaktadır.
İnsanın yaşadığı evreni yaratıcı bir perspektifle algılama ve tanımlama çabasının merkezinde yer alan sanatsal eylemler, yalnızca bireysel bir ifade biçimi değil , aynı zamanda bilgi alışverişine dayalı kültürel gelişim süreçlerini beslemektedir. Bu bağlamda sanat, eserlerin kamusal alanlarda ve mekanlarda görünürlük kazanması, yaygınlaşması ve alımlayıcı ile doğrudan etkileşim kurması sayesinde, kültürel dönüşümün olumlu etkilerini ortaya çıkaran bir araç konumuna yükselmektedir (Parlakkalay, 2020).



Görsel 6. Erzurum Kongresi Binası Atatürk Heykeli
Kamusal sanatın kent mekanlarında varlık göstermesiyle birlikte ortaya çıkan estetik deneyim, bireylerin kolektif belleğini güçlendirmekte ve kent kimliğinin oluşumuna anlamlı katkılar sunmaktadır. Böylece kamusal heykeller, yalnızca sanatsal bir ifade biçimi olarak değil, aynı zamanda toplumsal aidiyetin ve kültürel sürekliliğin görünür kılındığı simgesel yapılar olarak değerlendirilmektedir (Taun, 1977; Zukin, 1995). Erzurum Kongresi Binası, Türkiye Cumhuriyeti'nin kuruluş sürecine tanıklık etmiş mekanlardan biridir. Bu önemde Atatürk'ün Figüratif temsili, yalnızca bireysel bir anma değil, aynı zamanda ulusal kimliğin ve tarihsel sürekliliğin mekânsal bir ifadesi olarak okunabilir.



Görsel 7. Görüş Babayev, « Palyaço », I.Uluslararası Erzurum Taş Heykel Sempozyumu,2005

Görüş Babayev 'in "Palyaço" (2005) adlı taş heykeli I.Uluslararası Erzurum Taş Heykel Sempozyumu kapsamında üretilmiş ve kent peyzajına kalıcı bir müdahale olarak konumlandırılmıştır. Bu anıtsal çalışma, figüratif ve soyut biçimlerin iç içe geçtiği bir plastik dil aracılığıyla, kamusal alanda mizahın ve hüznün eşzamanlı temsiline olanak tanır. Erzurum'un doğal peyzajıyla bütünleşen bu çalışma, sempozyumun kültürel diplomasi ve taş heykel geleneğini çağdaş yorumlarıyla yeniden üretme hedefi doğrultusunda değerlendirilmelidir (Babayev.2005).



Görsel 8. Rahmi Atalay, «Boğa", Traverten, I.Uluslararası Erzurum Taş Heykel sempozyumu,2005

Rahmi Atalay'ın Boğa adlı heykeli 2005 yılında düzenlenen I. Uluslarası Erzurum Taş Heykel Sempozyumu kapsamında üretilmiş ve kentin kamusal alanına kalıcı bir iz olarak yerleştirilmiştir. Doğal taşın katmanlı dokusunu koruyan bu soyut form hem hayvansal gücün hem de yerel coğrafyanın sertliğini simgelerken, kent peyzajıyla kurduğu görsel ilişki sayesinde toplumsal bellekte özgün bir yer edinmektedir.



Görsel 9. Jhon Gogaberishvili,, «Aks", Traverten, I.Uluslararası Erzurum Taş Heykel Sempozyumu,2005



Görsel 10. Mustafa Bulat, «Çift Başlı Kartal», I.Uluslararası Erzurum Taş Heykel Sempozyumu,410x130x130cm,mermer,2005

Sempozyum, bienaller ve festivaller gibi sanat odaklı etkinlikler, çağdaş kentlerin kültürel ve estetik dokusunu dönüştüren dinamik platformlar olarak öne çıkmaktadır. Bu tür organizasyonlar yalnızca sanat üretimini teşvik etmekle kalmaz, aynı zamanda kamusal alanın yeniden tanımlanmasına, kolektif belleğin güçlenmesine ve estetik deneyimin demokratikleşmesine katkı sağlar. Özellikle taş heykel sempozyumları gibi üretim odaklı

etkinlikler, sanatçılar ile kent arasında doğrudan bir ilişki kurarak, kalıcı eserlerin ortaya çıkmasına ve bu eserlerin kent peyzajına entegre edilmesine olanak tanır.



Görsel 11. Serap Bulat, «Yedi Kapılar», traverten, I.Uluslarası Erzurum Taş Heykel Sempozyumu, 2005

Serap Bulat'ın 2005 yılında Erzurum'da gerçekleştirilen sempozyum kapsamında ürettiği Yedi Kapılar adlı heykel, kent mekanına yerleştirilmiş bir sanat yapıtı olarak hem fiziksel hem de simgesel bir eşik işlevi görür. Görseldeki kış atmosferi, heykelin çevresindeki sessizlik ve ışık oyunlarıyla birleşerek, yapıtın anlamını derinleştirir.
Kamusal alanda konumlanan bu tür heykeller, kentlerin yalnızca mimari ya da coğrafi değil, aynı zamanda kültürel ve psikolojik kimliklerini de yansıtır. Bulat'ın yapıtı, Erzurum'un tarihsel " Kapı" metaforlarıyla örtüşerek, geçmişten bugüne uzanan bir toplumsal geçiş ve dönüşüm sürecini temsil eder(Bulat & Kocaman, 2005).
Bu tür üretimler, sempozyum bağlamında sanatçının özgün bakış açısıyla kent mekanını yeniden yorumlama ve dönüştürme çabasının bir parçasıdır.



Görsel 12. Dominika Griesgraber, «Palandöken», I.Uluslararası Erzurum Taş Heykel Sempozyumu,2005
Uluslararası sempozyumlar, yerel kent dokusun küresel sanat pratikleriyle buluşturma potansiyeline sahiptir. Griesgraber 'in çalışması, bu potansiyelin somut bir örneği olarak değerlendirilebilir. Yabancı bir sanatçının yerel bir coğrafyayı yorumlaması, hem kent sakinleri için bir bakış açısı sunar hem de kamusal alanın anlamını çoğullaştırır. Bu tür etkinlikler, kent estetiğini sadece görsel düzeyde değil, aynı zamanda kültürel ve düşünsel düzeyde de dönüştürür (Bulat et al., 2025).
Griesgraber 'in "Palandöken" heykeli, taşın doğal dokusunu koruyarak, Erzurum'un sert iklim ve dağlık coğrafyasıyla bütünleşen bir form sunar. Bu bütünleşme, kamusal heykelin yalnızca mekana yerleştirilmiş bir

nesne değil, aynı zamanda o mekanın kimliğini yeniden üreten bir unsur olduğunu gösterir. Uluslarası katılımlı sempozyumların bu bağlamda kentle kurduğu estetik ilişki hem yerel hem de evrensel düzeyde değerlendirilmeyi hak eder.

Heykelin kent içinde varlığı, görsel bir katkı olarak değil aynı zamanda sosyo-kültürel bir diyalogun başlangıcıdır. Dolayısıyla sempozyumlar, bienaller ve festivaller, kent estetiğini biçimlendiren, kültürel çeşitliliği teşvik eden ve kamusal alanın anlamını yeniden üreten stratejik araçlar olarak değerlendirilmelidir (Bulat et al., 2025).



Görsel 13. Mustafa Bulat, Çift Başlı Kartal, Tırmanma Duvarı, Çelik+Polyester,12x24x8m, Atatürk Üniversitesi Koleksiyon ,2009

Mustafa Bulat'ın "Çift Başlı Kartalı" adlı yapıtı hem kamusal alan heykeli hem de spor işlevi taşıyan hibrit bir sanat nesnesi olarak yorumlanabilir. Bu çift yönlü işlev, çağdaş heykel pratiğinde nadir görülen bir sentez sunar.

Bulat, M. (2009). Çift Başlı Kartal figürü, tarihsel olarak güç, koruma ve çift yönlü bakışın simgesi olarak kullanılmıştır. Anadolu Selçuklu sanatında da sıkça rastlanan bu figür, üniversite yerleşkesinde kültürel bir aidiyet ve tarihsel süreklilik duygusu yaratır.

Eserin devasa boyutları ve açık alandaki konumlanışı, onu yalnızca görsel bir odak değil, aynı zamanda mekanı tanımlayan bir mimari unsur haline getirir. Bu yönüyle heykel, çevresindeki peyzajla etkileşime girerek kamusal alanı dönüştürür.

Heykel tırmanma duvarı olarak işlev görmesi, izleyiciyi pasif bir gözlemciden aktif bir katılımcıya dönüştürür. Bu, çağdaş sanatın katılımcı estetik anlayışıyla örtüşür (Bulat, 2009).

Eserin fiziksel yapısı, sporcuların kullanımı için tasarlanmış tırmanma yüzeyleri içerir. Bu, sanat nesnesinin sportif bir araç olarak yeniden işlevlendirilmesi dir. Sporcuların heykelle fiziksel temas kurması, sanatla beden arasındaki sınırları kaldırır. Bu durum, sanatın yalnızca zihinsel değil, bedensel bir deneyim alanı olduğunu gösterir.

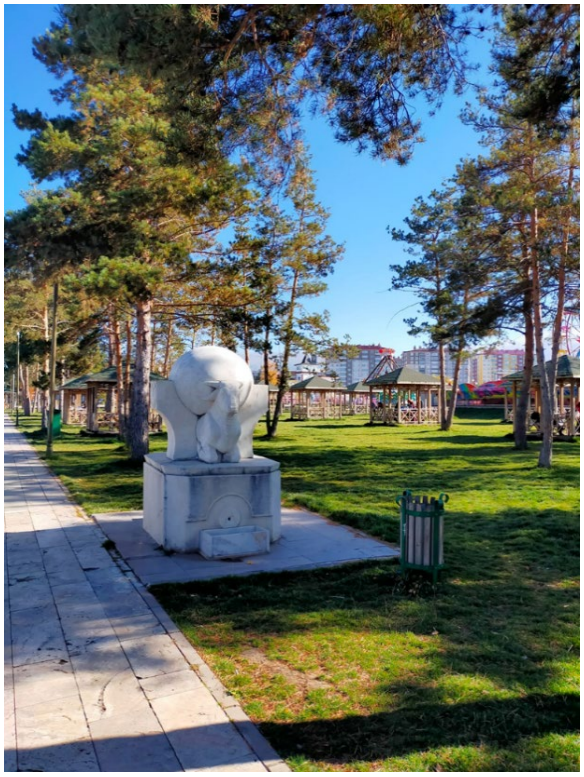


Görsel 14. İlhan Kaya & M.Hanifi Zengin, I.Uluslararası Erzurum Taş Heykel Sempozyumu, 2010

Modern kentlerin yoğun beton dokusu içerisinde heykeller, farkındalık ve duyarlılık alanları açarak görsel ve düşünsel bir karşıtlık oluşturur. Bunun yanı sıra, geçmişten günümüze taşınan kültürel mirastan referans alarak bellek ile aidiyet arasındaki ilişkiyi güçlendirir ve dün ile bugünün güncelliği arasında bir köprü kurar. Bu köprü, kültürlerarası diyaloğun göstergesi olduğu gibi, kent ve bulunduğu çevreye ilişkin bireysel ve toplumsal imgelerin oluşumunda da önemli bir rol üstlenir(Özkul & Küçükşen Öner, 2021).



Görsel 15. Barış Aydın &Volkan Doğan, 2010



Görsel 16. Ivane Tsiskadze, "Dünyayı Taşıyan Boğa", 2010

Sanatsal etkinlikler, kentlerin sosyal ve toplumsal yapısını olumlu yönde dönüştürme potansiyeline sahip önemli unsurlardan biridir. Toplum, yalnızca bireylerin bir araya gelerek oluşturduğu bir topluluk olarak değerlendirilemez; aynı şekilde kentleşme kavramı da yalnızca nüfus artışıyla sınırlı bir olgu değildir. Bu bağlamda, sanatsal üretim ve etkinliklerin kent yaşamına kattığı değer, toplumsal ilişkilerin güçlenmesine, kültürel çeşitliliğin görünür kılınmasına ve sosyal bütünleşmesinin desteklenmesine katkı sağlamaktadır.



Görsel 17. Şehit Öğretmen Anıtı, Millî Eğitim Vakfı, Bronz, 2010, Erzurum

Soğuk iklim estetiği, sanatın üretim ve algı süreçlerini belirleyen çevresel koşulların başat rol oynadığı bir bağlamdır. Erzurum soğuk iklimi, tarihsel belleği ve kültürel kimliğiyle kamusal heykel üretiminde özgün bir deneyim alanı sunar. Bu bağlamda "Şehit Öğretmen Anıtı" hem kavramsal anlatı hem de mekânsal yerleşimle kentin kimliğini güçlendiren bir örnek olarak öne çıkar.



Görsel 18. İlhan Kaya& Gökhan Taş , « Curling », III.Uluslararası Erzurum Taş Heykel Sempozyumu, Mermer, Curling Spor Salonu, Erzurum, 2010

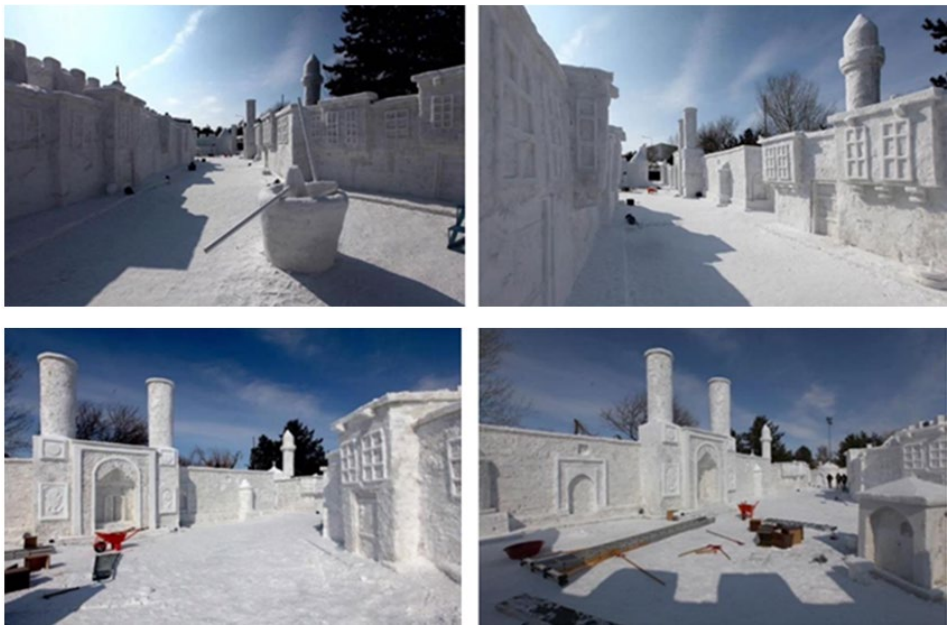
21. yüzyılda kentsel gelişimin ivme kazanmasıyla birlikte çağdaş düşünce ve sanat biçimlerinin kamusal alanlarda toplumla buluşturulması, izleyici ile etkileşim kurması ve toplumsal gelişime katkı sağlaması önemli dinamikler arasında yer almaktadır. Bu bağlamda, Lefebvre'nin kamusal mekan kuramı (991) kamusal alanın yalnızca fiziksel bir çevre değil, aynı zamanda toplumsal ilişkilerin üretildiği bir sahne olduğunu vurgulamaktadır. Benzer biçimde Habermas 'ın kamusal alan kavramı (1962/1989), sanatın ve kültürel etkinliklerin demokratik tartışma ortamlarını besleyerek toplumsal dönüşümde rol oynadığını ileri sürmektedir.

Sanatın geniş kitlelerle buluşturulması, sanatın toplumsal alanda yaygınlaştırılmasına olanak tanımakta; bu süreç, kent dokusunda gözlemlenen olumlu dönüşümlerle birlikte sosyal ilişkilerin yapısının iyileşmesine katkıda bulunmaktadır. Örneğin, İstanbul Bienali gibi uluslarası sanat etkinlikleri, kentin kültürel kimliğini küresel ölçekte görünür kılarken, yerel toplulukların sanatla etkileşimini artırmaktadır. Erzurum'daki kamusal heykel uygulamaları ise, kentin estetik dokusunu zenginleştirmenin yanı sıra, toplumsal belleğin ve kimliğin yeniden inşasında önemli bir rol oynamaktadır.



Görsel 19. Atlama Kuleleri,2010

Kamusal alanda gerçekleştirilen sanatsal etkinlikler, yalnızca sanatsal kaygıların ve aktarılan düşüncelerin görünür kılınması açısından değil, aynı zamanda birey üzerindeki etkisi ve oynadığı toplumsal rol bakımından da önem taşımaktadır. Bu etkinlikler, bireylerin estetik deneyimlerini dönüştürmekte, kent yaşamına katılımı teşvik etmekte ve toplumsal etkileşimi güçlendirmektedir. İlk aşamada fiziksel ihtiyaçları karşılamak üzere inşa edilen mekanlar, zamanla kamusal heykeller ve sanatsal müdahaleler aracılığıyla toplumsal belleğin taşıyıcılarına dönüşmüştür (Yağmur, 2018).



Görsel 20. EYOF 2017 Kardan Erzurum Kültür Sokağı

EYOF 2017 kapsamında Erzurum'da inşa edilen "Kardan Kültür Sokağı", geçici malzeme olan karın mimari ve kültürel biçimlerle yeniden yorumlanması yoluyla kamusal alanın estetik ve deneyimsel boyutlarını dönüştürmüştür. Bu tür geçici yerleştirmeler, kent mekanında süreklilikten ziyade anlık etkileşim ve mevsimsel hafıza üretimiyle öne çıkar. Kardan yapılan yapılar hem Erzurum'un iklimsel kimliğini vurgulamakta hem de kültürel temsiliyetin geçici bir formda nasıl sahnelenebileceğini göstermektedir. Kamusal alanda geçici malzeme kullanımı, kent estetiğini sabit bir formdan ziyade değişken, katılımcı ve mevsimsel bir deneyim olarak yeniden tanımlar (Bulat & Beyaztaş Özlütürk, 2024).



Görsel 21. Zekeriya Erdinç, « Esinti »,Metal Konstrüksiyon,74.Devlet Resim ve Heykel Sergisi,2018

Kamusal alan, modern kentlerin sosyo- kültürel kimliğini belirleyen önemli mekanlardan biridir. Sanatın bu alanlarda görünürlük kazanması, yalnızca estetik bir katkı değil, aynı zamanda toplumsal etkileşimin ve kültürel çeşitliliğin güçlenmesine aracılık eder. Uluslararası kongreler , sempozyumlar, festivaller ve yarışmalar, sanatın kamusal mekanla kurduğu ilişkiyi yeniden tanımlayarak, kent estetiğini küresel ölçekte tartışmaya açar. Bu bağlamda Bulat ve Beyaztaş Özlütürk (2024), kamusal alanın sanatsal üretimle birlikte dönüşümünü ele alarak, sanatın kent kimliğini yeniden üretme gücünü vurgulamaktadır. Dolayısıyla kamusal alanda sanatın varlığı hem mekânsal hem de kültürel açıdan kentlerin çağdaş kimliğini biçimlendiren bir unsur olarak değerlendirilebilir.



Görsel 22. İlhan Kaya & M. Hanif'i Zengin, « Uzaysal Form », Kurumuş Ağaçlara Sanatsal Uygulama, Atatürk Üniversitesi Kampüs Alanı, 2019

Çalışma, Atatürk Üniversitesi kampüsünde kurumuş ağaçların sanatsal müdahalelerle yeniden değerlendirilmesi hem çevresel geri dönüşüm hem de mekan-estetik ilişkisi açısından önemlidir. Kurumuş ağaçların, doğrudan kesilip yok edilmesi yerine, sanatsal bir uygulama ile mekana estetik ve kavramsal değer katacak biçimde dönüştürülmesi doğal malzemenin(kurumuş ağaç) yeniden işlevlendirilmesi çevresel farkındalık yaratmak ve sanatsal çalışmanın mekanla kurduğu ilişkiyi güçlendirmektedir.

“Uzay form” kavramı üzerinden , doğa ile sanatın kesiştiği bir estetik deneyim oluşturulmuştur. Bu bağlamda, ağaç gövdeleri yalnızca biyolojik bir kalıntı değil, aynı zamanda mekanın kimliğini dönüştüren sanatsal objeler olarak ele alınmıştır.



Görsel 23. Caner Şengünalp, « 35 », Muğla Mermeri, Erzurum,2019

Şengünalp 'ın "35" (2019)başlıklı mermer heykeli, Atatürk Üniversitesi yerleşkesinde konumlandırılmış olup, kamusal sanat örneklerinin düşünsel ve mekânsal etkisini görünür kılmaktadır. Bu soyut form hem malzemenin kalıcılığı hem de biçimin açıklığa direnen yapısıyla, üniversite mekanında düşünsel çoğulluğu ve yorum özgürlüğünü simgeler.

Kamusal alanda yer alan heykeller, özellikle akademik kurumlar önünde konumlandığında, yalnızca estetik bir katkı değil; aynı zamanda bilgi üretimi, sorgulama ve kültürel temsil gibi kavramlarla ilişki kurar. Bu bağlamda "35", üniversite mekanında sanatın sessiz ama etkili bir düşünsel eşlikçi olarak varlık gösterdiği örneklerden biridir. Eğitim kurumlarının kamusal sanatla kurduğu ilişki, öğrencilerin ve akademisyenlerin gündelik geçişlerinde sanatsal bir durak yaratırken, aynı zamanda mekanın kimliğini kültürel olarak derinleştirir (Bulat& Beyaztaş Özlütürk, 2024).

Şengünalp 'ın çalışması, biçimsel olarak açık uçlu bir yorum alanı sunarken, kavramsal düzeyde üniversite mekanının düşünsel özgürlük ve çok seslilik ilkeleriyle örtüşen bir estetik öneri sunar. Bu tür yerleştirmeler, sanatın yalnızca galeri ya da müze gibi kapalı alanlarda değil, kamusal ve akademik yaşamın tam kalbinde yer alabileceğini gösterir. Dolayısıyla "35", hem sanatın mekanla kurduğu ilişkiyi hem de üniversite gibi bilgi üretim merkezlerinin estetik sorumluluğunu görünür kılan örnek olarak değerlendirilebilir.

Erzurum kent merkezindeki kamusal heykellerin biçimsel ve kavramsal yönelimlerini belirleyen temel çerçeve, yalnızca estetik yaklaşım, malzeme seçimi ve mekânsal konumlanışla sınırlı değildir. Bu heykeller aynı zamanda toplumsal hafızanın inşasında, kamusal alanın kimlik kazanmasında ve kültürel sürekliliğin sağlanmasında etkin bir rol üstlenmektedir. İncelenen örnekler göstermektedir ki, soğuk iklim estetiğiyle ilişkilenen kamusal heykeller, bireysel deneyimleri toplumsal bir anlam çerçevesine dönüştürmekte; mekanın işleviyle bütünleşerek hem estetik hem de etik bir değer üretmektedir. Dolayısıyla kamusal heykel, yalnızca görsel bir ifade biçimi değil, aynı zamanda kültürel kimliğin, toplumsal sorumluluğun ve kolektif belleğin somut bir göstergesi olarak değerlendirilmelidir.



Görsel 24. İlhan KAYA, « Sağlık Çalışanları İçin, Akçaağaç Yaprağı », Sanatta Yeterlik Tezi, BAP Projesi Mermer, 2022

İlhan Kaya'nın Sağlık Çalışanları için, Akçaağaç Yaprağı adlı çalışması, kamusal alan heykeli olarak hem malzeme seçimi hem de mekânsal yerleşimiyle kentin kimliğini güçlendiren bir örnek olarak öne çıkmaktadır. Akçaağaç yaprağı formu, doğanın sürekliliğini ve yaşam döngüsünü simgelerken, aynı zamanda sağlık çalışanlarının özverili emeğine yönelik bir minnettarlık göstergesi olarak işlev görmektedir. Çalışma, kent merkezinde kamusal sanatın toplumsal bağlamda işlevselliğini somutlaştıran bir örnek niteliği taşır.

Heykelin hastane bahçesinde konumlandırılması, mekanın kimliğini dönüştüren bir müdahale olarak değerlendirilebilir. Sağlık çalışanlarının emeğini hatırlatan ve toplumsal minnettarlığı sembolleştiren bu çalışma, mekanın işlevsel boyutunu aşarak kimliksel bir derinlik kazandırır. Böylece kamusal alan, yalnızca geçiş ve kullanım mekanı olmaktan çıkar; toplumsal belleğin ve ortak duyguların somutlaştığı bir kültürel odak haline gelir.

Kaya'nın çalışması, pandemi sonrası dönemdeki sağlık çalışanlarına yönelik minnettarlığın mekânsal ve sanatsal bir ifade aracı olarak düşünülebilir. Sanatın yalnızca estetik bir nesne değil, aynı zamanda toplumsal değerlerin ve ortak hatıraların taşıcısı noktasında sanatın toplumsal dönüşümdeki rolüne örnek olarak verilebilir.

Sonuç

Erzurum kent merkezindeki kamusal heykeller, soğuk iklim estetiğiyle biçimsel ve kavramsal olarak bütünleşerek, kent kimliğinin görsel ve düşünsel bir temsiline dönüşmektedir. Bu heykeller, yalnızca estetik birer nesne değil; aynı zamanda toplumsal hafızanın taşıyıcısı, kültürel sürekliliğin aracı ve kamusal alanın etik değer üreticisi olarak işlev görmektedir. Mekanla kurduğu ilişki sayesinde bireysel deneyimleri kolektif bir anlam çerçevesine dönüştüren bu yapıtlar, kentte yaşayan bireylerin kültürel aidiyetini pekiştirmekte ve toplumsal sorumluluk bilincini görünür kılmaktadır.

Bu bağlamda, kamusal heykel üretiminin sürekliliği ve çeşitliliği, yalnızca sanatçının bireysel çabasıyla değil; aynı zamanda yerel yönetimlerin, kurumların ve akademik platformların aktif desteğiyle mümkündür. Sempozyumlar, festivaller, bienaller ve yarışmalar gibi etkinlikler, sanatçılara üretim alanı açmakla kalmaz; aynı zamanda kent estetiğini ve kültürel diyaloğu canlı tutan birer kamusal form işlevi görür. Bu tür organizasyonların sürekliliği, kamusal sanatın kent yaşamına entegre edilmesini ve kamusal alanın kültürel bir laboratuvar olarak değerlendirmesini mümkün kılar (Yıldız, 2023).

Dolayısıyla, kamusal heykel yalnızca bir sanat formu değil, aynı zamanda kent planlamasının, kültürel politikanın ve toplumsal iletişimim ayrılmaz bir parçası olarak ele alınmalıdır. Bu yaklaşım hem sanatın demokratikleşmesini hem de kentlerin kültürel kimliklerinin güçlenmesini sağlayacaktır.

Öneriler

Soğuk iklim koşullarına uygun, dayanaklı ve yenilikçi malzeme kullanımı teşvik edilmelidir. Ahşap, metal ve taş gibi geleneksel malzemelerin yanı sıra çağdaş alternatif malzemeler de değerlendirilmelidir.

Kamusal heykel projelerinde, sempozyumlar, bienaller, yarışmalar ve festivallerle Erzurum'un tarihsel ve kültürel belleğini yansıtan temalara öncelik verilmelidir. Bu yaklaşım, kent kimliğinin güçlenmesine katkı sağlayacaktır.

Heykel tasarım ve yerleştirme süreçlerinde yerel halkın, sanatçıların ve akademisyenlerin katılımı artırılmalıdır. Böylece eserler, toplumsal sahiplenmeyi ve aidiyet duygusunu güçlendirecektir.

Kamusal heykellerin konumlandırılmasında kent estetiği, mekânsal bütünlük ve işlevsellik göz önünde bulundurulmalıdır. Heykeller, yalnızca dekoratif unsurlar değil, aynı zamanda kamusal alanın anlamını derinleştiren yapılar olarak düşünülmelidir.
Erzurum'un soğuk iklim estetiğini yansıtan kamusal heykeller, ulusal ve uluslarası sanat etkinliklerinde tanıtılmalı; böylece kentin kültürel değerleri daha geniş bir bağlamda görünür hale getirilmelidir.

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EL ANATSUİ' NİN SANATSAL ÜRETİM İFADE YÖNTEMİ

Mustafa Bulat[212], Mariya Pınar[213]

Özet

Çalışma kapsamında ele alınan dünyaca ünlü Afrikalı heykel sanatçısı, El Anatsui' nin yapıtları, yapmış olduğu tasarımların, sıradanlığın oldukça dışında olması çalışmanın amacını oluşturmaktadır. Sanatçının ortaya çıkarmış olduğu yapıtlardaki ki en önemli özelliklerden birisinin, çalışmalarını oluşturmuş olduğu malzeme seçimi yapmasıdır.

Kendi kategorisinde yapmış olduğu yapıtlarda çağdaşlarının dışında heykeller oluşturan sanatçı, genellikle şişe kapakları ve büyük bir ağaç türü olan manyok rendeleri gibi atıl durumdaki malzemeleri kullanıyor olması da ünlü heykeltıraşa olan merağı artıran bir özellik olarak da El Anatsui'nin üretim pratiği yalnızca biçimsel bir yenilik olarak değil, aynı zamanda kavramsal ve eleştirel bir söylem alanı olarak da değerlendirilmektedir. Sanatçının atık ya da gündelik kullanım nesnelerini sanat yapıtına dönüştürme yaklaşımı, tüketim kültürü, sömürgecilik sonrası kimlik arayışı ve küreselleşmenin Afrika toplumları üzerindeki etkilerine göndermeler içermektedir. Özellikle metal şişe kapaklarını bir araya getirerek oluşturduğu geniş ölçekli heykelsi yüzeyler, geleneksel Afrika tekstil anlayışını çağrıştıran dokusal ve ritmik yapılar sunmakta; bu yönüyle heykel, tekstil ve enstalasyon sanatları arasında disiplinlerarası bir bağ kurmaktadır.

Anatsui'nin yapıtları, hem kullanılan malzemenin geçmişine dair anlatılar barındırması hem de izleyiciyle kurduğu mekânsal ilişki sayesinde, çağdaş sanat içerisinde güçlü bir anlatım dili oluşturmakta ve çalışmanın kavramsal çerçevesini derinleştirmekte olduğu görülmektedir.

Anahtar kelimeler: El Anatsui, Geri dönüşüm, Sanat, Tekstil

EL ANATSUI'S ARTISTIC PRODUCTION EXPRESSION METHOD

Abstract

Within the scope of this study, the works of the world-renowned African sculptor El Anatsui are examined, with particular emphasis on the fact that the designs he produces extend significantly beyond conventional notions of form and material, thereby constituting the primary objective of the research.

One of the most distinctive characteristics of the artist's oeuvre is his deliberate and conceptually driven selection of materials. By producing sculptural works that diverge from those of his contemporaries within the same category, Anatsui enhances scholarly interest through his frequent use of discarded materials such as bottle caps and cassava graters derived from large tree species. El Anatsui's artistic practice is regarded not merely as a formal innovation, but also as a field of conceptual and critical discourse. His transformation of waste and everyday utilitarian objects into works of art contains explicit references to consumer culture, postcolonial identity formation, and the effects of globalization on African societies. In particular, the large-scale sculptural surfaces he constructs by assembling metal bottle caps present textural and rhythmic structures that evoke traditional African textile practices; in this respect, his works establish an interdisciplinary relationship between sculpture, textile art, and installation.

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It is evident that Anatsui's works, through both the narratives embedded in the historical provenance of the materials used and the spatial relationship they establish with the viewer, generate a powerful expressive language within contemporary art and contribute to deepening the conceptual framework of the study.

Keywords: El Anatsui, Recycling, Art, Textil

GİRİŞ

4 Şubat 1944'te Nijerya'nın Gana kentinde doğmuş olan heykel sanatçısı, 1975'ten beri Nijerya Üniversitesi Nsukka' da öğretim görevlisi ve sanatçı olarak yaşamını sürdürmektedir. Uluslararası alanda 100'ü aşkın kişisel ve karma sergide yer almış olan heykel sanatçının (https://www.meer.com/en/24283-el-anatsui) Erişim, 07.11.2023. portresini sunan en önemli özelliğiyse, birbirinden farklı malzemeleri bir araya getirmesidir.

Sanatsal ifade yönünü nü vurgulayan en önemli kavram ise çağdaş heykel sanatı olmuştur. El Anatsui geçtiğimiz kırk yıl boyunca, çağdaş heykel dilini sadece Afrika'da değil uluslararası alanda genişleten çok sayıda çalışma yapmıştır (https://www.meer.com/en/24283-el-anatsui) Erişim, 07.11.2023

Yapmış olduğu çalışmalarla kariyerinin gelişimine oldukça farklı bakış açıları sunmakla beraber diğer yandan birçok sanatçı ve sanatçı adayları için de ilham verici bakış açıları geliştirmektedir.

Anatsui' nin çalışma odası ve stüdyosunda bulunan eskiz defterleri, çizimleri, mektuplar, sergi planlama ve okuduğu kitapları da dâhil olmak üzere birçok farklı materyal sanatçı hakkında oldukça fazla bilgi sunuyor.

EL ANATSUİ' NİN ÇALIŞMA ALANLARI

Nijeryalı sanatçı geçen yirmi yıl boyunca, geri dönüşüm içerisinde bulunan şişe kapakları üzerinde çalışmış ve bu atıl durumdaki malzemelerle sanatsal ifade yöntemini belirleyici sanatsal ürünler ortaya koymuştur.

Yok olmak üzere olan bildik nesneleri yeniden bir araya getirerek ve maddeselliğe odaklanması, Anatsui 'nin uluslararası alanda beğenilmesinde ki en büyük etmenlerden olarak sayılmakta ve sanatçı olarak statüsünü güçlendirmektedir.

Anatsui' yi tanıtırken, olasılıkları gerçeğe dönüştüren ve sınırsız bir tasarım sürecinin sürükleyiciliğini en iyi ifade eden sanatçılardan biri olduğu vurgulanmalıdır. Hatta Ganalı bir yazar Anatsui' hakkında şöyle ifade ediyor: "Anatsui stüdyoda çalışıyorken, gökyüzü yeryüzüyle konuşmak için eğiliyormuş gibi hissettiriyor".

EL ANATSUİ' NİN ÇALIŞMALARI

El Anatsui, 1980 ve 90'lı yıllarda çoğunlukla birbirine kenetlenen plâkalarda birleştirilmiş olan ahşap işleriyle tanınmış olduğu bilinmektedir. Çoğu defa kesilmiş, yanmış yahut özellikle yakılmış ahşap yaratımları kullanarak, ince renk geçişleri ve karmaşık desenlerle oluşturmuş olduğu çalışmalarla tezat bir anlam sunmaya çalışılmış olduğu gözlemlenmektedir.



Fotoğraf 1: El Anatsui ‘nin ahşap çalışmalarından bir görsel.



Fotoğraf 2: Yakma yöntemiyle tasarlanılmış heykeller.

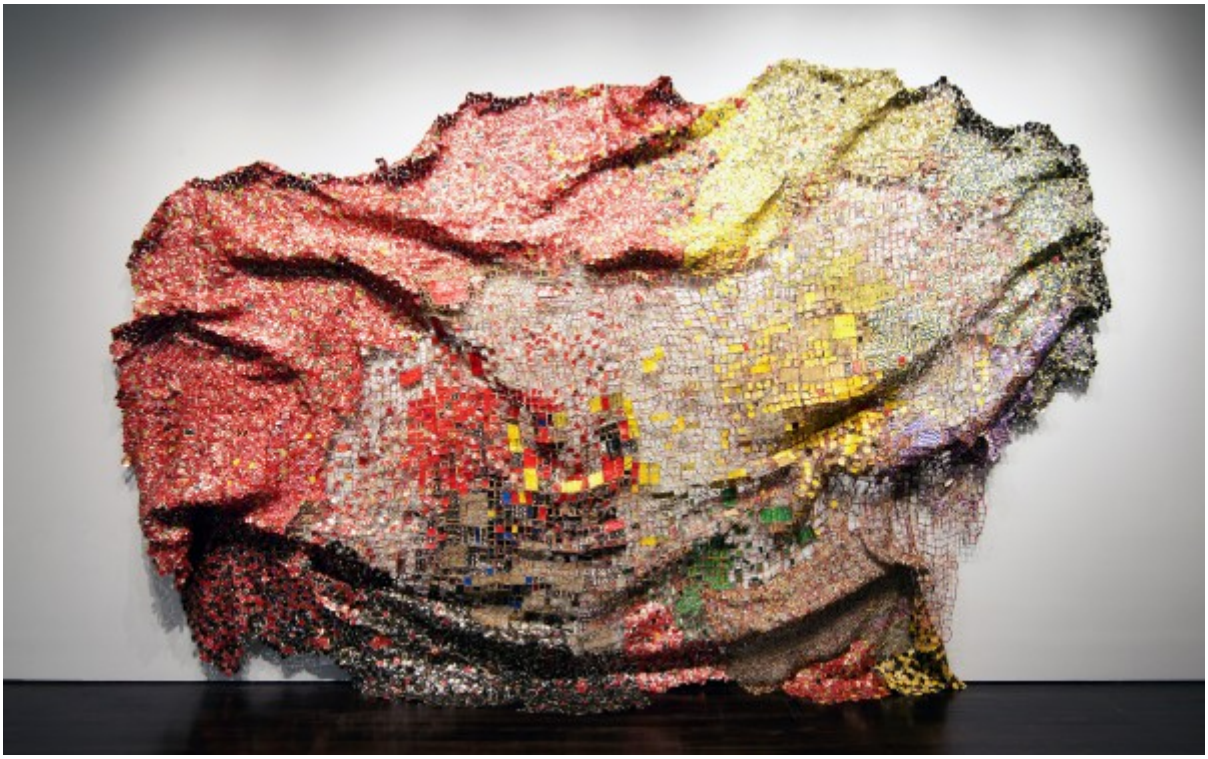
Bir ağaç türü olan manyoku yontma işlemine tabi tutmadan, doğal haliyle bazı kısımları yakılarak elde edilmiş olan heykeller malzemenin dönüşmeden de çağdaş eserler var edebileceğini ispatlayıcı nitelik taşıdıkları izlenimi oluşturmaktadır.



Fotoğraf 3: Wonder Masquerade (1990)

Bu figüratif heykel, Anatsui' nin ahşap çalışmalarının birçoğunun özelliği olan semboller ve çizgilerden oluşturulmuş olup; yanmış ince, ahşapların girintilerle yakılarak kavisli bir görünüm elde edilerek ahşap şeritlerden hazırlanılmış bir heykeldir. Bu heykelde, ahşap şeritler heykelin kenarları boyunca ince bir kıvrım oluşturacak şekilde dikey olarak toparlanarak, pelerinli bir biçimde zarif bir görünüm elde edilmeye çalışılmıştır. Heykelin bulunduğu ortamın duvarlarında asılı olan ahşap ve metal parçalardan oluşan birkaç yontu ve bir araya getirme yöntemiyle elde edilmiş tablo niteliği taşıyan eserlerse, El Anatsui' nin imzası niteliğini taşımaktadırlar.

Anatsui 'nin en çok tanındığı görkemli metal duvar kaplamalarıysa çoğunlukla şişelerinden elde edilen atık alüminyumların titizlikle bir araya getirilmesi ve buna ilave olarak geri dönüştürülmüş malzemelerle ortaya çıkarmış olduğu devasa eserleridir.



Fotoğraf 4: El Anatsui' nin şişe kapaklarıyla oluşturulup " stresli dünya adını verdiği eser.

Atılmış şişe kapakları kullanılarak tasarlanmış olan bu tasarım izleyicisine duvar halısı izlenimi vererek bu eseri farklı yorumlatma gücüne sahip olduğu düşünülmekte. Uzaktan bakınca, metal şişe kapaklarının rengi ve desenlerinin, yerli bir Gana tekstil ürünü olan kente kumaşına görsel bir gönderme yapıyor olduğu izlenimi vermesinin yanı sıra, aynı zamanda dünya haritasına da bir gönderme söz konusu olabilmektedir.



Fotoğraf 5: Gana'ya ait bir kumaş türü.



Fotoğraf 6: 2007 de, Many Moons adını vermiş olduğu Alüminyum ve bakır telden oluşturulmuş eseri.

Araştırma kapsamında ele alınmış olan El Anatsui' nin, kendi kültürünü yansıttığı düşünülen çalışmaları "Afrika Sanatı" olarak anılmasına kapı aralasa da kendisi aksini şu sözlerle ifade etmektedir; "Ben sadece bir sanatçıyım. Afrika futbolu yok. Futbol futboldur. İnsanlar Japon sanatı, Afrika sanatı vb. diyor ama sanat sanattır. Bunu coğrafi olarak tanımlamanıza gerek yok." https://en.wikipedia.org/wiki/El_Anatsui Erişim, 06.11.2023.

Fakat yapılmış olan bu araştırma göstermektedir ki heykel ve tekstil arasında gidip gelen söz konusu tasarımlar bu anlamda sınıflandırmaya meydan okumaktadır.

ULUSAL - ULUSLARARASI ARAŞTIRMALARI, ALMIŞ OLDUĞU ÖDÜLLER VE KATILMIŞ OLDUĞU SERGİLER

Japonya, Amerika Birleşik Devletleri ve Avustralya'daki iş seyahatleriyle ilgili birçok önemli geriye dönük araştırma yapmış olduğu bilinmektedir. Çalışmaları, New York'taki Metropolitan Sanat Müzesi, Paris'teki Centre Pompidou ve Londra'daki Tate Modern ve British Museum gibi önemli müze koleksiyonlarında yer almaktadır (https://www.meer.com/en/24283-el-anatsui) Erişim, 07.11.2023.

2012 ve 2013 yıllarında büyük ölçekli halka açık kurulumlar arasında, Broken Bridge II yer alıyor High Line Art tarafından sipariş edilen ve New York'taki Friends of the High Line tarafından sunulan ve 2013 yılında Londra'daki Kraliyet Sanat Akademisinde de eserlerinin sergilendiği bilinmektedir.

Almış Olduğu Ödüller

El Anatsui, 1968 yılında lisans öğrencisi olarak katılmış olduğu 1. Gana Ulusal sanat yarışmasında Mansiyon ödülü kazanmıştır. Sonraki yıldaysa Gana'nın kumaşı sanat kolejinde yılın En İyi Öğrencisi ödülüne layık görülmüştür.

1983 yılında mozaik yüzeyli çimentodan yapılmış iki büyük heykel halka açık bir komisyonda ödül kazanmıştır.

1984 yılında Batı Almanya'nın Cuxhaven kentinde düzenlenen Zweitessempozyumu Nordesekkuste misafir programına davet edilen 10 sanatçıdan biri olarak seçilmiştir.

1990 da Anatsui 44 senelik Venedik Bienalinin 5 Çağdaş Afrika Sanatçısı sergisine davet edildi ve burada da Mansiyon ödülü aldı. Aynı yıl içerisinde Amerikan belgeseli Nijeryalı Sanat-Kindred Spirilse dâhil edildiği bilinmektedir.

2015 de Venedik Bienali, Anatsui 'ye Hayat boyu başarı altın aslan ödülünü kazandırmıştır. 2017 yılında Anatsui, uluslararası sanat ödülünü kazanan ilk Ganalı olarak Praemium imperiale ödülüne layık görülmüştür

Almış olduğu diğer ödüller arasındaysa şunlar yer almaktadır:

- 1990 – Halk Ödülü, 7. Yıllık Kleinplastik Trienali.
- 1995 – Kansai Televizyon Yayını Ödülü, 6. Osaka Heykel Trienali.
- 1998 – Bronz Ödül, 9. Osaka Heykel Trienali.
- 2008 – Vizyonerler Ödül, Sanat ve Tasarım Müzesi (MAD)
- 2009 – Prens Claus Ödülü
- 2009 – 30. Yıldönümü Kutlaması için Ulusal Afrika Sanatı Müzesine Onur Sanatçısı olarak davet edilmiştir.

Onursal dereceleri

- 2016 – Fahri doktora, Harvard Üniversitesi.
- 2017 – Fahri doktora, Kwame Nkrumah Bilim ve Teknoloji Üniversitesi

Katılmış olduğu bazı sergiler

- 1990 ve 2007 yıllarında Hayward Galerisi
- 1990 yılında Anatsui ilk önemli grup sergisini New York Harlem'deki Studio Museum'da gerçekleştirmiştir. Aynı yıl içerisinde beş yıl süreyle uzatılan "Çağdaş Afrika Sanatçıları: Değişen Gelenekler" sergisinde seçilen üç sanatçıdan birisi olmuştur.
- 1995 yılında 5. Gwangju Bienali
- 2001 yılında Barselona Kültür Merkezi
- 2001 yılında, 8. Osaka Heykel Trienali
- 2002 yılında Ulusal Afrika Sanatı Müzesi
- 2004 yılında Doha'daki Arap Modern Sanat Müzesi
- 2005 yılında Liverpool Bienali
- 2007 yılında Venedik Bienali
- 2008 yılında UCLA' daki Fowler Müzesi
- 2008–09 yıllarında Ulusal Afrika Sanatı Müzesi, Smithsonian Enstitüsü, Washington.
- 2013 yılında Brooklyn Müzesi dâhil olmak üzere dünya çapında eserleri sergilenmiştir.2011 yılında Rice Üniversitesi Sanat Galerisi, Houston
- 2010 yılında Metropolitan Sanat Müzesi, New York
- 2019 ve 2020 yılında Kunstmuseum Bern

Daha birçok çalışması olan sanatçı, Avrupa ve Amerikalı sanatçılar tarafından kullanılan bir üsluba sahip olmuştur. Fakat çalışmaları Afrika ülkelerinde çok fazla kullanılmayan kavramsal tarzlara sahip çalışmalardır. El Anatsui' nin ilk kez "büyük bir sanat müzesindeki kalıcı koleksiyonun bir parçası olarak ortaya çıkmasını sağlayan çalışmaları 2005 yılında San Francisco'daki de Young Müzesi'nde sergilenmiştir. Yine 2005 yılında New York'un Skoto Galerisi'ndeki "Danudo" sergisi, metal levhalarının bir Amerikan şehrinde sergilendiği ilk sergi olduğu bilinmektedir. Bu galeride Skoto Aghahowa, Sol LeWitt ile birlikte Anatsui'nin ahşap duvar panellerini sunduğu 'nin çizimleri yer almaktadır. Bu sergi Anatsui' nin basında daha çok bilinmesiyle birlikte şişe kapağı çalışmalarını da popülerleştirmiştir.

Sanatçının eserleri, kırmızı, siyah ve altın renginin de dâhil olmak üzere farklı doku ve renkleri içermektedir. Şişe kapaklarının duvar boyunca uzanan şekli, söz konusu çalışmaları galerideki diğer çalışmalardan farklı kılan bir durum ve duygu oluşturmuştur. Bienalin sanat küratörü Robert Storr, sanatçının serisinin "savaş sonrası dönemdeki bir dizi şeye uzandığını, daha önce görmediği bir duyguya sahip olduğunu" belirtmiştir. Venedik gösterisi sırasında Anatsui, izleyicileri için kavramsal olarak yeni bir deneyim yaratmak istedi. "İnsan hayatının kesilip kurutulan bir şey olmadığına, sürekli değişim halinde olan bir şey olduğuna" inandığını ifade ederek sanata olan bakış açısını vurgulamıştır.

SONUÇ

Heykel sanatçısı, El Anatsui' nin yapmış olduğu tasarımların, sıradanlığın oldukça dışında olması ünlü sanatçıyı araştırma merakı geliştirmiştir. Sanatçının ortaya koymuş olduğu eserlerde ki en önemli gözlem, çalışmalarını oluşturmuş olduğu malzeme seçimi olmuştur.

Anatsui' nin sanatsal anlatımındaki en önemli faktör ise çağdaş heykel sanatçısı olmasıdır. Kırk yıl boyunca, çağdaş heykel dilini sadece Afrika'da değil uluslararası alanda genişleten çok sayıda çalışma yapmış olması, kariyerinin gelişimine oldukça farklı bakış açıları sunmakla beraber birçok sanatçı adayları için de ilham verici bakış açıları geliştirmektedir.

El Anatsui, 1980 ve 90'lı yıllarda çoğunlukla birbirine kenetlenen plâkalarda birleştirilmiş olan ahşap işleriyle tanınmış olmasına rağmen sanatçı geçtiğimiz yirmi yıl boyunca, geri dönüşüm içerisinde bulunan şişe kapakları üzerinde çalışarak sanatsal ifade yöntemini belirleyici sanatsal ürünler ortaya koymuştur.

Atıl durumda ki nesneleri bir araya getirerek ve maddeselliğe odaklanması, Anatsui 'nin uluslararası alanda beğenilmesinde ki en büyük etmenlerden olarak sayılmış ve sanatçının statüsünü güçlendirmiştir.

Geri dönüştürüle bilinen malzemelerin dışında, kesilmiş, yanmış veya özellikle yakılmış ahşap malzemeleri kullanarak, malzemeyi her hangi bir dönüşümden geçirmeden de çağdaş eserler var edebileceğini ortaya koymuştur.

Son zamanlarda eserlerinde sıklıkla görülen şişe kapaklarıyla tasarlanmış olduğu tasarımların uzaktan bakıldığında, metal şişe kapaklarının rengi ve desenlerinin, duvar halısı izlenimi vermesi yahut yerli bir Gana tekstil ürünü olan kente kumaşına görsel bir gönderme yapıyor olduğu izlenimi vermektedir. Bunların yanı sıra, dünya haritasına da bir gönderme söz konusu olabilmesi sanatçının son dönemde oluşturmuş olduğu tasarımlarını farklı perspektiflerle yorumlama gücünü artırıcı özellikler taşıdığı görülmektedir.

Ulusal ve uluslararası alanda birçok çalışması olan sanatçının almış olduğu birçok ödül fahri unvan ve eserlerini sergilemiş olduğu sergiler bulunmaktadır. El Anatsui' nin ilk kez "büyük bir sanat müzesindeki kalıcı koleksiyonun bir parçasının olarak ortaya çıkmasını sağlayan çalışmaları 2005 yılında San Francisco'daki de Young Müzesi'nde sergilenmiştir. Yine 2005 yılında New York'un Skoto Galerisi'ndeki "Danudo" sergisi, metal levhalarının bir Amerikan şehrinde sergilendiği ilk sergi olduğu bilinmektedir. Bu galeride Skoto Aghahowa, Sol LeWitt ile birlikte Anatsui'nin ahşap duvar panellerini sunduğu çizimleri yer almaktadır. Bu sergi Anatsui' nin basında daha çok bilinmesiyle birlikte şişe kapağı çalışmalarını da popülerleştirmiştir.

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SAKİNŞEHİR UZUNDERE'DE YEREL MİMARLIK MİRASININ EKOLOJIK SENTEZİ VE SÜRDÜRÜLEBİLİR TURİZME ENTEGRASYONU

Sanaz Davardoust[214], Mustafa Özgeriş[215], Faris Karahan[216]

Özet
Sakinşehir Uzundere, Türkiye'de kültürel peyzajın, yerel mimari mirasın ve ekolojik hassasiyetin kesiştiği özgün bir kırsal yerleşim örneği sunmaktadır. Bu çalışma, Uzundere'deki yerel mimarlık mirasını ekolojik ilkeler doğrultusunda ele alarak, söz konusu mirasın sürdürülebilir turizme entegrasyon potansiyelini ortaya koymayı amaçlamaktadır. Yerel yapı dokusu, bölgenin topoğrafyası, iklimsel koşulları ve malzeme kültürüyle kurduğu uyum üzerinden değerlendirilmiş; elde edilen bulgular sürdürülebilir kırsal gelişme hedefleriyle ilişkilendirilmiştir.
Yerel yapı stoğunun taşıdığı özgün biçimsel ve işlevsel özellikler, bölgedeki ekolojik adaptasyon süreçlerinin somut bir yansımasını oluşturmaktadır. Taş, ahşap ve kerpiç gibi yerel malzemelerin kullanımı; güney yamaç yerleşim düzeni; termal kütle etkisi, pasif ısıl denge ve doğal havalandırma gibi bioklimatik stratejiler, uzun dönemli yapım bilgisinin çevresel koşullara uyum sağlama kapasitesini göstermektedir. Bu nitelikler, yalnızca mimari mirasın korunması açısından değil, aynı zamanda düşük karbonlu, çevre duyarlı ve özgün mekânsal deneyimler sunan sürdürülebilir turizm uygulamaları açısından da önemli bir potansiyel barındırmaktadır.
Kırsal kalkınma vizyonları ve sürdürülebilirlik değerlendirmeleri, Uzundere'de turizm gelişiminin yerel değerlerin korunması, kültürel peyzaj bütünlüğünün sürdürülmesi ve ekolojik ilkelerin gözetilmesi temeline dayanması gerektiğini göstermektedir. Bu bağlamda, yerel mimarinin ekolojik sentezi; eko-konaklama birimlerinden kırsal yaşam müzelerine, agro-turizm yapılarından yavaş rota duraklarına kadar farklı tasarım ve planlama bileşenlerinde uygulanabilir bir referans alanı oluşturmaktadır. Genel olarak çalışma, yerel mimarlık mirasının koruma–kullanma dengesi içinde değerlendirilmesinin, Sakinşehir Uzundere'nin sürdürülebilir turizm vizyonuna güçlü bir katkı sağlayabileceğini ortaya koymakta; mimarlık, kırsal planlama ve turizm disiplinleri arasında bütünleştirici bir kavramsal çerçeve önermektedir.
Anahtar Kelimeler: Ekolojik Mimarlık, Yerel Kültürel Miras, Sürdürülebilir Turizm

ECOLOGICAL SYNTHESIS OF VERNACULAR ARCHITECTURAL HERITAGE AND ITS INTEGRATION INTO SUSTAINABLE TOURISM IN CITTASLOW UZUNDERE

Abstract
Cittaslow Uzundere presents itself as a distinguished rural landscape in Türkiye, where cultural identity, vernacular architectural heritage and ecological sensibilities converge in a remarkably coherent manner. This study explores the region's architectural legacy through an ecological perspective, aiming to reveal its potential integration into sustainable tourism. The spatial fabric and material logic of the settlement are examined with reference to its topography, climatic conditions and traditional resource practices, and the insights gained are aligned with broader objectives of rural sustainability.
The vernacular building stock reflects a sophisticated interplay between form, function and environmental adaptation. The utilisation of stone, timber and adobe, the orientation of settlements along sun exposed southern slopes and the adoption of bioclimatic strategies such as thermal mass, passive temperature regulation and natural ventilation illustrate a longstanding architectural intelligence shaped by environmental realities. These attributes render the architectural tradition not only worthy of safeguarding but also exceptionally compatible with contemporary sustainable tourism, which privileges low carbon approaches, ecological sensitivity and culturally grounded spatial experiences.
Current visions for rural development and sustainability emphasise that tourism growth in Uzundere must proceed with respect for local values, cultural landscape continuity and ecological integrity. In this light, the ecological synthesis of vernacular architecture offers a versatile framework for design and planning, informing a wide spectrum of applications including eco accommodation structures, rural life museums, agro tourism facilities and slow travel routes. Overall, the study demonstrates that evaluating vernacular architectural heritage within a balanced conservation and utilisation framework can substantially strengthen Uzundere's sustainable tourism trajectory. It establishes a conceptual bridge between architecture, rural planning and tourism, reinforcing the position of Sakinşehir Cittaslow Uzundere as an exemplary model of environmentally attuned cultural development.
Keywords: Ecological Architecture, Vernacular Cultural Heritage, Sustainable Tourism

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1. Giriş

Kırsal yerleşimlerin taşıdığı kültürel ve mimari miras, yalnızca geçmişin izlerini aktaran bir değer değil; aynı zamanda çağdaş sürdürülebilirlik yaklaşımlarının temel bileşenlerini barındıran yaşamsal bir bilgi deposudur. Son yıllarda ekolojik mimarlık ve sürdürülebilir turizm kavramları, özellikle kırsal bölgelerde yerel kalkınmanın temel bileşenleri hâline gelmiştir. Bununla birlikte günümüzde plansız turizm gelişimi, kırsal yerleşimlerde kültürel kimliğin aşınmasına, doğal kaynak tüketiminin artmasına ve yerleşim dokusunda geri dönüşü olmayan bozulmalara neden olabilmektedir (Özgeriş ve Karahan, 2021a). Doğal kaynakların aşırı tüketimi, plansız turizm yatırımları ve küresel ölçekte artan çevresel baskılar, yerel değerlerin korunmasına dayalı alternatif modellerin önemini giderek artırmaktadır (Bahtiyar ve Karadeniz, 2014). Kırsal yerleşimlerin korunması, kültürel peyzaj bütünlüğünün sürdürülmesi ve yerel toplulukların katılımını esas alan sürdürülebilir turizm yaklaşımları ise kalkınma politikalarının önemli bileşenleri hâline gelmiştir. Bu bağlamda Cittaslow (Sakinşehir) yaklaşımı, yerel yaşam biçimlerini, mimari kültürü, toplumsal bütünleşmeyi ve doğal değerleri korumayı merkezine alan sürdürülebilir bir turizm çerçevesi sunmaktadır. Yerel mimari mirasın sürdürülebilir turizmle bütünleştirilmesi, Cittaslow felsefesinin temel ilkelerindendir. Aynı zamanda Cittaslow yaklaşımı; kültürel özgünlük, ekolojik hassasiyet ve yerel üretimin güçlendirilmesini ön plana çıkarmaktadır (Mayer ve Knox, 2006; Knox ve Mayer, 2009; Marandu vd., 2020).

Türkiye'de Cittaslow ağına katılan Uzundere, zengin bitki örtüsü, göl–vadi sistemleri, tarihi yerleşim izleri ve özgün mimarisi ile özgün bir kırsal peyzaj niteliğine sahiptir (Karahan ve Davardoust, 2020). Uzundere'deki mimari miras, coğrafi koşullar, iklimsel gereklilikler, malzeme kültürü ve sosyo-kültürel yaşam biçimleriyle uzun süreli bir etkileşim sonucu oluşmuş vernacular (yerel) mimarlık karakteri sergiler. Yerel halk tarafından geliştirilen yapı teknikleri; taş, kerpiç ve ahşap gibi yerel malzemelerin optimal kullanımı, güney yamaç yerleşimi, yüksek termal kütle ve doğal havalandırma gibi bioklimatik stratejiler içerir. Bu özellikler hem ekolojik adaptasyonun hem de kültürel sürekliliğin somut karşılıklarıdır. Yerel yapıların iklimsel uyum kapasitesi, modern mimarlığın sürdürülebilirlik arayışlarına da önemli katkılar sunmaktadır.

Ancak Uzundere'de son yıllarda gerçekleştirilen mekânsal tasarım projelerinin çoğunun, sürdürülebilirlik ölçütleriyle sınırlı düzeyde uyum sağladığı, hatta yer yer yerel kimliği zayıflattığı görülmektedir (Özgeriş ve Karahan, 2021a, 2021b). Bu çalışma Uzundere'deki yerel mimarlık mirasını ekolojik ilkeler doğrultusunda ele alarak, söz konusu mirasın sürdürülebilir turizme entegrasyon potansiyelini ortaya koymayı amaçlamaktadır. Çalışma kapsamında Uzundere'deki yerel mimarlık mirası çağdaş ekolojik tasarım ilkeleriyle uyumluluğu bakımından değerlendirilerek, mimarlık, kırsal planlama ve turizm disiplinleri arasında bütünleştirici bir sürdürülebilir turizm entegrasyonu çerçevesi sunmaktadır.

1.1. Ekolojik Mimarlık ve Sürdürülebilir Tasarım İlkeleri

Ekolojik mimarlık, yapı ile doğa arasındaki karşılıklı bağı güçlendirmeyi amaçlayan; düşük karbon ayak izi, doğal malzeme kullanımı, pasif iklimlendirme ve yerel ekosistemle uyum gibi ilkeleri temel alan bir tasarım yaklaşımıdır. Bu perspektif, yerel yapı geleneklerindeki kadim bilgilerin çağdaş sürdürülebilirlik paradigmasıyla uyumlu olduğunu göstermektedir. Ekolojik mimarlık, yapının doğal çevre ile simbiyotik bir ilişki kurmasını amaçlayan, enerji etkinliği, düşük karbon salımı, yerel malzemelerin kullanımı ve pasif iklimlendirme stratejilerini temel alan bir yaklaşımdır (Gürel ve Irklı Eryıldız, 2021). Özellikle iklim ve topoğrafya ile uyumlu planlama ve yöresel malzeme kullanımının, bina ömrü boyunca enerji ihtiyacını azalttığı çeşitli çalışmalarda ortaya konmuştur (Saatcı ve Erinsel Önder, 2016).

Biyoklimatik tasarım ise ekolojik mimarlığın alt bileşenlerinden biridir ve yapıların mikro-iklim koşullarına göre şekillendirilmesini öngörür. Güneşe yönelim, doğal havalandırma, ısıl kütle kullanımı ve rüzgâr yönleriyle uyum gibi faktörler bu stratejilerin temelini oluşturur (Kısa Ovalı, 2020).

1.2. Yerel Mimari Mirasın Önemi

Yerel mimarlık mirası, hem fiziksel (malzeme, form, mekânsal düzen) hem de soyut kültürel değerlerin (zanaatkârlık, üretim pratikleri, toplumsal hafıza) taşıyıcısıdır. Bütünleşik bir koruma yaklaşımı, bu değerlerin yaşam döngüsü içinde güncellenmesini ve toplumsal faydaya dönüşmesini hedefler. Yerel mimari miras, geleneksel yapı tekniklerinin yanı sıra sosyal yaşam pratiklerini, topluluk kültürünü ve üretim biçimlerini yansıtır. Bu nedenle, kırsal miras yalnızca fiziksel yapıların korunmasıyla değil, aynı zamanda kültürel hafızanın sürdürülebilirliğiyle ilişkilidir (Muşkara, 2017). Yerel mimarinin korunması ve yeniden işlevlendirilmesi, hem ekonomik hem de ekolojik açıdan güçlü etkiler yaratmaktadır (Özer Baş, 2024).

1.3. Sürdürülebilir Turizmin Kırsal Kalkınmadaki Rolü

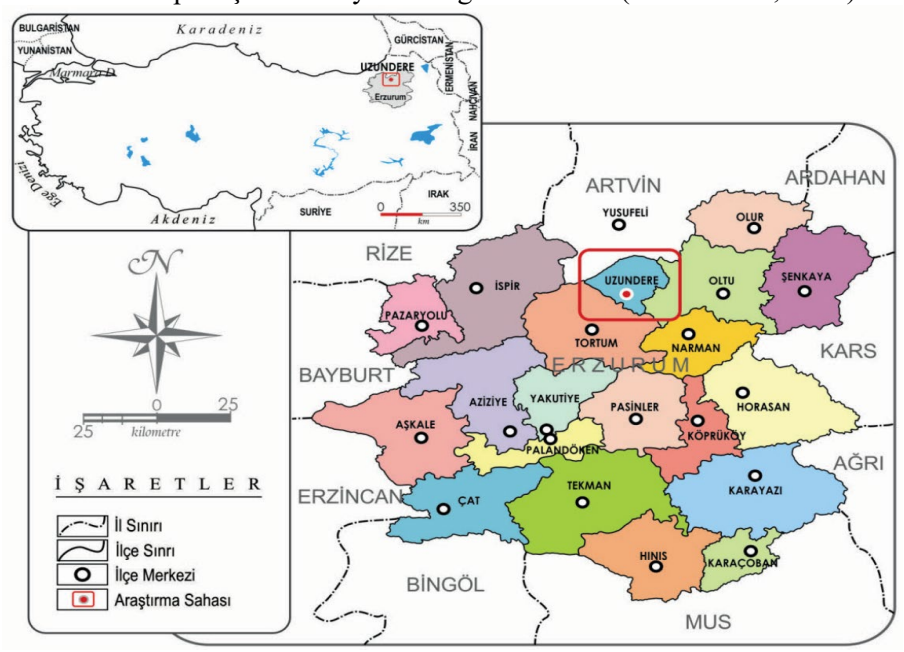
Sürdürülebilir turizm, yerel toplulukların ekonomik fayda elde etmesini sağlarken çevresel değerlerin korunmasına odaklanan bir turizm modelidir. Bu model, kaynak tüketimini azaltmayı, karbon salımını minimize etmeyi, yerel kültürü görünür kılmayı ve doğal peyzaj bütünlüğünü sürdürmeyi hedefler (UNWTO, 2018). Kırsal bölgelerde sürdürülebilir turizm, tarım, zanaatkârlık, gastronomi ve ekoturizm gibi çeşitli üretim biçimleri ile bütünleşik bir yapı oluşturarak, yerel toplulukların sosyal ve ekonomik faydalar edinmesini hedeflemektedir (Akbaş ve Koday, 2020).

2. Materyal ve Yöntem

2.1. Materyal

Çalışmanın ana materyalini Türkiye'nin kuzeydoğusunda, Erzurum ili sınırları içinde yer alan Uzundere ilçesinin yerel mimari dokusu ve peyzaj bileşenleri oluşturmaktadır. Çalışma konusu kapsamında Uzundere'de yürütülen önceki çalışmalar ise çalışmanın yardımcı materyalleri olarak kullanılmıştır.

Uzundere, coğrafi olarak Doğu Karadeniz Bölgesi'nde yer almaktadır (Şekil 1). Bu bölgedeki vadiler ve tepelik alanlar arasında 600 ila 3650 m arasında önemli bir yükseklik farkı bulunmaktadır. Uzundere, Erzurum şehir merkezine 84 km uzaklıkta olup ulaşım asfalt yol ile sağlanmaktadır (Karahan vd., 2011).



Şekil 1. Çalışma alanı konumu

Uzundere ilçesi rakım, iklim koşulları ve bölge dışından başlayan dağ uzantısı gibi doğal çevresel faktörlerden etkilenmektedir. İlçenin ortalama yağış miktarı 434,9 mm'dir. En fazla yağış Mayıs ayında, en az yağış ise Eylül ayında görülmektedir. Yıllık ortalama sıcaklık 8,3 C ile 14,5 C arasında değişen Uzundere'de, gündüz ve gece ile mevsimler arasındaki sıcaklık farkları yüksektir. Uzundere'nin toplam güneş radyasyonu 1450 ile 1650 (KW/M2-yıl) arasında değişmektedir. Bölgenin kuzeyinde yaşayanlar için güneş ışınımı 1450 ile 1550 (KW/M2 yıl) arasında kabul edilebilirken, bölgenin güneyinde yaşayanlar için 1550 ile 1650 (KW/M2-yıl) arasındadır (Canka Kılıç, 2015). Bu durum bölgedeki yerel mimarinin şekillenmesinde etkili olmaktadır (Karahan ve Davardoust, 2020).

Uluslararası Doğa Koruma Birliği (IUCN) sınıflandırmasına göre Kafkasya Ekolojik Bölgesi'nin batı kesimindeki Çoruh Vadisi'nin güneyinde yer alan Uzundere, bu doğal ekosistemin şekillendirdiği kültürün yansımalarını taşımaktadır. Bu yansımaların görüldüğü alanlardan biri de yerel geleneksel mimaridir (Karahan ve Davardoust, 2020; Özgeriş ve Karahan, 2021c). Bölgeye özgü yapı malzemeleriyle ve doğal çevre koşullarına uygun olarak inşa edilen yerel mimari örnekleri, 1990'lardan itibaren plansız ve betonarme yapılaşmayla birlikte tahrip olmaya başlamıştır.

2.2. Yöntem

Bu çalışmada 3 aşamalı bir nitel araştırma yöntemi kullanılmıştır. Çalışmanın 1. aşamasında literatür taraması yapılarak;

- Uzundere yerel mimarisini iklimsel uyum ve sürdürülebilirlik açısından inceleyen; yapı tipolojisini, malzeme kültürünü ve yerleşim düzenini plan–kesit analizleriyle birlikte değerlendiren çalışmalar,
- Biyoklimatik tasarım, kırsal mimari, kırsal turizm, ekolojik planlama ve sürdürülebilir turizm gelişimi stratejileri ve
- Cittaslow Uzundere uygulama raporları, bölgesel planlama belgeleri ve kültürel miras envanterleri derlenerek metin/doküman analizi yapılmıştır.

Çalışmanın 2. aşamasında literatürdeki çalışmalardan hareketle Uzundere'deki yerel mimari örneklerinin;

- Yönlenme,
- Malzeme tipleri,
- Cephe düzenlemeleri,
- Doğal havalandırma düzenekleri ve
- Yapı-topografya ilişkisini içeren tipolojik ve morfolojik analizleri değerlendirilerek, ekolojik sentezi ortaya konulmuştur.

Çalışmanın ikinci aşamasında ayrıca ilçede yürütülen mekânsal tasarım uygulamalarının sürdürülebilirliği değerlendirilmiştir.

Çalışmanın 3. aşamasında ise Uzundere'deki yerel mimari mirasın mevcut mekânsal tasarım uygulamalarıyla birlikte eko-konaklama, kırsal müzecilik, agro-turizm yapıları ve sakin şehir rota durakları gibi turizm bileşenlerinin sürdürülebilir turizme entegrasyonunu açıklayan planlama ve uygulama modeli geliştirilmiştir. Bu yöntemsel çerçeve, hem mevcut durum tespitine hem de sürdürülebilir turizm için uygulanabilir senaryoların geliştirilmesine olanak sağlamıştır.

3. Bulgular

Uzundere yerel mimarisine ait konut örneklerinin plan ve kesit ilişkileri tipolojik çeşitlilik üzerinden değerlendirilmektedir. Yapıların büyük bölümünde alt katlar ahır, depo veya gıda saklama işlevleriyle; üst katlar ise yaşam mekânlarıyla ilişkilidir. Sofa, balkon ve dış merdiven gibi yarı açık mekânlar iklimsel geçiş alanları oluşturarak doğal havalandırma ve güneş kazanımını desteklemektedir. Tek katlı örneklerde kompakt plan düzeni ve yüksek ısıl kütleye sahip yapı kabuğu öne çıkmaktadır (Şekil 2).

3.1. Uzundere Yerel Mimarisinin Tipolojik Özellikleri

3.1.1. Malzeme Kültürü

Uzundere'de yerel mimari yapılar, bölgedeki doğal kaynaklarla doğrudan ilişkisi bulunan taş, kerpiç ve ahşap malzemelerle inşa edilmiştir. Bu malzemelerden;

- Taş: Kuru duvar örgüsü veya harçlı yığma sistemlerle kullanılarak, yüksek ısıl kütle sağlamakta,
- Kerpiç: Nem dengesi ve iç mekân konforu açısından etkili olmakta,
- Ahşap: Döşeme, hatıl ve çatı ana yapı elemanlarında yer almaktadır.

Duvar inşasında taş malzemenin yoğun kullanıldığı yapılarda, çatı malzemesi olarak ise yazın aşırı ısınmayı, kışın ısı kaybını önleyen ahşap ve toprak damlı sistemler tercih edilmiştir. Bu malzemeler temel ve dış duvarlar ile çatı örtüsünde yüksek termal kütle oluşturarak ekolojik uyumu sağlamaktadır.

3.1.2. Yönlenme ve Yerleşim Karakteri

Yerleşimler çoğunlukla güney yamaçlarda konumlanmıştır. Bunun başlıca nedenleri,

- Güneş kazanımının artırılması,
- Kış rüzgârlarının korunma,
- Vadi rüzgârlarının doğal havalandırmada kullanılması ve
- Kuzey rüzgârlarının etkisinin azaltmasıdır.

Bu durum, iklimsel uyumu temel alan bilinçli bir mekânsal tercihtir (Karahan ve Davardoust, 2020).

3.1.3. Isıl Performans ve Biyoklimatik Tasarım

Uzundere'deki yerel yapılar, iklimle uyumlu ve biyoklimatik tasarım ilkelerinin özelliklerini taşır niteliktedir. Bu bakımdan yapılar incelendiğinde,

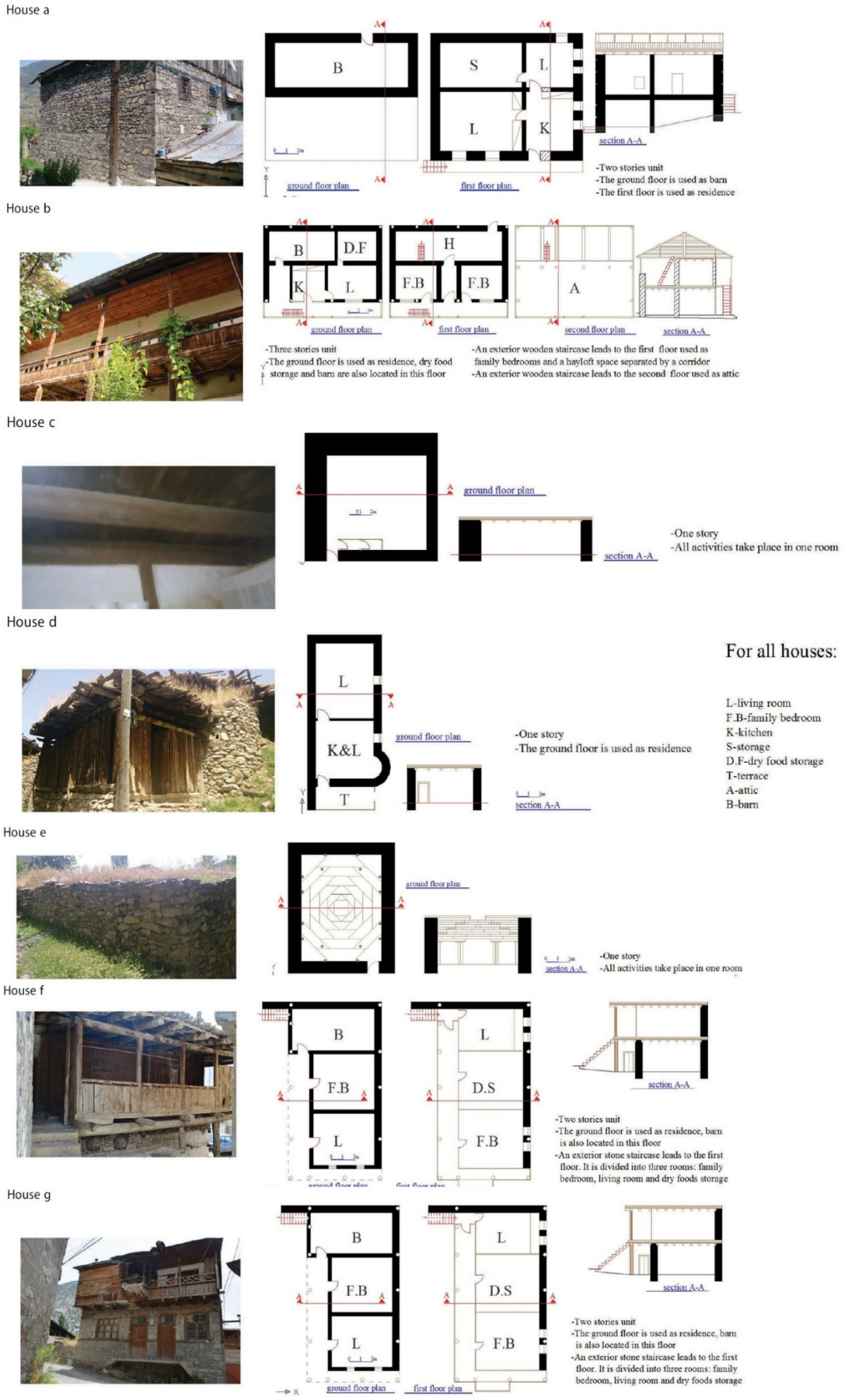
- Masif duvarlarla ısı depolama,
- Küçük pencere açıklıklarıyla ısı kaybını azaltma,
- Topografyaya uyumlu yerleşme ve
- İç avlu ve sofa gibi yarı açık mekânlarla doğal havalandırma sağladığı görülmektedir.

Bunun yanında yerleşim, duvar ve çatı malzemesi ve havalandırma tipolojileriyle yerel ekolojiyle uyum göstermektedir (Karahan ve Davardoust, 2020).

3.1.4. Yerel Plan Tipolojileri

Uzundere evleri genellikle iki katlı olarak inşa edilmiştir. Plan tipolojileri incelendiğinde,

- Depo, kiler, hayvan barınağı olarak kullanılan alt kat,
- Yaşam birimlerinin yer aldığı üst kat ve
- İklimsel denge sağlayan geçiş mekânlarının oluşturduğu sofa ve balkon mekanlarından oluştuğu görülmektedir.



Şekil 2. Yapı tipolojilerinin analizi

3.2. Mekansal Planlama ve Tasarımların Sürdürülebilirliği

Uzundere, kültürel peyzaj ve mimari miras açısından çok katmanlı bir potansiyel sunmaktadır. Bununla birlikte ilçede turizmi desteklemek amacıyla yapılan projelerin bir çoğu yerel değerlerle zayıf bir bağlantı kurularak gerçekleştirilmiştir (Özgeriş, 2020). Bu bağlamda ilçede gerçekleştirilen mekânsal tasarım ve planlamaların sürdürülebilirlik değerlendirmesi aşağıda verilmektedir (Özgeriş, 2020; Özgeriş, 2021a, 2021b):

- Modern tasarımların yerel mimari ile bütünleşememesi,
- Tasarım standartlarının yerel malzeme ve tipolojiye dayanmamasından kaynaklanan kimlik kaybı,
- Biyoklimatik ilkelerin göz ardı edilmesinin neden olduğu ekolojik uyumsuzluk,
- Yerel halkın projelere katılımda sınırlı rol üstlenmesi,
- Mekânsal projelerin üretilmesinde sürdürülebilirliğin gereksinimlerini ihmal eden yaklaşımlar,
- Planlama belgeleri ile sahadaki uygulamalar arasındaki anlamlı farklılıklar,
- Kültürel peyzaj bütünlüğünün birçok projede yeterince gözetilmemesi.

3.3. Yerel Mirasın Sürdürülebilir Turizme Entegrasyon Potansiyeli

Bu çalışma ile önerilen yerel mirasın sürdürülebilir turizme entegrasyonu modeli, yerel mimarinin sadece korunacak bir değer olarak değil, aynı zamanda aktif bir ekolojik tasarım bileşeni olarak ele alınmasını hedeflemektedir. Bu bağlamda önerilen sürdürülebilir turizme entegrasyon modeli aşağıda verilmektedir:

- **Eko-Konaklama Yapıları**
  - Yerel mimari tekniklerinin modern yapılarla bütünleştirilmesi, enerji tüketimini azaltan, karbon ayak izini düşüren, ziyaretçilere özgün deneyim sunan, kimlik temelli konaklama alanları oluşturabilir.
- **Kırsal Yaşam Müzeleri**
  - Yerel evlerin restorasyonu ile mimari mirasın görünürlüğünün artırılması sağlanabilir ve turizme kültürel içerik kazandırılabilir.
- **Agro-Turizm ve Ekolojik Üretim Alanları**
  - Yöreye özgü meyvecilik, arıcılık ve geleneksel tarım pratikleri, yerel mimari ile birlikte değerlendirilerek mekânsal bir bütünlük oluşturabilir.
- **Yavaş Rota Durakları**
  - Cittaslow temalarıyla uyumlu olarak yürüyüş yolları, panoramik seyir noktaları, köy içi kültür durakları tasarlanabilir.
  - Yavaş yaşam temalı yürüyüş ve bisiklet rotaları, geleneksel yapı dokusu ve peyzaj ile bütünleştirilebilir.

4. Tartışma

Araştırma bulguları, Uzundere'nin geleneksel yapılarında kullanılan taş, ahşap ve kerpicin ekolojik mimarlığın temel ilkeleri ile doğal olarak uyumlu olduğunu ortaya koymaktadır. Ayrıca, Uzundere'nin evlerinin içinde yer aldığı sokak dokusu ve yerleşim formunun biyoklimatik tasarım ilkeleriyle örtüştüğü değerlendirilmiştir. Bu durum, yerleşimin modern sürdürülebilirlik yaklaşımlarından önce de ekolojik temelli bir çevresel adaptasyon süreci geliştirdiğini göstermektedir.

Uzundere örneği, yerel yapı tekniklerinin sadece geleneksel bir birikim değil, aynı zamanda ekolojik bilginin mekâna yansımasına işaret etmektedir. Uzundere yerel mimarisi, sürdürülebilir mimarlık literatüründe vurgulanan; düşük enerji kullanımı, yerel malzeme kullanımı, pasif iklimlendirme ve karbon ayak izinin azaltılması ilkeleriyle birebir uyum göstermektedir. Bu nedenle Uzundere mimarisinin modern ekolojik tasarım için bir referans oluşturduğu söylenebilir.

Uzundere'nin yerel mimari, teraslanmış tarım alanları, su kanalları, meyve bahçeleri ve köy meydanları ile kurduğu bütünlük, bölgenin kültürel peyzaj karakterinin sürdürülebilir turizm açısından güçlü bir potansiyel taşıdığını ortaya koymaktadır.

Güncel literatürde sürdürülebilir turizmde mimari mirasın dönüşümü, hem ekonomik hem de kültürel sürdürülebilirlik açısından önemli görülmektedir. Çalışma ile Uzundere örneğinde, yerel yapı stoğunun turizme entegrasyonu için eko-konaklama birimleri, yavaş rota durakları, kırsal yaşam müzeleri ve agro-turizm odaklı tesisler önerilmiştir. Bu tür mekânlar hem yerel istihdam yaratacak hem de Uzundere'nin özgün mimari kimliğini görünür kılacaktır.

Sürdürülebilir turizm geliştirme sürecinde en önemli konulardan biri de koruma-kullanma dengesinin sağlanmasıdır. UNESCO (2021) tarafından belirlenen kültürel miras koruma ilkeleri ile paralel olarak geleneksel yapıların aslına uygun malzemelerle onarılması, yeni yapılaşmanın peyzaj ölçeğinde denetim altında tutulması, yerel ustalık bilgisinin yaşatılması ve ziyaretçi sayılarının taşıma kapasitesine göre planlanması yerel mimarinin korunması ve gelecek kuşaklara aktarılması noktasında başat bir rol oynayabilir. Bununla birlikte planlama-uygulama kopukluğu ve turizm projelerinin yerel kimliği yeterince taşımaması, sürdürülebilir turizmin önündeki en büyük engeldir. Bu sorun, tasarım standartlarının yeniden düzenlenmesini gerektirmektedir.
Ayrıca Uzundere'nin dahil olduğu Cittaslow hareketi, Uzundere'nin kimlik temelli sürdürülebilirlik hedefleriyle uyumlu olmak üzere, bölgesel ölçekte daha bütüncül stratejiler üretilmesinde fırsatlar sunabilir.

5. Sonuç ve Öneriler

Bu çalışma, Sakinşehir Uzundere'nin yerel mimarlık mirasının ekolojik prensiplerle uyumlu olduğunu ve bu uyumun sürdürülebilir turizme entegre edilmesi için güçlü bir potansiyel taşıdığını ortaya koymuştur. Geleneksel yapı malzemeleri, biyoklimatik stratejiler, kültürel peyzaj bütünlüğü ve yerel yaşam pratikleri; hem koruma politikaları hem de turizm planlamaları açısından kritik önemdedir.
Uzundere'nin geleceğe yönelik kırsal kalkınma vizyonu, yerel değerlerin korunması, ekolojik duyarlılık, topluluk temelli turizm ve özgün mekânsal deneyimlerin güçlendirilmesi esaslarına dayanmalıdır. Mimarlık, kırsal planlama ve turizm alanlarının kesişiminde ortaya çıkan bu bütüncül yaklaşım, Uzundere örneği üzerinden kırsal yerleşimlere yönelik sürdürülebilir kalkınma modellerine katkı sunmaktadır.
Sonuç olarak Uzundere örneği, kırsal yerleşimlerde mimarlık-ekoloji-turizm ilişkisinin bütüncül bir modelle ele alınabileceğini ortaya koymaktadır.
Çalışmanın sonuçlarına dayanarak Uzundere örneğinde yerel mimari-sürdürülebilir turizm entegrasyonu için getirilen öneriler aşağıda verilmektedir:

a) Planlama ve Yönetim Önerileri

- Planlama süreçlerinde yerel mimari miras ana bileşen olarak ele alınmalıdır.
- İlçe genelinde ekolojik–kültürel koruma zonları oluşturulmalı ve ekolojik koridorlar güçlendirilmelidir.
- Yeni yapılaşmada yerel özgün tipolojiye uygun tasarım rehberleri hazırlanmalıdır.
- Yerel dokuya uyumlu olmayan yapılaşma sınırlanmalıdır.

b) Mimari ve Tasarım Önerileri

- Yeni turizm tesisleri güney yönlenme, geleneksel malzeme, pasif iklimlendirme ilkeleriyle tasarlanmalıdır.
- Bozulmuş yerel yapı stoğu için restorasyon–yeniden kullanım projeleri geliştirilmelidir.

c) Turizm Gelişimi Önerileri

- Eko-konaklama modeli yaygınlaştırılmalıdır ve eko-konaklama standartları belirlenmelidir.
- Kırsal yaşam müzesi, yerel gastronomi merkezleri ve agro-turizm alanları oluşturulmalıdır.
- Uluslararası Cittaslow ağıyla kültür temelli turizm programları geliştirilmelidir.
- Yavaş rotalar için tematik duraklar oluşturulmalıdır.

d) Toplumsal Katılım Önerileri

- Yerel halkın bilgi ve deneyimleri karar alma süreçlerine dahil edilmelidir.
- Kadın girişimciliği ve yerel üreticiler desteklenmelidir.
- Eğitim programlarıyla ekolojik tasarım ve farkındalık bilinci artırılmalıdır.
- Yerel üreticiler için ekonomik destek modelleri oluşturulmalıdır.

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ERZURUM KENTİ OKUL BAHÇELERİNİN BİYOÇEŞİTLİLİK DİRENCİNİN BELİRLENMESİ

Didem İlbaş[217], Hasan Yılmaz[218]

Özet
Hızlı kentleşme, doğal kaynakların tükenmesi, ekosistemlerin bozulması ve altyapı yetersizlikleri gibi bir dizi çevresel sorunu beraberinde getirmektedir. Bu bağlamda, iklim değişikliği, dünya genelinde giderek daha belirgin hale gelmekte ve günümüzdeki en büyük çevresel tehditlerden biri olarak öne çıkmaktadır. Bu değişim, özellikle şehir ekosistemlerinde ciddi ekolojik, ekonomik ve sosyal sorunlara yol açabilecek potansiyel senaryoları beraberinde getirmektedir. Bu nedenle, şehir planlaması, peyzaj tasarım ve inşaat süreçlerinde sürdürülebilirlik ilkesinin temel bir rehber olarak benimsenmesi zorunludur. Soğuk iklim kuşaklarında ise bu ihtiyaç daha da kritik bir hal almaktadır; çünkü bu bölgelerdeki iklimsel zorluklar, hem doğa üzerinde hem de toplumsal yapılar üzerinde yoğun bir baskı yaratmaktadır. Soğuk iklimlerde bitki çeşitliliğinin artırılması, ekosistem dayanıklılığı ve sürdürülebilirlik açısından önem taşımaktadır. Ayrıca, bu tür bölgelerdeki biyoçeşitlilik direnci, iklim değişikliğinin etkilerine karşı daha duyarlı olduğu için, bu değerlerin korunması büyük önem taşımaktadır. Bu doğrultuda, meyveli bitkiler ile doğal bitkilerin kullanımının yanı sıra yerel ekosistemlerin gözetilmesi, sürdürülebilir tasarım ve yapılaşma süreçlerinde hem çevresel dengeyi desteklemek hem de yerel biyolojik çeşitliliği korumak açısından kritik bir rol oynamaktadır. Okul bahçeleri de bu ilkenin bir yansıması olarak, doğal bitki örtüsü ve yerel ekosistemleri barındırarak öğrencilere çevresel farkındalık kazandırmak ve sürdürülebilirlik bilincini aşılamak için etkili bir araç olabilir. Soğuk iklim kentlerinden Erzurum ilinde bulunan okul bahçelerinin bu kapsamda değerlendirilip biyolojik çeşitliliğe uygun hale getirilmesi ve biyoçeşitlilik direncinin belirlenmesi önemlidir. Çalışmanın materyalini Erzurum ilinin Palandöken ilçesinde bulunan 5 okul bahçesi oluşturmaktadır. Araştırma kapsamında ele alınan 5 okul bahçesinde yürütülen çalışma kapsamında, mevcut bitki tür çeşitliliği belirlenmiş ve bu çerçevede meyveli bitkiler ile doğal bitkilerin oranları ortaya konmuştur.
Anahtar Kelimeler: Kentleşme, İklim Değişikliği, Biyoçeşitlilik, Erzurum, Okul Bahçeleri, Doğal Bitkiler

DETERMINING THE BIODIVERSITY RESILIENCE OF SCHOOL GARDENS IN ERZURUM CITY

Abstract
Rapid urbanization brings with it a series of environmental problems such as the depletion of natural resources, the degradation of ecosystems, and inadequate infrastructure. In this context, climate change is becoming increasingly apparent worldwide and stands out as one of the greatest environmental threats today. This change brings with it potential scenarios that could cause serious ecological, economic, and social problems, especially in urban ecosystems. Therefore, it is imperative that the principle of sustainability be adopted as a fundamental guide in urban planning, landscape design, and construction processes. This need is even more critical in cold climate zones, as climatic challenges in these regions exert intense pressure on both nature and social structures. Increasing plant diversity in cold climates is important for ecosystem resilience and sustainability. Furthermore, biodiversity resilience in such regions is more sensitive to the effects of climate change, making the protection of these values of great importance. In this regard, the use of fruit-bearing plants and natural plants, along with the preservation of local ecosystems, plays a critical role in supporting environmental balance and protecting local biodiversity in sustainable design and construction processes. School gardens, as a reflection of this principle, can be an effective tool for raising environmental awareness among students and instilling a sense of sustainability by hosting natural vegetation and local ecosystems. It is important to evaluate school gardens in Erzurum, a city with a cold climate, in this context, adapt them to suit biological diversity, and determine their biodiversity resilience. The material for the study consists of 5 school gardens located in the Palandöken district of Erzurum province. Within the scope of the study conducted in the 5 school gardens included in the research, the existing plant species diversity was determined, and the ratios of fruit-bearing plants and natural plants were revealed.
Keywords: Urbanization, Climate Change, Biodiversity, Erzurum, School Gardens, Native Plants

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1. Giriş

Kentsel çevrelerde biyoçeşitliliğin düzeyini belirleyen çok sayıda etken bulunmaktadır. İklimsel değişimler, çevre kirliliği ve doğal kaynakların plansız ve aşırı kullanımı, yalnızca ekosistem çeşitliliğini değil, aynı zamanda insan yaşamının sürdürülebilirliğini ve temel ihtiyaçların karşılanmasını da olumsuz yönde etkilemektedir. Bu bağlamda, günümüzde biyoçeşitlilik açısından en kırılgan alanların başında kentler gelmektedir. Nüfusun hızlı artışıyla birlikte şehirlerin düzensiz ve sürekli genişlemesi, kentsel alanlarda yaşayan canlı türlerinin habitatlarının bozulmasına neden olmakta ve kent ekosistemlerindeki tür çeşitliliğini tehdit etmektedir. Ayrıca bu süreç, kent çevresinde yer alan su havzaları, tarım alanları ve ormanlık bölgeler üzerinde yoğun baskı oluşturarak, bu doğal alanlardaki biyoçeşitliliğin zarar görmesine yol açmaktadır (Solduk, 2010).

Doğal çevrenin korunması ve yaşam kalitesinin artırılabilmesi için biyolojik çeşitliliğin yapısal bütünlüğünün ve tür popülasyonlarının sürekliliğinin sağlanması temel bir gerekliliktir. Bu kapsamda, canlı türlerinin ve onların yaşam alanlarının korunması ile iyileştirilmesine yönelik çalışmalar büyük önem taşımaktadır. Dolayısıyla, biyolojik unsurlara ilişkin verilerin güvenilir biçimde belirlenmesi, düzenli olarak kayıt altına alınması ve bilimsel yöntemlerle değerlendirilmesi gerekmektedir (Yılmaz, 2007).

Bilimsel çalışmalar, küresel ölçekte kentsel biyoçeşitlilik göstergeleri ile iklim değişikliğinin oluşturduğu baskıların, kent ekosistemlerinin korunması ve sürekliliğinin sağlanmasına yönelik yeni yaklaşımların geliştirilmesini gerekli kıldığını ortaya koymaktadır. İklim değişikliğinin olumsuz etkilerine karşı kentsel yeşil alanların dirençli hale getirilmesi, biyolojik çeşitliliğin desteklenmesi, ekosistem dayanıklılığının güçlendirilmesi ve daha nitelikli bir kentsel yaşam ortamının oluşturulabilmesi için, yerel doğal bitki türleri ile yenilebilir meyve veren bitkilerin kullanımının yaygınlaştırılması önem taşımaktadır (Yılmaz, 2024a).

Kentsel alanlarda yerel ağaç türlerinin ve bu türlerle ilişkili yaban yaşamının korunabilmesi için, yerel ve bölgesel ölçekte faaliyet gösteren eğitim merkezlerine yönelik yatırımların artırılması gerekmektedir. Bu durum, özellikle gelişmişlik düzeyi düşük ya da gelişmekte olan ülkelerde biyolojik çeşitliliğin uzun vadede sürdürülebilmesi açısından kritik bir rol oynamaktadır. Bununla birlikte, söz konusu yatırımlar iklim değişikliğinin yol açtığı olumsuz etkilerin azaltılmasına da katkı sağlamaktadır (Askan ve Yılmaz, 2024).

Kentlerde biyolojik çeşitliliğin varlığı, zararlı organizmalar, hastalıklar ve iklim değişikliği kaynaklı çevresel baskılara karşı ekosistemlerin dayanıklılığını ve uyum kapasitesini güçlendirmesi bakımından büyük önem taşımaktadır. Bu çeşitliliğin sürdürülebilir biçimde yönetilebilmesi ve desteklenmesi amacıyla Santamour tarafından geliştirilen 10/20/30 kuralı yaygın olarak uygulanmaktadır. Söz konusu yaklaşıma göre, belediyelere ait ormanlık alanlarda tek bir türün toplam ağaç varlığının %10'unu, herhangi bir cinsin %20'sini ve herhangi bir familyanın ise %30'unu aşmaması önerilmektedir (Kendal vd, 2014).

Gelecek kuşaklara temiz bir atmosfer, sağlıklı bir çevre ve sürdürülebilir yaşam alanları bırakılabilmesi adına, kentlerin nefes almasını sağlayan yeşil alanların gereksinimleri karşılayacak biçimde tasarlanması ve planlama süreçlerinde belirlenen ölçütlere uygun kararların hayata geçirilmesi büyük önem taşımaktadır (Dinç, 2020).

Kentlerdeki yeşil alan sisteminin önemli unsurlarından biri olan okul bahçeleri, öğrencilerin günün büyük bölümünü geçirdikleri mekânlar arasında yer almaktadır. Bu alanlar, çocukların sosyal, bedensel ve bilişsel gelişimlerinin desteklenmesine katkı sağlamaktadır. Bunun yanı sıra okul bahçeleri, çocukların doğayla etkileşim kurabildikleri alanlar olarak da özel bir yere sahiptir. Özellikle gelişim dönemindeki çocukların doğal çevreyle güçlü ilişkiler kurması, çevresel farkındalık ve bilinç kazanmaları açısından önemli bir etki yaratmaktadır (Moore, 1997).

Mahalle ölçeğinde değerlendirildiğinde, okul bahçeleri en önemli açık ve yeşil alanlar arasında yer almaktadır. Bu alanlar, çevre eğitiminin ve sürdürülebilir peyzaj yaklaşımlarının desteklenmesine katkı sağlarken, aynı zamanda yerel ekosistemler üzerinde de olumlu etkiler oluşturabilmektedir. Yerel yaban yaşamı için uygun habitatlar sunulması ve bölgeye özgü bitki türlerinin tercih edilmesi yoluyla biyolojik çeşitliliğin artırılmasına olanak tanıyan okul bahçeleri, ekosistemlerin bütünlüğünün ve canlılığının korunmasına katkı sunmaktadır (Şahin ve Dostoğlu, 2015).

Okul alanlarının iklim değişikliğine uyum süreci, küresel ölçekte yaşanan iklim değişikliğinin oluşturduğu risklerin azaltılmasını ve aynı zamanda ortaya çıkabilecek fırsatların değerlendirilmesini hedefleyen uygulamalar bütününü kapsamaktadır. Bu bağlamda, okul peyzajlarında iklim değişikliğine yönelik kararların alınabilmesi ve bu kararların etkililiğinin ölçülebilmesi için belirli kriterlerin tanımlanması, ayrıca uyum sürecine ilişkin yol gösterici plan ve stratejilerin oluşturulması gerekmektedir (Akten, 2024).

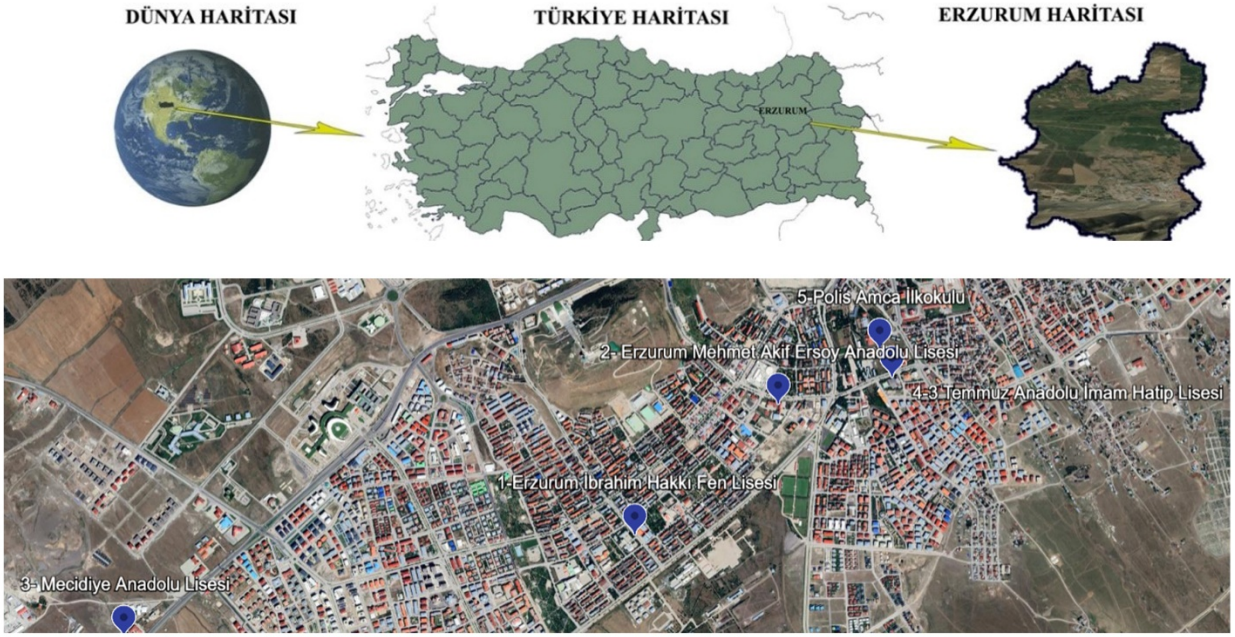
Erzurum'daki okul bahçeleri, nitelik ve nicelik açısından değerlendirildiğinde, mevcut standartlar, bilimsel çalışmalar ve toplumsal beklentilerle kıyaslandığında istenen düzeyin oldukça gerisinde kalmaktadır (Vural ve Yılmaz, 2018).

Bu çalışma, Erzurum'da bulunan okul bahçelerinde bulunan bitki türlerinin tespit edilmesi, biyoçeşitlilik direncinin belirlenmesi ve sürdürülebilirliğinin sağlanmasına yönelik stratejiler geliştirmeyi, doğal bitki türlerinin kullanımıyla iklim değişikliğine karşı dayanıklılığı artırmayı ve kaynakların etkin kullanımına dikkat çekmeyi amaçlamaktadır. Özellikle soğuk iklim koşullarına sahip Erzurum kentinde, okul bahçelerinin iklim değişikliğine karşı daha dirençli, yaşanabilir ve sürdürülebilir alanlara dönüştürülmesine katkı sağlaması hedeflenmektedir.

2. Yöntem

Araştırmanın yürütüldüğü alan, Türkiye'nin doğu kesiminde yer alan Erzurum ilidir. Kent, yazları sıcak ve kurak, kışları ise uzun, soğuk ve yağışlı geçen karasal iklim özellikleri göstermektedir. Uzun dönem meteorolojik gözlemlere göre Erzurum'da yıllık ortalama sıcaklık 5,6 °C olup, ölçülen en yüksek sıcaklık 36,5 °C, en düşük sıcaklık ise -37,2 °C'dir. Bölgede hâkim rüzgâr yönü batı (W) olup, rüzgâr hızının saatlik maksimum değeri 108 km'ye ulaşabilmektedir. Ortalama bağıl nem oranı %65,2, yıllık toplam yağış miktarı 408,1 mm olarak kaydedilmiştir. Günlük en yüksek yağış miktarı 59,6 mm, maksimum kar kalınlığı ise 110 cm'dir. Günlük ortalama güneşlenme süresi yaklaşık 6,5 saat olarak belirlenmiştir. Deniz seviyesinden 1869 m yükseklikte bulunan Erzurum, denize yaklaşık 377 km uzaklıktadır. Bölgede Meteoroloji Bölge Müdürlüğü'ne bağlı bir klima, bir sinoptik ve bir ravinsonde istasyonu faaliyet göstermektedir. Ayrıca 2011 yılına ait Mart, Eylül, Ekim, Kasım ve Aralık ayları uzun yıllar ortalamalarına göre kurak geçmesine rağmen, yıllık toplam yağış miktarı 473,1 mm ile ortalamanın üzerinde gerçekleşmiştir (Çevre ve Şehircilik Bakanlığı, 2019).

Araştırmanın çalışma materyalini, Erzurum il merkezinde yer alan Palandöken ilçesine ait toplam 5 okul bahçesi oluşturmaktadır. Seçilen okulların genel konum haritası aşağıda verilmiştir (Şekil 1).



Şekil 1. Çalışma alanlarının genel konum haritası

İncelenen okul bahçeleri, rastlantısal örnekleme yöntemiyle belirlenmiş; kent genelinde öne çıkan, bilinirliği yüksek ve araştırmanın amacıyla örtüşen okullar, temsil yetenekleri göz önünde bulundurularak örneklem grubuna dâhil edilmiştir.

Araştırma süreci; konuya ilişkin ön inceleme, literatür taraması, arazi çalışmaları, analiz ve değerlendirme ile sonuç ve önerilerin oluşturulması olmak üzere beş temel aşamada yürütülmüştür.

•Çalışma yöntemi olarak ilk olarak araştırma konusu, amacı ve kapsamı belirlenmiştir.

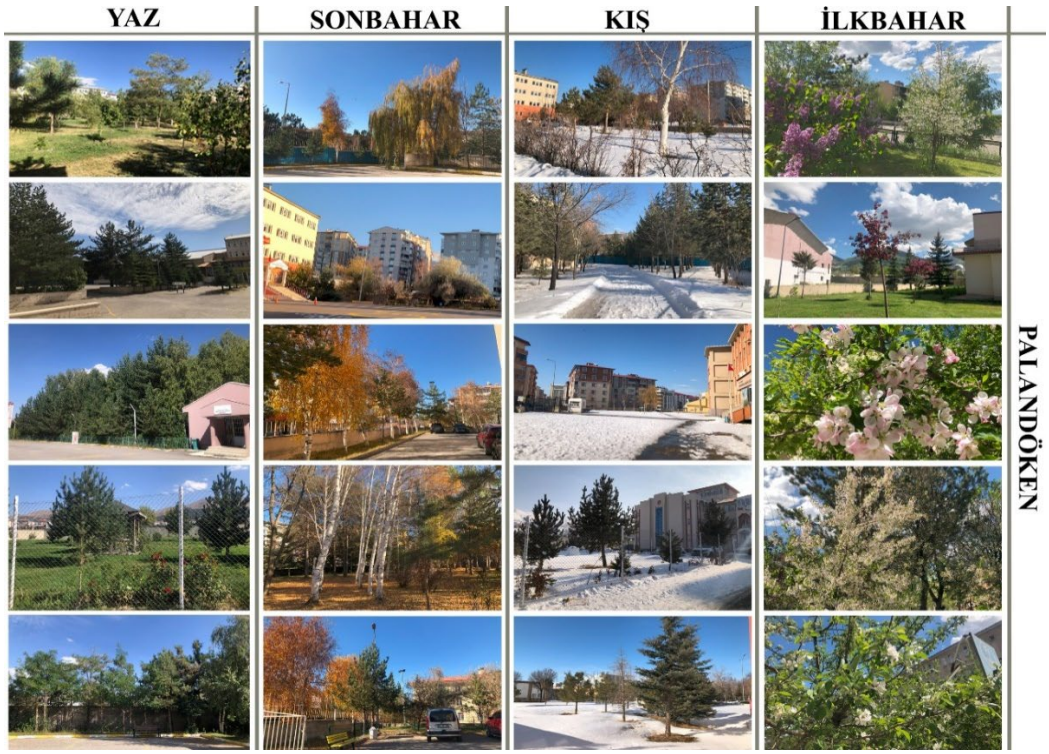
•Konu hakkında literatür taraması yapılmış ve Erzurum kentinde bulunan Palandöken ilçesinden 5 okul şehrin büyük ve bilinirliği, temsil gücü ve araştırma konusuna uygunluğu dikkate alınarak örneklem kapsamına dâhil edilmiştir.

•2024-2025 yıllarının yaz, sonbahar, kış ve ilkbahar mevsimlerinde, Erzurum Valiliği ve Erzurum İl Milli Eğitim Müdürlüğü'nden gerekli resmî izinler alınarak okul bahçelerinde saha çalışmaları gerçekleştirilmiş ve görsel veriler elde edilmiştir.

•Biyodost Yerleşke Kavramı Kriterleri (Yılmaz, 2024a)'ün iki kriteri yöntem olarak belirlenmiş ve her bir okul bahçesi analiz edilmiştir. Okul bahçelerinde yer alan bitkilerin doğal tür oranı ile meyvesi yenilebilen bitki türlerinin oranı temel belirleyici kriterler olarak ele alınmış; bu iki ölçütü de karşılayan okul bahçeleri biyoçeşitlilik direnci açısından uygun olarak değerlendirilmiştir.
*Değerlendirme kapsamında, doğal bitki türlerinin kullanım oranının toplam tür sayısının en az %10'unu oluşturması gerekmektedir. Benzer şekilde, etli meyveye sahip bitki türlerinin oranının da toplam tür sayısının en az %10 olması ölçüt olarak belirlenmiştir (Yılmaz, 2024a).
•Bitki türlerinin teşhisi TÜBİVES, bizzat kendi tarafımızdan yapılmış, her bahçede kullanılan bitki türlerinin yanı sıra kaç adet oldukları bahçelerde yapılan gözlem ve araştırmalarla belirlenmiştir. Bu doğrultuda sonuçlar ve ihtiyaca göre bazı öneriler oluşturulmuştur.

3. Bulgular

2024-2025 yıllarının yaz, sonbahar, kış ve ilkbahar mevsimlerinde, Palandöken ilçesinde bulunan 5 okulda gerçekleştirilen çalışmanın bulguları; alandaki bitki türleri tablolar ve görseller ile aşağıda sunulmuştur.
Palandöken ilçesinde bulunan 5 okulun 2024 yılı yaz, sonbahar, 2025 yılı kış ve ilkbahar mevsimlerinde elde edilen genel görselleri aşağıda kolaj şeklinde verilmiştir (Şekil 2).



Şekil 2. Palandöken ilçesinde bulunan okulların 4 mevsim görselleri

1-Erzurum İbrahim Hakkı Fen Lisesi:

Okul bahçesindeki bitki türleri, adetleri, doğallık (D) ve meyveli olma (M) özelliklerine göre gruplandırılmış ve aşağıda gösterilmiştir (Tablo 1).
Tablo 1. Erzurum İbrahim Hakkı Fen Lisesi Bitki Listesi

No	Bitki Türü	Türkçesi	Doğallık	Meyveli	Adet
1	*Betula verrucosa*	*Adi huş*	**D**		**32**
2	*Betula pendula* 'Youngii'	*Sarkık dallı huş*			**8**
3	*Biota orientalis*	*Doğu mazısı*			**1**
4	*Cupressocyparis leylandii*	*Leylandi / melez servi*			**2**
5	*Cupressus sempervirens*	*Akdeniz servisi*	**D**		**3**
6	*Elaeagnus angustifolia*	*Kuş iğdesi*	**D**	**M**	**5**
7	*Fraxinus americana*	*Amerika dişbudağı*			**4**
8	*Fraxinus excelsior*	*Adi dişbudak*	**D**		**8**

9	*Juniperus chinensis*	*Çin ardıcı*			**1**
10	*Juniperus chinensis* 'Pfitzeriana'	*Pfitzer çin ardıcı*			**1**
11	*Malus domestica*	*Elma*	**D**	**M**	**5**
12	*Picea pungens* 'Glauca'	***Mavi ladin***			**16**
13	*Picea pungens* 'Hoopsii'	*Aşılı avrupa mavi ladini*			**9**
14	*Pinus nigra*	*Karaçam*	**D**		**55**
15	*Pinus sylvestris*	*Sarıçam*	**D**		**132**
16	*Populus nigra*	*Kara kavak*	**D**		**1**
17	*Prunus domestica*	*Erik*	**D**	**M**	**1**
18	*Pyrus communis*	*Avrupa armudu*	**D**	**M**	**3**
19	*Ribes aureum*	*Sarı çiçekli frenk üzümü*	**D**	**M**	**10**
20	*Robinia pseudoacacia*	*Beyaz çiçekli yalancı akasya*	**D**		**1**
21	*Salix babylonica*	*Ağlayan söğüt*			**2**
22	*Syringa vulgaris*	*Adi leylak*			**7**
23	*Thuja occidentalis*	*Batı mazısı*			**1**
24	*Ulmus glabra*	*Dağ karaağacı*	**D**		**20**
25	*Ulmus minor*	*Ova karaağacı*	**D**		**10**
				Toplam:	**338**

Erzurum İbrahim Hakkı Fen Lisesi okul bahçesinde:
Toplam bitki türü sayısı: 25
Doğal bitki türü sayısı: 14
Meyveli bitki türü sayısı: 5
Bu doğrultuda toplam bitki türü sayısının doğal bitki türü sayısına oranı %56, meyveli bitki türü sayısına oranı %20 olarak belirlenmiş ve biyoçeşitlilik direncini sağladığı belirlenmiştir.

2- Erzurum Mehmet Akif Ersoy Anadolu Lisesi:
Okul bahçesindeki bitki türleri, adetleri, doğallık (D) ve meyveli olma (M) özelliklerine göre gruplandırılmış ve aşağıda gösterilmiştir (Tablo 2).
Tablo 2. Erzurum Mehmet Akif Ersoy Anadolu Lisesi Bitki Listesi

No	**Bitki Türü**	**Türkçesi**	**Doğallık**	**Meyveli**	**Adet**
1	***Acer platanoides***	*Çınar yapraklı akçaağaç*	**D**		**3**
2	***Aesculus hippocastanum***	*Beyaz çiçekli at kestanesi*			**1**
3	*Betula verrucosa*	*Adi huş*	**D**		**12**
4	***Crataegus monogyna***	*Adi alıç*	**D**	**M**	**2**
5	***Fraxinus excelsior***	*Adi dişbudak*	**D**		**11**
6	*Fraxinus excelsior* 'Westhof's Glorie'	*Batı avrupa dişbudak ağacı*			**8**
7	***Juglans regia***	*Adi ceviz*		**M**	**4**
8	***Juniperus chinensis***	*Çin ardıcı*			**11**
9	***Juniperus excelsa***	*Boylu Ardıç*			**22**
10	***Ligustrum vulgare***	*Adi Kurtbağrı*	**D**		**4**
11	***Malus domestica***	*Elma*	**D**	**M**	**1**
12	***Malus domestica* 'Amasya Misket'**	*Amasya misket elması*		**M**	**1**
13	***Malus domestica* 'Granny Smith'**	*Granny smith elması*		**M**	**1**
14	***Malus domestica* 'Starkrimson'**	*Starkrimson elması*		**M**	**1**
15	***Malus floribunda***	*Süs elması*		**M**	**2**
16	***Picea pungens* 'Glauca'**	***Mavi ladin***			**16**
17	***Picea pungens* 'Hoopsii'**	*Aşılı avrupa mavi ladini*			**1**
18	***Pinus nigra***	*Karaçam*	**D**		**9**
19	***Pinus sylvestris***	*Sarıçam*	**D**		**15**

20	***Populus nigra***	*Kara kavak*	**D**		**2**
21	***Prunus armeniaca***	*Kayısı*		**M**	**3**
22	***Prunus avium***	*Kiraz*	**D**	**M**	**2**
23	***Prunus cerasus* 'Kütahya'**	*Kütahya vişnesi*		**M**	**3**
24	***Prunus cerasifera***	*Süs eriği*		**M**	**1**
25	***Pyrus communis***	*Avrupa armudu*	**D**	**M**	**2**
26	***Ulmus minor***	*Ova karaağacı*	**D**		**3**
				Toplam:	**141**

Erzurum Mehmet Akif Ersoy Anadolu Lisesi okul bahçesinde:
Toplam bitki türü sayısı: 26
Doğal bitki türü sayısı: 12
Meyveli bitki türü sayısı: 12
Bu doğrultuda toplam bitki türü sayısının doğal bitki türü sayısına oranı %46, meyveli bitki türü sayısına oranı %46 olarak belirlenmiş ve biyoçeşitlilik direncini sağladığı belirlenmiştir.

3- Mecidiye Anadolu Lisesi:
Okul bahçesindeki bitki türleri, adetleri, doğallık (D) ve meyveli olma (M) özelliklerine göre gruplandırılmış ve aşağıda gösterilmiştir (Tablo 3).
Tablo 3. Mecidiye Anadolu Lisesi Bitki Listesi

No	Bitki Türü	Türkçesi	Doğallık	Meyveli	Adet
1	*Betula verrucosa*	*Adi huş*	**D**		**5**
2	*Fraxinus excelsior*	*Adi dişbudak*	**D**		**3**
3	*Malus domestica*	*Elma*	**D**	**M**	**1**
4	*Pinus sylvestris*	*Sarıçam*	**D**		**25**
5	*Prunus cerasus*	*Vişne*		**M**	**5**
				Toplam:	**39**

Mecidiye Anadolu Lisesi okul bahçesinde:
Toplam bitki türü sayısı: 5
Doğal bitki türü sayısı: 4
Meyveli bitki türü sayısı: 2
Bu doğrultuda toplam bitki türü sayısının doğal bitki türü sayısına oranı %80, meyveli bitki türü sayısına oranı %40 olarak belirlenmiş ve biyoçeşitlilik direncini sağladığı belirlenmiştir.

4-3 Temmuz Anadolu İmam Hatip Lisesi:
Okul bahçesindeki bitki türleri, adetleri, doğallık (D) ve meyveli olma (M) özelliklerine göre gruplandırılmış ve aşağıda gösterilmiştir (Tablo 4).
Tablo 4. 3 Temmuz Anadolu İmam Hatip Lisesi Bitki Listesi

No	Bitki Türü	Türkçesi	Doğallık	Meyveli	Adet
1	***Acer platanoides***	*Çınar yapraklı akçaağaç*	**D**		**1**
2	***Aesculus hippocastanum***	*Beyaz çiçekli at kestanesi*			**2**
3	*Betula verrucosa*	*Adi huş*	**D**		**12**
4	***Betula pendula* 'Youngii'**	*Sarkık dallı huş*			**10**
5	***Crataegus monogyna***	*Adi alıç*	**D**	**M**	**1**
6	***Elaeagnus angustifolia***	*Kuş iğdesi*	**D**	**M**	**2**
7	*Fraxinus americana*	*Amerika dişbudağı*			**3**
8	***Fraxinus excelsior***	*Adi dişbudak*	**D**		**13**
9	***Juglans regia***	*Adi ceviz*		**M**	**3**

10	***Juniperus chinensis***	*Çin ardıcı*			**1**
11	***Malus domestica***	*Elma*	**D**	**M**	**5**
12	***Morus alba***	*Beyaz dut*	**D**	**M**	**1**
13	***Pinus sylvestris***	*Sarıçam*	**D**		**30**
14	***Populus nigra***	*Kara kavak*	**D**		**3**
15	***Prunus armeniaca***	*Kayısı*		**M**	**2**
16	***Prunus avium***	*Kiraz*	**D**	**M**	**1**
17	***Prunus cerasus***	*Vişne*		**M**	**4**
18	***Prunus domestica***	*Erik*	**D**	**M**	**5**
19	***Pyrus communis***	*Avrupa Armudu*	**D**	**M**	**1**
20	***Ribes aureum***	*Sarı çiçekli frenk üzümü*	**D**	**M**	**25**
21	***Robinia pseudoacacia***	*Beyaz çiçekli yalancı akasya*	**D**		**1**
22	***Rosa canina***	*Kuşburnu*	**D**	**M**	**3**
23	***Salix babylonica***	*Ağlayan söğüt*	**D**		**1**
24	***Syringa vulgaris***	*Adi leylak*			**25**
25	***Ulmus glabra***	*Dağ karaağacı*	**D**		**2**
				Toplam:	**157**

3 Temmuz Anadolu İmam Hatip Lisesi okul bahçesinde:
Toplam bitki türü sayısı: 25
Doğal bitki türü sayısı: 17
Meyveli bitki türü sayısı: 12
Bu doğrultuda toplam bitki türü sayısının doğal bitki türü sayısına oranı %68, meyveli bitki türü sayısına oranı %48 olarak belirlenmiş ve biyoçeşitlilik direncini sağladığı belirlenmiştir.

5- Polis Amca İlkokulu:
Okul bahçesindeki bitki türleri, adetleri, doğallık (D) ve meyveli olma (M) özelliklerine göre gruplandırılmış ve aşağıda gösterilmiştir (Tablo 5).
Tablo 5. Polis Amca İlkokulu Bitki Listesi

No	**Bitki Türü**	**Türkçesi**	**Doğallık**	**Meyveli**	**Adet**
1	*Acer negundo*	*Dişbudak yapraklı akçaağaç*			**1**
2	*Betula verrucosa*	*Adi huş*	**D**		**5**
3	*Elaeagnus angustifolia*	*Kuş iğdesi*	**D**	**M**	**3**
4	*Fraxinus excelsior* 'Westhof's Glorie'	*Batı avrupa dişbudak ağacı*			**7**
5	*Malus domestica*	*Elma*	**D**	**M**	**2**
6	*Populus nigra*	*Kara kavak*	**D**		**3**
7	*Prunus cerasus*	*Vişne*		**M**	**5**
8	*Pyrus calleryana*	*Süs armudu*		**M**	**1**
9	*Pinus sylvestris*	*Sarıçam*	**D**		**18**
10	*Rosa canina*	*Kuşburnu*	**D**	**M**	**1**
11	*Syringa vulgaris*	*Adi leylak*			**6**
12	*Ulmus minor*	*Ova karaağacı*	**D**		**5**
				Toplam:	**57**

Polis Amca İlkokulu okul bahçesinde:
Toplam bitki türü sayısı: 12
Doğal bitki türü sayısı: 7
Meyveli bitki türü sayısı: 5
Bu doğrultuda toplam bitki türü sayısının doğal bitki türü sayısına oranı %58, meyveli bitki türü sayısına oranı %41 olarak belirlenmiş ve biyoçeşitlilik direncini sağladığı belirlenmiştir.

4. Tartışma

1. okulumuz Erzurum İbrahim Hakkı Fen Lisesi okul bahçesinde, Erzurum kent merkezinde nadir görülen melez servi (Cupressocyparis leylandii) ile Akdeniz servisi (Cupressus sempervirens) türleri, korunmuş bir alan içerisinde başarılı bir şekilde değerlendirilmiştir. Alanda baskın olarak yer alan bitkiler arasında ise Erzurum'da yaygın biçimde bulunan adi huş (Betula verrucosa), sarıçam (Pinus sylvestris) ve karaçam (Pinus nigra) türleri bulunmaktadır.
2.okulumuz Erzurum Mehmet Akif Ersoy Anadolu Lisesi okul bahçesinde, doğal yayılım alanı sınırlı olan boylu ardıç (Juniperus excelsa) türü çalışma alanında yer almaktadır. Bununla birlikte, alanda çeşitli meyve ağaçları tür ve çeşitleri de bulunmaktadır. Açık yeşil alanlar, mekânın genelinde daha geniş bir yer kaplamakta ve diğer kullanım alanlarına kıyasla daha yoğun bir dağılım göstermektedir.
3.okulumuz Mecidiye Anadolu Lisesi okul bahçesinde, Erzurum kent florasında yayılış gösteren Sarıçam (Pinus sylvestris) egemen olarak bulunmaktadır.
4.okulumuz 3 Temmuz Anadolu İmam Hatip Lisesi okul bahçesinde, çalışma alanında farklı tür ve çeşitlerde çok sayıda meyve ağacı yer almakta olup, Erzurum kent florasında sınırlı yayılış gösteren at kestanesi (Aesculus hippocastanum) ise alanda nadir olarak gözlemlenmiştir.
5.okulumuz Polis Amca İlkokulu okul bahçesinde, Erzurum kent florasında yayılış gösteren sarıçam (Pinus sylvestris) egemen olarak bulunduğu tespit edilmiştir.
Bu bağlamda İlbaş (2025) tarafından yapılan tez çalışmasında Erzurum kent merkezindeki okul bahçelerinde doğal bitki türlerinin kullanımı, hem ekolojik dengeyi korumak hem de yerel flora ile uyumlu sürdürülebilir peyzaj alanları oluşturmak açısından önem taşımaktadır. Halihazırda bazı okul bahçelerinde doğal türlerden sarıçam (Pinus sylvestris) ve adi huş (Betula pendula) gibi türler yer almakta olup, özellikle bölgenin simgesel ağaçlarından biri olan adi huşun kullanımının yaygınlaştırılması gerekmektedir. Bölgenin karasal ve kurak iklim özelliklerine dayanıklılığıyla öne çıkan doğal bitkilerden; beyaz çiçekli yalancı akasya (Robinia pseudoacacia), çınar yapraklı akçaağaç (Acer platanoides), mürver (Sambucus nigra), adi dişbudak (Fraxinus excelsior), gümüş ıhlamur (Tilia tomentosa), adi ardıç (Juniperus communis), titrek kavak (Populus tremula), karaağaç (Ulmus minor), alıç (Crataegus monogyna) ve süs eriği (Prunus cerasifera) gibi türlerin okul bahçelerinde yaygınlaştırılması, ekosistem hizmetlerinin artırılması açısından önem arz etmektedir. Bu ağaç taksonları hem kurağa dayanıklı hem de estetik, ekonomik özellikleri ile gölgeli mekânlar düzenlenerek termal konfora ve kentsel biyoçeşitliliğe katkı sağlayacağı düşünülmektedir. Bu türlerin kullanımı, aynı zamanda düşük bakım maliyetleri ve doğal adaptasyon özellikleri ile sürdürülebilir peyzaj anlayışına katkı sunmaktadır (İlbaş, 2025).
Elde edilen bulgular doğrultusunda, Erzurum Palandöken ilçesinde bulunan okul bahçelerinde doğal bitki türleri ile meyve veren bitkilerin kullanım düzeyinin, biyoçeşitlilik direnci üzerinde doğrudan etkili olduğu görülmektedir. Yerel bitki türlerinin tercih edilmesi, bölge ekosistemine uyumlu habitatların oluşmasını desteklerken, meyveli bitkilerin varlığı ise hem yaban hayatı için besin kaynağı oluşturmakta hem de ekolojik etkileşimi artırmaktadır. Bu bağlamda, okul bahçelerinde doğal ve meyveli bitki türlerinin kullanımının artırılması, kentsel ölçekte biyoçeşitliliğin korunması ve güçlendirilmesi açısından önemli bir araç olarak değerlendirilmektedir.
Nitekim Askan ve Yılmaz (2024) tarafından gerçekleştirilen çalışmada, eğitim kampüslerine yerel ve bölgesel ölçekte yapılan yatırımların artırılmasının gerekliliği vurgulanmaktadır. Bu yaklaşım, kentsel alanlarda yerli ağaç türlerinin çeşitliliğinin korunması ve bu alanlarda yaşayan yaban hayatının sürdürülebilirliği açısından önemli bir katkı sunmaktadır. Özellikle gelişmişlik düzeyi düşük ya da gelişmekte olan ülkelerde, biyolojik çeşitliliğin devamlılığının sağlanmasında bu tür yatırımlar kritik bir rol üstlenmektedir. Bunun yanı sıra, söz konusu yatırımların iklim değişikliğinin yol açtığı olumsuz etkilerin azaltılmasına da katkı sağlayacağı ifade edilmektedir (Askan ve Yılmaz, 2024).

Ayrıca, yenilebilir bahçelerin okul bahçelerine entegre edilmesi, öğrencilerin üretim sürecine aktif katılımını teşvik ederken sağlıklı beslenmeye yönelik farkındalık oluşturmaktadır. Bu uygulama, öğrenme ortamlarını zenginleştirmesi ve sürdürülebilirlik ile biyoçeşitliliğe ilişkin somut deneyimler sunması bakımından eğitimsel açıdan önemli görülmektedir.
Buna paralel olarak Adams, Larkham ve Hardman (2023)' de yaptığı çalışmada, geçirgen ve çevreyle uyumlu sınır düzenlemelerinin türler arasındaki etkileşimi güçlendirerek iklim değişikliğine daha dayanıklı yeşil alanların gelişimine katkı sunduğunu ortaya koymaktadır. Bu bağlamda, yenilebilir bahçe yaklaşımı kentsel tarımı yalnızca üretim odaklı değil, ekosistem hizmetleri ve sosyal sürdürülebilirlik boyutlarıyla ele alınması gereken bir uygulama olarak değerlendirmektedir (Adams vd, 2023).

5. Sonuç ve Öneriler

Kentsel biyolojik çeşitliliğin korunması, geliştirilmesi ve yaşam alanlarının artırılmasında; kent merkezleri ile çevresinde yer alan ormanlık alanlar, tarım alanları, koruluklar, çayırlar, meralar, yeşil yollar ve ekolojik koridorlar, vadiler, akarsular, botanik bahçeleri ve hobi bahçeleri önemli işlevler üstlenmektedir. Kent içi ölçekte ise parklar, yol kenarı ağaçlandırmaları, konut bahçeleri, su yüzeyleri ile çatı ve yapı cephelerinde gerçekleştirilen bitkilendirme uygulamaları ve mezarlık alanları, kent florasının zenginleşmesine ve dolaylı olarak kentsel biyolojik çeşitliliğin desteklenmesine katkı sağlamaktadır. Tür çeşitliliğinin sürdürülebilmesi için söz konusu alanların korunması ve geliştirilmesine yönelik bütüncül ve sürdürülebilir bir planlama yaklaşımının benimsenmesi gerekmektedir (Yılmaz, 2024b).
Sürdürülebilirlik ilkeleri temel alınarak tasarlanan yapılar, özellikle eğitim amaçlı binalar, öğrenme sürecini destekleyen etkili araçlar olarak değerlendirilebilmektedir. Bu kapsamda, ülkemizde toplumsal farkındalığın artırılabilmesi için eğitim yapılarının tasarım süreçlerine öncelik verilmesi önemli katkılar sunacaktır. Sürdürülebilir okul tasarımına yönelik kılavuzların hazırlanması ve örnek uygulamaların hayata geçirilmesi, geleceğin tasarımcı ve mühendislerinin erken yaşlardan itibaren sürdürülebilirlik bilinci edinmelerine olanak sağlayacaktır. Bu yaklaşımın göz ardı edilmemesi, alanın gelişimine katkı sunan temel unsurlardan biri olarak değerlendirilmelidir (Şahin ve Dostoğlu, 2015).
Bu çalışma, kentsel ölçekte biyoçeşitliliğin korunması ve iklim değişikliğine uyum sürecinde okul bahçelerinin önemli bir potansiyele sahip olduğunu ortaya koymaktadır. Erzurum gibi soğuk iklim koşullarına sahip kentlerde, doğal bitki türleri ile meyve veren bitkilerin okul bahçelerinde dengeli ve bilinçli biçimde kullanılması, ekosistem direncinin artırılmasına ve kentsel biyolojik çeşitliliğin desteklenmesine katkı sağlamaktadır. Elde edilen bulgular, okul bahçelerinin yalnızca eğitim mekânları değil, aynı zamanda çevresel farkındalığın geliştiği ve sürdürülebilirlik ilkelerinin somut olarak deneyimlendiği alanlar olarak ele alınması gerektiğini göstermektedir. Bu doğrultuda, okul bahçelerinin planlama ve tasarım süreçlerinde ekolojik temelli yaklaşımların benimsenmesi, yerel koşullara uyumlu bitkisel materyalin tercih edilmesi ve bu alanların uzun vadeli stratejilerle desteklenmesi, kentlerin iklim değişikliğine karşı dayanıklılığının ve biyoçeşitlilik direncinin artırılmasında etkili bir araç olarak değerlendirilmektedir.
Okul bahçelerinin kentsel biyoçeşitliliğin desteklenmesi ve iklim değişikliğine uyum sürecinde daha etkin bir rol üstlenebilmesi için ekolojik temelli planlama ve tasarım yaklaşımlarının yaygınlaştırılması önerilmektedir. Özellikle yerel ve doğal bitki türleri ile meyve veren bitkilerin kullanımının artırılması, hem ekosistem bütünlüğünün korunmasına hem de çevresel farkındalığın gelişmesine katkı sağlayacaktır. Ayrıca, okul bahçelerinin sürdürülebilirliğini destekleyecek rehber dokümanların hazırlanması, eğitim kurumları için örnek uygulamaların geliştirilmesi ve ilgili paydaşlar arasında iş birliğinin güçlendirilmesi büyük önem taşımaktadır. Soğuk iklim koşullarına sahip kentlerde, iklime uyumlu tasarım stratejilerinin benimsenmesi ve okul bahçelerinin uzun vadeli yönetim planlarıyla desteklenmesi, bu alanların daha yaşanabilir, dirençli ve sürdürülebilir mekânlar haline gelmesine katkı sağlayacaktır. Okul bahçelerinde ekolojik temelli planlama yaklaşımlarının benimsenmesi, biyoçeşitlilik direncinin artırılmasına katkı sağlarken, kentlerin iklim değişikliğine karşı daha sürdürülebilir ve yaşanabilir hale gelmesine olanak tanıyacaktır.

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ERZURUM İLİ ŞENKAYA İLÇESİ MISIR ÜRETİM ALANLARINDA KULLANILAN BAZI HERBİSİTLERİN YABANCI OTLANMA İLE MISIR VERİMİNE ETKİLERİ ÜZERİNE BİR ARAŞTIRMA

Seda Nur Doğanay[219], İrfan Çoruh[220]

Özet

Bu çalışma, Erzurum ili Şenkaya ilçesi mısır (Zea mays L.) ekim alanlarında sorun olan yabancı otların kontrolü amacıyla 2019 yılında yürütülmüştür. Araştırmada, farklı herbisit uygulamalarının ve fiziksel mücadelenin yabancı ot yoğunluğu ile mısır verimi unsurlarına olan etkilerinin belirlenmesi amaçlanmıştır. Deneme, Erzurum ili Şenkaya ilçesinde üretici arazisinde, Tesadüf Blokları Deneme Deseni'ne göre 4 tekerrürlü olarak kurulmuştur. Çalışma, Yabancı Otlu Kontrol, %47.5 Linuron (Çıkış Öncesi), 330 g/L Pendimethalin (Çıkış Öncesi), 37.5 g/L Mesotrione + 15 g/L Nicosulfuron + (Çıkış Sonrası), Yabancı Otsuz Kontrol (elle yolma ve çapalama) ve 8 Yapraklı Dönemde Fiziksel Mücadele (elle yolma) uygulamalarını içeren 6 karakterden oluşmuştur. Deneme alanında baskın yabancı ot türlerin Sirken (Chenopodium album L.), Kırmızı Köklü Tilki Kuyruğu (Amaranthus retroflexus L.), Yapışkan otu (Galium tricornutum Dandy), Darıcan (Echinochloa crus-galli (L.) P.Beauv.) ve Tarla Sarmaşığı (Convolvulus arvensis L.) olduğu saptanmıştır. Yabancı otların sürekli elle yolma ve çapa yapılması ile (Yabancı Otsuz Kontrol), hiçbir müdahale yapılmayan yabancı otlu parsellere göre dane veriminde %87,5 oranında artış sağladığı belirlenmiştir. Yabancı otlu parselde dane verimi 545.2 kg/da iken, yabancı otsuz parselde 1022.5 kg/da olarak tespit edilmiştir. Kullanılan bütün herbisit uygulamalarından elde edilen verimler, yabancı otlu kontrol parseline göre istatistiksel olarak daha yüksek bulunmuştur. Kimyasal uygulamalar içerisinde en etkili yabancı ot kontrolü ve en yüksek dane verimi (1015.3 kg/da) 37.5 g/L Mesotrione + 15 g/L Nicosulfuron uygulamasından elde edilmiş olup, bu uygulama yabancı otsuz kontrol parseline en yakın sonucu vermiş ve aynı istatistiksel grupta yer almıştır. Kimyasal mücadele, doğru zamanda ve önerilen dozda uygulandığında etkili olur, fakat entegre mücadele ile bu etki daha kalıcı hale gelir ve sürdürülebilir bir tarım sağlanır.

Anahtar Kelimeler: Mısır, Yabancı Ot, Herbisit, Verim, Şenkaya, Erzurum

A Research on the Effects of Some Herbicides Used in Corn Production Areas of Şenkaya District of Erzurum Province on Corn Yield by Weeding

Abstract

This study was carried out in 2019 in order to control weeds that are a problem in corn (Zea mays L.) cultivation areas in Şenkaya district of Erzurum province. In the study, it was aimed to determine the effects of different herbicide applications and physical control on weed density and corn yield elements. The trial was established on the producer's land in Şenkaya district of Erzurum province with 4 repetitions according to the Coincidence Blocks Trial Design. The study consisted of 6 characters, including Weed Control, 47.5% Linuron (Pre-emergence), 330 g/L Pendimethalin (Pre-Emergence), 37.5 g/L Mesotrione + 15 g/L Nicosulfuron + (Post-Emergence), Weed-Free Control (hand plucking and hoeing) and Physical Control (hand plucking) in the 8-Leaf Period. The dominant weed species in the trial area were Lamb's quarters (Chenopodium album L.), Red-Rooted Foxtail (Amaranthus retroflexus L.), Rough Bedstraw (Galium tricornutum Dandy), Barnyard Grass (Echinochloa crus-galli (L.) P.Beauv.) and Field Bindweed (Convolvulus arvensis L.). It has been determined that continuous hand plucking and hoeing of weeds (Weed Free Control) provides a 87,5% increase in grain yield compared to weedy parcels without any intervention. While the grain yield was 545.2 kg/da in the weedy parcel, it was determined as 1022.5 kg/da in the weed-free parcel. The yields obtained from all herbicide applications used were found to be statistically higher than the weed control plot. Among the chemical applications, the most effective weed control and the highest grain yield (1015.3 kg/da) were obtained from the application of 37.5 g/L Mesotrione + 15 g/L Nicosulfuron, and this application gave the closest result to the weed-free control plot and was included in the same statistical group.

Chemical control is effective when applied at the right time and in the recommended dose, but with integrated control, this effect becomes more permanent and sustainable agriculture is ensured.

Keywords: Corn, Weed, Herbicide, Yield, Şenkaya, Erzurum

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ERZURUM'DAKİ OSMANLI DÖNEMİ HAMAMLARININ PLAN TİPOLOJİSİ

Elif Polat Topcu

Özet
İnsanlık, varoluşunun ilk dönemlerinden itibaren özellikle beslenme ve sağlıklı bir yaşam sürdürebilme ihtiyacı doğrultusunda su kaynaklarının bulunduğu bölgelerde yerleşim alanları kurmuştur. Su, yalnızca yaşamın devamı için değil, temizlik ve hijyenin sağlanması açısından da vazgeçilmez bir unsur olmuştur. Bu gereksinim zamanla bireysel banyoların ötesine geçerek, toplumun ortak kullanımına açık kamusal yapılar olan hamamların inşa edilmesini beraberinde getirmiştir. Nitekim hamamlar, tarih boyunca sadece beden temizliği için kullanılan mekânlar olmamış; aynı zamanda sosyal ilişkilerin geliştiği, kültürel değerlerin paylaşıldığı ve yaşam biçiminin yansıdığı önemli toplumsal alanlar haline gelmiştir. Bu bağlamda, hamamlar, dönemlerinin toplumsal ilişkilerini, kültürel alışkanlıklarını ve estetik anlayışını yansıtan mimari öğeler olarak değerlendirilmelidir. Bu doğrultuda, insanlık tarihinin ve medeniyetin beşiği olarak kabul edilen Anadolu coğrafyasında yer alan hamam yapılarının incelenmesi, geçmiş uygarlıkların sosyal, kültürel ve mimari özelliklerinin anlaşılmasına önemli katkılar sunmaktadır. Bu çalışma kapsamında, Erzurum kentinde yer alan tescilli Osmanlı dönemi hamamlarının plan özellikleri analiz edilerek tipolojik özelliklerinin ortaya konulması amaçlanmaktadır. Yapılan çalışmalar sonucunda, bu yapıların plan şemalarının oluşumunda işlevsel gereksinimler, kullanım biçimleri ve iklimsel koşulların etkili olduğu görülmüştür. Hamam yapılarının anlaşılması, kentsel kültürel mirasın korunması ve sürdürülebilir tanıtım stratejilerinin geliştirilmesi açısından da bilimsel önem taşımaktadır.
Anahtar Kelimeler: Erzurum, hamam, Osmanlı hamamları, plan şeması, tipolojik analiz

Plan Typology of Ottoman Period Baths in Erzurum

Abstract
Humanity, since its earliest existence, has established settlements near water sources, driven by the need for nourishment and the desire to maintain a healthy life. Water has been an indispensable element not only for sustaining life but also for ensuring cleanliness and hygiene. Over time, this necessity evolved beyond individual bathing practices, leading to the construction of public bathhouses (hamams) accessible to the broader community. Throughout history, hamams have served not merely as places for bodily cleansing; they have also become significant social spaces where interpersonal relationships developed, cultural values were shared, and lifestyles were reflected. In this context, hamams should be regarded as architectural elements that mirror the social relations, cultural habits, and aesthetic preferences of their respective periods. Accordingly, the study of hamam structures located in Anatolia—recognized as the cradle of human history and civilization—provides valuable insights into the social, cultural, and architectural characteristics of past societies. This study analyzes the plan features of registered Ottoman-period hamams in the city of Erzurum, aiming to reveal their typological characteristics. The findings indicate that functional requirements, usage patterns, and climatic conditions played a decisive role in shaping the plan schemes of these structures. Understanding hamam architecture in this manner holds scientific significance for the preservation of urban cultural heritage and the development of sustainable promotion strategies.
Keywords: Erzurum, hamam, Ottoman bathhouses, plan scheme, typological analysis

SAĞLIK TESİSLERİNDE ERİŞİLEBİLİRLİK STANDARTLARININ GELİŞTİRİLMESİ: STEES SERTİFİKASYON SİSTEMİ ÖNERİSİ

Burak Keskin[221], Şölen Köseoğlu[222]

Özet

Erişilebilirlik kavramı bilgi, hizmet, teknoloji ve ürünün herkes tarafından kullanılabilir, ulaşılabilir ve anlaşılabilir olması olarak tanımlanmaktadır. Türkiye Ulusal Engelli Veri Sistemi'nde 1.097.307'si kadın 1.414.643'ü erkek olmak üzere toplam 2.511.950 engelli vatandaş kayıtlıdır. Resmi olmayan rakamlara göre ise doğru sayının 9 milyon olduğu tahmin edilmektedir. Dahası bugün engelli olmayan her bireyin bir engelli adayı olduğu unutulmamalıdır. Günümüzde Türkiye nüfusunun %11'lik kısmını oluşturduğu tahmin edilen engelli bireyler, birçok yapıda olduğu gibi sağlık tesislerinde de hizmet almakta güçlüklerle karşılaşmaktadır. Türkiye'de engelli bireyler ile ilgili faaliyetler Aile ve Sosyal Hizmetler Bakanlığına bağlı Engelli ve Yaşlı Hizmetleri Genel Müdürlüğünce yürütülmektedir. Aile ve Sosyal Hizmetler Bakanlığınca yapılarda erişilebilirlik standartlarını belirlemek üzere 2020 yılında "Erişilebilirlik Kılavuzu: Binalar" isimli tasarım rehberi yayımlanmıştır. Sağlık Bakanlığı'na bağlı sağlık tesislerinde her yıl düzenli olarak erişilebilirlik denetimi yapılsa da belirlenen aksaklıkların düzeltilmesi ile ilgili takip mekanizmaları bulunmamaktadır.

Bu sebeple, bu çalışmada sağlık tesislerinde erişilebilirlik üzerine "Sağlık Tesisleri Engelsiz Erişilebilirlik Standartları" (STEES) adıyla bir sertifikasyon sistemi oluşturulması amaçlanmaktadır. STEES sertifikasyon sisteminin amacı, yapıların erişilebilirlik standartlarına uygun hale getirilmesini sağlamak, kamusal alanlarda erişilebilirliği arttırmak, yapıların engelli vatandaşlarımıza olan yararlarına göre tanınırlığını arttırmak, yapılar için güvenilir bir erişilebilirlik etiketi oluşturmak, erişilebilir yapılara olan ilgiyi arttırmak, erişilebilirlik kavramının ilerlemesini sağlamak ve engelli bireylerin yaşam kalitesini arttırarak topluma katılımını desteklemektir. STEES sertifikasyon sistemi ile yapıların standartları sağlama oranına göre bronz, gümüş, altın ve platin olmak üzere toplam dört sertifika aracılığıyla değerlendirilmesi planlanmaktadır.

Daha sonra, çalışma kapsamında oluşturulan STEES sertifikasyon sistemi, Ağrı ilinde bulunan sağlık tesislerinin değerlendirilmesinde kullanılacaktır. Çalışma örneklemini oluşturan tesisler, Ağrı Eğitim ve Araştırma Hastanesi, Taşlıçay Devlet Hastanesi, Doğubayazıt Ağız ve Diş Sağlığı Merkezi'dir ve araştırmanın alan çalışması bu üç hastane ile sınırlı olacaktır. Yapılan sertifikalandırma sürecinde, ülkemizde bulunan sağlık tesisleri Ağrı ili özelinde incelenerek eksikliklerin tespit edilmesi ve kamu yapılarında yaptırım yerine ödül sistemi oluşturularak; erişilebilirlik standartları uygulamalarının pekiştirilmesi amaçlanmaktadır. Çalışmanın, sağlık yapılarında erişilebilirliğin artırılmasına yönelik çalışmalara ve engellilik araştırmalarına katkı sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Erişilebilirlik, Evrensel Tasarım, Sağlık Yapıları, Engelli Bireyler, Engellilik Araştırmaları

Improving Accessibility Standards in Healthcare Facilities: A Proposed STEES Certification System

Abstract

The concept of accessibility is defined as information, services, technology, and products being usable, accessible, and understandable to everyone. In Turkey's National Disability Data System, a total of 2,511,950 disabled citizens are registered, including 1,097,307 women and 1,414,643 men. Unofficial figures estimate the true number to be around 9 million. Furthermore, it should not be forgotten that every individual who is not currently disabled is a potential candidate for disability. Disabled individuals, estimated to constitute 11% of Turkey's population, face difficulties in accessing services in many facilities, including healthcare.

In Turkey, activities related to disabled individuals are carried out by the General Directorate of Services for the Disabled and Elderly under the Ministry of Family and Social Services. In 2020, the Ministry of Family and Social Services published a design guide titled "Accessibility Guide: Buildings" to determine accessibility standards in buildings. Although accessibility audits are conducted regularly every year in healthcare facilities under the Ministry of Health, there are no follow-up mechanisms for correcting identified deficiencies.

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Therefore, this study aims to establish a certification system called "Healthcare Facilities Barrier-Free Accessibility Standards" (STEES) for accessibility in healthcare facilities. The purpose of the STEES certification system is to ensure that buildings comply with accessibility standards, increase accessibility in public spaces, enhance the recognition of buildings based on their benefits to disabled citizens, create a reliable accessibility label for buildings, increase interest in accessible buildings, advance the concept of accessibility, and support the participation of disabled individuals in society by improving their quality of life. The STEES certification system plans to evaluate buildings based on their compliance with standards through a total of four certifications: bronze, silver, gold, and platinum.

Subsequently, the STEES certification system created within the scope of this study will be used to evaluate healthcare facilities in Ağrı province. The facilities forming the study sample are Ağrı Training and Research Hospital, Taşlıçay State Hospital, and Doğubayazıt Oral and Dental Health Center, and the field study of the research will be limited to these three hospitals. The certification process involves examining healthcare facilities in Ağrı province to identify shortcomings and reinforce accessibility standards in public buildings by establishing a reward system rather than a sanction system. It is believed that this study will contribute to efforts to improve accessibility in healthcare facilities and to disability research.

Keywords: Accessibility, Universal Design, Healthcare Buildings, People with Disabilities, Disability Studies

TARİHİ KENT MERKEZLERİNİN YENİDEN CANLANDIRILMASI: ERZURUM MİRZAMEHMET MAHALLESİ VE ÇEVRESİ

Beyza Şahintürk[223], Emriye Kazaz[224]

Özet

Toplumsal, ekonomik ve kültürel yaşamın biçimlendiği kent kimliğini ve kent belleğini temsil eden tarihi kent merkezleri insanlık tarihinin sürekliliğinin izlerini barındırırlar. Hızlı kentleşme, sanayileşme ve fonksiyon değişimleri, nüfus hareketliliği ve mekânsal bozulmalar tarihi kent merkezlerinin çöküntü haline gelmesi ve köhneleşmesine neden olmuştur. Bu nedenlerle tarihi kent merkezlerinde işlevsel olarak gerileme, nitelik azalması, işlevsel kopukluk, fiziksel bozulmalar gibi sorunlar ortaya çıkmıştır. Bu sorunlar doğrultusunda tarihi kent merkezlerinin yeniden canlandırılması kavramı oluşmuştur.

Yeniden canlandırma, köhneleşmiş bölgelerin çöküntüye ve eskimeye neden olan fiziksel, sosyal, ekonomik ve kültürel etmenlerin ortadan kaldırılarak kent ile bütünleşmesi olarak tanımlanmaktadır. Bu kavram, tarihi kent merkezlerini oluşturan bileşenlerin iyileştirilmesi ve kentlere ait özgün dokuların korunması biçiminde bütüncül olarak düşünülmesi gerekmektedir.

M.S. 5. yüzyılda Doğu Roma İmparatorluğu tarafından askeri bir garnizon şehri olarak kurulan Erzurum; stratejik konumu, ticari ve siyasi önemi nedeniyle pek çok medeniyete ev sahipliği yapmış ve bunların izlerini günümüze kadar taşımıştır. Başlangıçta iç kale ve dış surdan oluşan şehir, zaman içinde farklı medeniyetlerin katkılarıyla gelişerek büyürken iki sur daha şehri kuşatmıştır. İç kale çevresinde yerleşimleri oluşturan mahalleler, ticari faaliyetlerin yoğunluk kazandığı çarşılar, sosyal ve kültürel hayatın odak noktaları olan camiler ve eğitim faaliyetlerinin yürütüldüğü medreseler tarihi merkezin en önemli bileşenleri olmuşlardır ve hala günümüzde aktif bir merkez olarak kullanılmaya devam etmektedir. Ne var ki, kentsel dönüşüm, çeşitli turizm faaliyetleri, çevre ve yapıların çağdaş ihtiyaçlara yeterince cevap verememesi gibi sebeplerle tarihi çekirdekteki mahallerin bir kısmı yıkılıp park alanlarına çevrilirken bir kısmı da terkedilmiştir. İç Kale'nin kuzeyindeki Mirzamehmet Mahallesi de dokunun bir kısmı yıkılmış, bazı restorasyon faaliyetlerine karşılık kapsamlı müdahale gerektiren pek çok geleneksel konut barındıran neredeyse tamamen boşaltılmış tarihi bir mahalledir. Kültür Yolu Projesinin ana güzergahlarından biri olmasına rağmen bölgede yerli halk ya da turistlerin ihtiyaçlarını karşılamaya yönelik çalışmalar oldukça sınırlı olduğu gibi tanımsız sokak dokusu, boş parseller ve bakımsız çevre nedeniyle tarihi dokunun algılanmasında da sorunlar mevcuttur. Oysa ki, tarihi yerleşimler geçmişten gelen izleri ve hatıraları barındıran kent katmanlarını içerirler. Toplumsal hafızanın ve kültürün sürekliliği için bu alanları korumalı, yaşatmalı ve gelecek kuşaklara aktarmalıyız.

Bu bağlamda, Erzurum'un tarihi mahallerinden biri olan Mirzamehmet Mahallesi sosyal-kültürel ve fiziksel yönleriyle incelenerek bölgedeki başlıca sorunlar tespit edilmiştir. Bunun için saha çalışması verileri ile birlikte literatür taraması yapılarak bir takım mekânsal ve morfolojik analizler yapılmıştır. Elde edilen veriler doğrultusunda söz konusu alanın yeniden canlandırılması için öneriler geliştirilmiştir.

Anahtar Kelimeler: Tarihi Kent Merkezi, Yeniden Canlandırma, Erzurum, Mirzamehmet Mahallesi

Revitalization of Historic City Centers: Erzurum Mirzamehmet Neighborhood and Its Surroundings

Abstract

Historic city centers, which embody urban identity and collective memory shaped by social, economic, and cultural life, preserve traces of the continuity of human history. Rapid urbanization, industrialization, functional transformations, population mobility, and spatial deterioration have led these historic urban cores to decline and become derelict. Consequently, issues such as functional degradation, loss of quality, functional discontinuity, and physical deterioration have emerged. In response to these problems, the concept of revitalizing historic city centers has gained prominence.

Revitalization is defined as the integration of deteriorated areas into the urban fabric by eliminating the physical, social, economic, and cultural factors that cause decline and obsolescence. This concept must be

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approached holistically, aiming both to improve the components that constitute historic urban centers and to preserve the unique character of cities.

Founded as a military garrison city by the Eastern Roman Empire in the 5th century AD, Erzurum has hosted numerous civilizations due to its strategic location and its commercial and political significance, carrying their traces to the present day. Initially composed of an inner castle and an outer fortification, the city expanded over time with the contributions of different civilizations, ultimately being encircled by two additional defensive walls. Neighborhoods surrounding the inner castle, bazaars where commercial activity intensified, mosques that served as focal points of social and cultural life, and madrasas where educational functions were performed constituted the main components of the historic center and continue to serve as an active core today. However, due to urban transformation practices, tourism-oriented interventions, and the inability of surrounding structures to meet contemporary needs, some of the neighborhoods in the historic core have been demolished and converted into parks, while others have been abandoned. Mirzamehmet Neighborhood, located north of the Inner Castle, is one such area—its urban fabric partially demolished, largely vacated, and containing numerous traditional houses that require comprehensive restoration despite some ongoing conservation efforts. Although it lies along one of the main routes of the Cultural Route Project, efforts to address the needs of local residents and visitors remain highly limited. Undefined street patterns, vacant lots, and neglected surroundings further hinder the perception and legibility of the historic fabric. However, historic settlements also encompass urban layers that retain the traces and memories of the past. For the continuity of social memory and cultural heritage, these areas must be preserved, sustained, and transmitted to future generations.

In this context, Mirzamehmet Neighborhood—one of Erzurum's historic districts—has been examined through its social-cultural and physical characteristics, and the primary issues affecting the area have been identified. Fieldwork data, combined with a literature review, served as the basis for a series of spatial and morphological analyses. Based on the findings, proposals have been developed for the revitalization of the area.

Keywords: Historic City Center, Revitalization, Erzurum, Mirzamehmet Neighborhood

SANATTA DİJİTALLEŞME VE YAPAY ZEKÂ: OTANTİKLİĞE İLİŞKİSEL BİR SOSYOLOJİK YAKLAŞIM

Nazar Bal[225]

Özet
Dijitalleşme ve yapay zekâ teknolojileri, sanatsal üretim, sergileme ve dolaşım pratiklerini dönüştürerek kültürel mirasın korunması ve erişilebilirliği açısından yeni olanaklar sunmaktadır. Türkiye'de bazı çağdaş sanatçıların yapay zekâ ve dijital araçları kullanırken, eserlerin izleyiciler tarafından algılanışı ve kurumlar tarafından tanınma süreçleri üzerinde önemli etkisi olduğu söylenebilir. Bununla birlikte bu dönüşüm, sanat alanında otantiklik, özgünlük ve kültürel değer kavramlarının nasıl tanımlandığına ve anlamlandırıldığına ilişkin toplumsal soruları da beraberinde getirmektedir. Sanatta dijitalleşme ve yapay zekâ temelli üretimler, çoğu zaman "özgünlük kaybı" ile "teknolojik ilerleme" arasında kurulan ikili karşıtlıklar üzerinden ele alınmaktadır. Çalışmada, dikotomik yaklaşımların ötesine geçilerek, otantikliğin sanatta toplumsal olarak tanınışı ve değer kazanışı ilişkisel sosyolojik bir bakışla ele alınmaktadır. İlişkisel sosyoloji, sanatsal değeri sabit nitelikler ya da karşıt kategoriler üzerinden değil; sanatçılar, kurumlar, izleyiciler ve teknolojik aracılar arasındaki ilişkiler ağı içinde ele almayı mümkün kılmaktadır. Bu bağlamda çalışmanın çıkış noktasını oluşturan temel soru şudur: Sanatta dijitalleşme ve yapay zekâ temelli üretimler, otantikliğin toplumsal olarak nasıl sınıflandırıldığına ve değer kazandığına dair hangi toplumsal süreçleri görünür kılmaktadır? Otantiklik kavramını ontolojik bir hakikat veya estetik bir özellik olarak değil, toplumsal bir sınıflandırma ve değer üretim mekanizması olarak kavramsallaştırılmaktadır. Otantiklik, sanat eserinin üretim biçiminden ziyade, müzeler, galeriler, küratörler, akademi ve sanat piyasası gibi kurumsal aktörler tarafından tanınan, dolaşıma sokulan ve meşrulaştırılan bir değerdir. Sanatsal değerin oluşumunda etkili olan meşrulaştırma, seçme–dışlama ve değer biçme süreçlerini, sanatta dijitalleşme bağlamında düşünmeye yönelik bir çerçeve oluşturmaya çalışılmaktadır. Bu çerçeve, dijital ve yapay zekâ temelli sanatsal üretimlerin, sanat alanında hangi koşullar altında tanındığını, görünürlük kazandığını ve meşru kabul edildiğini toplumsal ve ilişkisel bir bakışla tartışmaya açmayı amaçlamaktadır. Kuramsal çerçevede Walter Benjamin'in sanat eserinin auraya dayalı tekilliği kavramı, ontolojik bir özgünlük tanımı olarak değil; sanatsal değerin tarihsel ve toplumsal koşullar altında nasıl dönüştüğünü anlamaya yardımcı olan bir araç olarak ele alınmaktadır. Pierre Bourdieu'nün kültürel üretim alanı yaklaşımı, otantikliğin kurumsal tanınma ve meşruiyet süreçleriyle ilişkisini tartışmaya açarken; Bruno Latour'un insan ve insan-dışı aktörleri birlikte ele alan perspektifi, algoritmaların ve yapay zekânın sanatsal üretim ve dolaşım süreçlerindeki rolünü düşünmeye imkân tanımaktadır. Sanatta dijitalleşme ve yapay zekâ temelli üretimlerin, otantikliğin insan merkezli ve tekil sanatçı öznesine dayalı bir nitelik olarak ele alınması sorgulanarak, bu kavramın kurumsal tanınma, algoritmik aracılık ve dolaşım süreçleri üzerinden yeniden nasıl anlamlandırılabileceği tartışılmaktadır. Sosyoloji, sanat ve teknoloji alanlarının kesişiminde bir bakış açısı sunularak, kültürel miras, çağdaş sanat ve dijital teknolojiler arasındaki ilişkiye bütüncül bir toplumsal perspektiften yaklaşılması hedeflenmektedir.
Anahtar kelimeler: Dijitalleşme, Kültürel Üretim, İlişkisel Sosyoloji

DIGITALIZATION AND ARTIFICIAL INTELLIGENCE IN ART: A RELATIONAL SOCIOLOGICAL APPROACH TO AUTHENTICITY

Abstract
Digitalization and artificial intelligence (AI) technologies are transforming artistic production, exhibition, and circulation practices, providing new opportunities for the preservation and accessibility of cultural heritage. It can be argued that some contemporary artists in Turkey, while using AI and digital tools, significantly affect how artworks are perceived by audiences and recognized by institutions. At the same time, this transformation raises social questions regarding how authenticity, originality, and cultural value are defined and understood within the art field. Artistic productions based on digitalization and AI are often discussed through the binary of "loss of originality" versus "technological progress." This study moves beyond such dichotomies, considering how authenticity is socially recognized and valued in art from a relational sociological perspective. Relational sociology allows artistic value to be understood not through fixed qualities or binary categories, but

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within networks of relationships among artists, institutions, audiences, and technological intermediaries. The central research question of this study is: How do digitally and AI-produced artworks render visible the social processes through which authenticity is classified and valued in the art field? Authenticity is conceptualized not as an ontological truth or an aesthetic feature but as a social classification and value-production mechanism. In this context, authenticity is understood less in terms of the production mode of artworks and more as a value recognized, circulated, and legitimized by institutional actors such as museums, galleries, curators, academia, and the art market. The study offers a framework for considering the processes of legitimization, inclusion–exclusion, and valuation in the context of digitalized art production. This framework opens a discussion on the conditions under which digitally and AI-produced artworks are recognized, gain visibility, and are legitimized from a social and relational perspective. Within the theoretical framework, Walter Benjamin's concept of the aura of the artwork is treated not as an ontological definition of originality but as a tool to understand how artistic value transforms in historical and social contexts. Pierre Bourdieu's field of cultural production approach examines the relationship between authenticity and institutional recognition and legitimacy, while Bruno Latour's perspective, which considers both human and non-human actors, provides a lens to reflect on the role of algorithms and AI in artistic production and circulation processes. Digitally and AI-produced artworks problematize authenticity as a human-centered and singular attribute of the artist, opening up a discussion on how this concept can be reinterpreted through institutional recognition, algorithmic mediation, and circulation processes. By offering a perspective at the intersection of sociology, art, and technology, the study aims to approach the relationship between cultural heritage, contemporary art, and digital technologies from a holistic social perspective.

Keywords: Digitalization, Cultural Production, Relational Sociology

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