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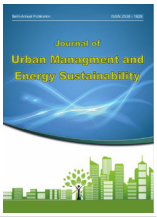

ORIGINAL RESEARCH PAPER

Explanation the model of influential indexes in the architectural designs architectural's works of Darvish and Foroughi in European countries

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ABSTRACT

Iranian architecture boasts a rich heritage, continually evolving to meet modern demands while honoring its historical roots. This research investigates the key factors influencing the architectural designs of prominent Iranian architects, Jahangir Darvish and Mohsen Foroughi, specifically within the context of European countries. The study employs a descriptive-analytical approach with a developmental aim, emphasizing a deep exploration of theoretical underpinnings. Information was gathered through both library research and field studies, drawing upon resources from academic institutions' architecture departments, international databases, and online sources. The research process involved examining the architects' historical backgrounds, works, and design methodologies. Key factors were extracted, and the Delphi method was used to establish final indicators, resulting in a proposed model. Findings indicate that "attention to user needs," "understanding local culture," and "environmental sustainability" were the most impactful indicators, receiving high scores from experts, 4.96, 4.94, and 4.79 respectively. These factors significantly shaped the architectural designs of Darvish and Foroughi in European settings. The research proposes a structural model based on these findings, offering valuable insights for future architectural studies. Subsequent research can leverage this framework to evaluate the effectiveness of these factors in individual architectural projects.

Running Title: The model of influential indexes in the architectural designs architectural's works of Darvish and Foroughi

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INTRODUCTION

Iranian Architecture

As one of the most ancient and affluent architectural styles in human history is Iranian architecture that stands as a confluence of culture, history, and climate. This unique architectural tradition has evolved over millennia, reflecting the diverse landscapes and rich cultural heritage of the region. Iranian architecture is characterized by a remarkable synergy between form and function, emphasizing features such as symmetry, proportion, and the utilization of eco-conscious materials. These elements blend to create exceptional spaces that not only cater to human needs but also embody the spirit of Iranian culture and tradition (Ahmad et al., 2020). Traditional Iranian structures often incorporate innovative cooling techniques, such as windcatchers and thick adobe walls, which allow them to maintain comfortable indoor temperatures even in extreme heat. This eco-conscious approach not only serves practical needs but also signifies a deep-rooted respect for nature and sustainability (Akhgar & Moulis, 2021). The historical context of Iranian architecture further highlights its significance. Dating back to ancient Persia, architectural practices evolved under various empires, each leaving a distinct mark on the landscape. (Canepa, 2020). The influence of Zoroastrianism, followed by Islam, played a crucial role in shaping these designs, often integrating spiritual elements within the structures themselves. Renowned structures like the Sheikh Lotfollah Mosque in Isfahan and the exquisite Persian gardens exemplify the artistic aspects and meticulous design inherent in this architectural tradition. (Fresku, 2024). This mosque, along with similar structures, conveys a sense of transcendence, inviting visitors to engage in reflection and spirituality. Similarly, the Persian gardens, with their carefully planned layouts and water features, reflect a philosophical connection to paradise and the importance of nature in Iranian culture. (Hensel & Gharleghi, 2012). Water, a central element in these gardens, represents life and vitality, demonstrating the critical role of environmental elements in Iranian design. In addition to their aesthetic appeal, Iranian architectural elements often carry deep symbolic meanings. For instance, the incorporation of azure blue tiles commonly found in mosques signifies the heavens and the infinite. Elements such as courtyards and gardens are not only functional spaces but also serve as representations of tranquility and the ideal human experience (Mohamadi et al., 2021). Scholars have noted that many contemporary architects draw inspiration from the intricate designs and principles of Iranian architecture, leading to a resurgence of interest in its unique attributes (Nari Ghomi & Momtahen, 2023). The principles of symmetry, light, and shadow in Iranian design are being revisited, often finding their way into modern urban developments and public spaces. One contemporary example of this influence is the use of traditional Persian motifs in modern architecture, where patterns and intricate designs are seamlessly integrated into the facades of new buildings (Soltanzadeh et al., 2019). Architects today are increasingly appreciating the value of cultural heritage and its role in shaping identity, leading to a blend of old and new methodologies in urban environments. This dialogue between ancient and contemporary practices reflects the timeless relevance of Iranian architectural concepts in today's fast-evolving architectural landscape (Stojkov, 2023). The role of architecture in representing national identity cannot be underestimated. In Iran, many architects and designers strive to incorporate traditional elements into modern designs as a means of fostering cultural pride and continuity. This commitment leads to spaces that resonate with the community, reflecting their heritage while also catering to modern needs (Wang et al., 2021). The revival of traditional techniques in contemporary projects showcases a renewed appreciation for Iranian architectural history. Internationally, the recognition of Iranian architecture's beauty has contributed to a broader understanding of architectural diversity (Rahbar

& Ebrahimbaysalami, 2021). This visibility opens up opportunities for cultural exchange, allowing Iranian architectural principles to inform practices in different contexts around the world. Another significant aspect of Iranian architecture is its adaptability. The ability of Iranian structures to evolve over time, absorbing influences while maintaining their unique identity, is a testament to the resilience and creativity of Iranian architects. From ancient fortresses to modern urban developments, this adaptability speaks to cultural continuity and the ongoing conversation about architectural identity (Diba, 2012). Iranian architects have played a pivotal role in shaping the architectural landscape of the region, blending traditional designs with innovative techniques. Historically, architects such as Ostad Ali Akbar Isfahani, who constructed the famous Sheikh Lotfollah Mosque, exemplified the heights of creativity and craftsmanship in the Safavid period. His ability to harmonize intricate tile work with elegant proportions has left a lasting legacy. (Dariush et al., 2021). In addition to individual contributions, Iranian architecture has seen a collaborative spirit, especially during the Qajar era, where architects and artisans worked together to create magnificent palaces and gardens. Structures such as the Golestan Palace in Tehran reflect the fusion of Persian architectural styles with European influences, showcasing how collaboration led to exceptional results. These buildings not only served as royal residences but also represented the burgeoning identity of a nation grappling with modernization (Ghafari et al., 2020). Moreover, the influence of contemporary Iranian architects extends beyond national borders. Individuals like Zaha Hadid, an influential Iraqi-British architect of Iranian descent, have brought international attention to Persian architectural elements. Hadid's fluid designs and bold forms, often inspired by the natural landscapes of Iran, demonstrate how cultural heritage can inform modern architectural practices. Her iconic projects, such as the MAXXI Museum in Rome, highlight the potential of integrating traditional aesthetics within a modern framework (Akbari, 2020). Today, a new generation of Iranian architects is emerging, focused on sustainability and environmental consciousness. Architects like Hadi Teherani are leading the way in eco-friendly designs that prioritize natural light, sustainable materials, and energy efficiency while respecting traditional Persian architecture›s cultural values. (Mahdavinejad & Abazari, 2015). In conclusion, Iranian architects have continuously adapted and innovated, shaping a rich architectural legacy that blends the past with the present. Their ability to draw upon historical influences while addressing contemporary challenges showcases the versatility and resilience of Iranian architecture. As these architects continue to explore new possibilities, they ensure that the essence of Iranian culture remains vibrant and influential in the global architectural discourse.

MATERIALS AND METHODS

Characteristics of Iranian Architecture

The hallmarks of Iranian architecture include the optimized use of space, connection with nature, and attention to climate. Examples such as Persian gardens, mosques with towering minarets, and elegant iwans exemplify these characteristics (Roudbari, 2013). Moreover, Iranian architecture has long been influenced by the rich philosophies and literature of this land, consequently manifesting a prominent element of spirituality and symbolism in spatial design (Miryounessi, 2017). This architectural style possesses an adaptability to temporal and spatial exigencies, which explains its continued relevance among contemporary architects (Shirazi, 2018). Notably, the role of Iranian architects in introducing these features to the global community and their impact on modern designs is highly significant, potentially leaving a lasting imprint on the future of architecture (Payamifar, 2022). It is worth noting that Iranian architecture is not confined solely to the geographical borders of this land; the works of Iranian architects in Europe also demonstrate its cultural and artistic

influence.4 Over the past two centuries, Iranian architects, through the transmission of their knowledge and architectural methods to European countries, have contributed to the transformation of spatial and building design (Eiraji & Fard, 2021). Among these architects is Abdolali Ashtiani, who, through the establishment of architectural educational institutions in Europe, provided a platform for the dissemination of innovative Iranian architectural approaches (Akbari, 2020). Additionally, the impact of works by architects such as Zahedi and Sharifi on the design of public spaces in European countries is noteworthy, where traditional design principles have been integrated with modern techniques (Mahdavinejad & Abazari, 2015). Furthermore, the works of Iranian architects in European countries differ significantly from other architectural styles in terms of aesthetics and functionality. The distinctive designs of mosques and public buildings in Europe, inspired by Iranian patterns, illustrate the profound influence of this art on modern architecture (Eiraji & Fard, 2021). Moreover, Iranian architecture, particularly through its use of unique geometric forms and patterns, has fostered innovative designs that many European architects have drawn upon (Dariush et al., 2021). These institutions and projects, beyond their impact on practical dimensions, have also enriched the social and cultural fabric of the host communities (Rahbar & Ebrahimbaysalami, 2021).

Characteristics of Works by Iranian Architects in European Countries

1. Use of Natural Light: Iranian architects pay considerable attention to the utilization of natural light in interior spaces. This feature not only reduces energy consumption costs but also renders interior spaces more comfortable and pleasant (Nari Ghomi & Momtahen, 2023). The incorporation of large windows and central courtyards in design exemplifies this characteristic (Mohamadi et al., 2021). Given the importance of sustainability in modern architecture, this approach is considered a key principle in the design of public and private spaces in European countries (Hensel & Gharleghi, 2012).
2. Efficient Design of Public Spaces: Iranian architects prioritize the design of public spaces that foster social interaction (Fresku, 2024).5 The creation of open spaces and green areas adjacent to buildings encourages social engagement and civic life (Canepa, 2020). These public spaces have positive psychological and social effects on residents and visitors, thereby contributing to the improvement of urban life quality (Ahmad et al., 2020).
3. Application of Geometric Patterns and Ornamentation: Iranian architects employ geometric patterns and decorative arts, particularly on exterior facades, in their designs (Ghafari et al., 2020). These arts not only enhance the aesthetic appeal of buildings but also reflect national culture and identity (Wang et al., 2021). The integration of these patterns with modern techniques leads to the creation of a unique design language (Diba, 2012).
4. Harmony with Nature: A prominent feature of Iranian architectural works is their environmentally conscious design and harmony with nature (Wang et al., 2021).7 This design is achieved through the use of natural materials, green spaces, and the establishment of central courtyards, which create a serene and pleasant atmosphere (Ahmad et al., 2020).
5. Attention to Color and Texture: Iranian design emphasizes the display of diversity in color and texture, a feature that enhances the spatial and visual relationships of spaces (Soltanzadeh et al., 2019). The use of traditional colors and local patterns in the restoration or redesign of new buildings has given a distinct character to Iranian architecture in modern Europe (Stojkov, 2023).

Iranian architects: Mohsen Foroughi and Jahangir Darvish

Mohsen Foroughi

Mohsen Foroughi is celebrated as one of the

foremost architects of modern Iran, known for his innovative designs that harmoniously blend traditional Persian architecture with contemporary aesthetics. Born in 1924, he studied architecture in France before returning to Iran, where he played a crucial role in shaping the architectural landscape during a time of transformation and modernization in the mid-20th century. Foroughi's work is characterized by its attention to detail, use of local materials, and incorporation of cultural motifs derived from Iranian heritage. One of Foroughi's most notable achievements is the Shahid Beheshti University in Tehran, which serves as a prime example of his ability to create functional and inspiring academic environments. The campus is designed to foster collaboration and creativity among students, featuring open spaces, gardens, and natural light. Foroughi's thoughtful design enhances the educational experience and promotes a sense of community among the students and faculty. His ability to create modern spaces while honoring traditional elements has made a significant impact on the subsequent generations of architects in Iran. Additionally, Mohsen Foroughi was instrumental in the preservation and renovation of historical sites, recognizing the importance of safeguarding Iran's architectural heritage. He believed that modern architecture should respect and reflect the culture and history from which it springs. His influence extends beyond individual projects, as he has served as a mentor and educator, inspiring many young architects to integrate cultural values into their modern designs (Roudbari, 2013). Through his commitment to architectural integrity and cultural context, Foroughi has contributed to a richer understanding of Iranian identity in architecture. Mohsen Foroughi is renowned for his integration of traditional Persian architectural features into modern designs, producing structures that resonate with cultural significance while addressing contemporary needs. His work often combines natural materials, such as brick and stone, with innovative structural elements, creating a dialogue between the past and the present. Foroughi's buildings frequently showcase extensive use of light and air, with thoughtfully arranged windows and open layouts that promote a sense of tranquility. He also pays meticulous attention to detail, evident in the decorative elements of his designs, such as tile work and stucco, which often incorporate traditional Persian motifs. Furthermore, Foroughi's commitment to sustainability is reflected in his approach to site planning and landscape integration, as he seeks to create spaces that not only serve their functional purpose but also honor the surrounding environment. (Fig. 1 and 2)

Jahangir Darvish

Jahangir Darvish, a prominent Iranian architect active during the 20th century, is renowned for his versatile approach and innovative designs that have significantly influenced contemporary architecture in Iran. Born in the 1930s, Darvish was deeply influenced by the architectural practices of his time, striving to marry modernist principles with the rich traditions of Persian architecture. His designs often feature clean lines, functional forms, and a thoughtful use of light, creating spaces that are both practical and visually striking. One of Darvish's most acclaimed projects is the Cultural Complex of Isfahan, which showcases his ability to integrate cultural, historical, and modern elements into a cohesive architectural statement. This complex serves as a multi-functional space and emphasizes community engagement through its design. Darvish's attention to context and his commitment to creating inviting public spaces highlight his understanding of architecture as a means to enhance social interaction and cultural expression .Darvish's work extends beyond mere aesthetics; he is also recognized for his contributions to architectural education in Iran. He has been actively involved in academia, teaching and mentoring aspiring architects. His emphasis on understanding the cultural and historical backgrounds of architectural styles encourages students to appreciate and leverage their heritage in

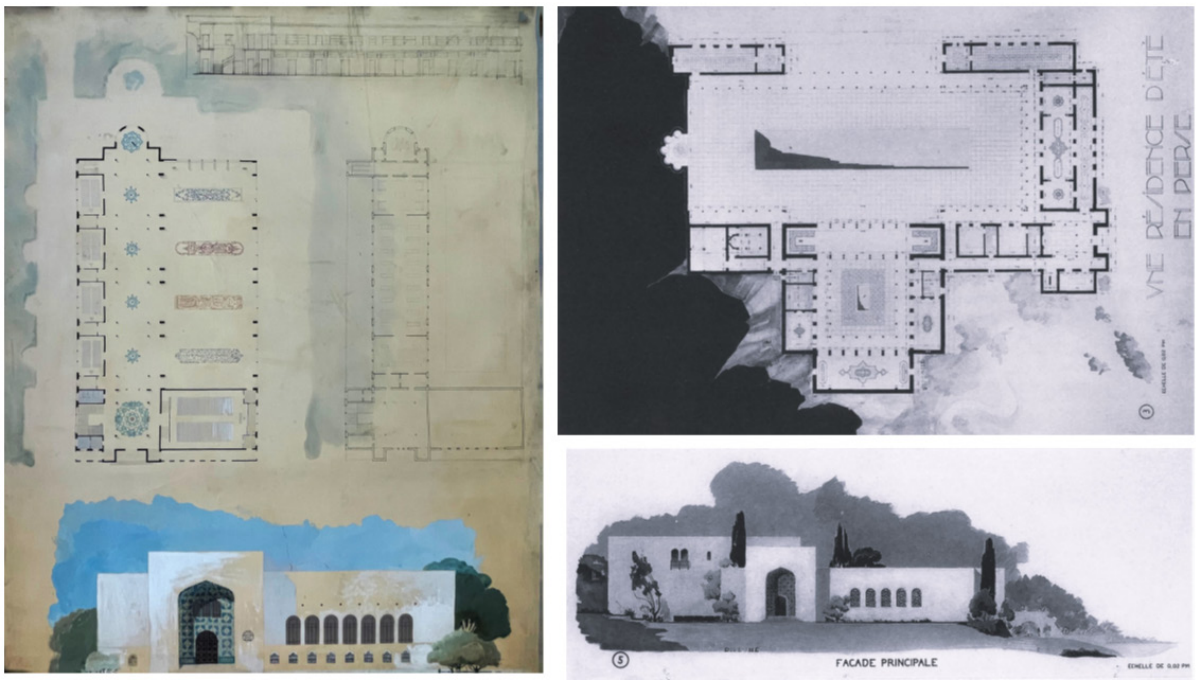

Figure 1: (Left). Une École des langues Orientales by M. Foroughi, Source: Mohsen Foroughi's archive, École des Beaux-Arts. Figure 1 (Right). Une résidence d'été en Perse by M. Foroughi, Source: diploma project presented at the École des Beaux-Arts, June 1937. Plan drawing published in Les médailles des concours d'architecture de l'École Nationale des Beaux-Arts de l'année scolaire 1936–37 (Paris: Vincent, Fréal & Cie, 1937), pl. 109. The project was awarded third prize, as noted in the jury report published in Bulletin de la SADG, 32e année, no. 17–18 (1–15 septembre 1937)

their designs. Through his teaching, Darvish has cultivated a new generation of architects who value both innovation and tradition. Moreover, Jahangir Darvish's influence can be seen in his efforts to advocate for sustainable architectural practices within Iran. By promoting the use of local materials and eco-friendly technologies, he has aligned his work with the global dialogue on sustainability in architecture. His vision remains relevant today, emphasizing the balance between modern development and environmental stewardship in Iranian architecture . Jahangir Darvish is known for his ability to synthesize traditional Persian architectural elements with modern design principles, resulting in buildings that are both functional and aesthetically pleasing. His architecture often features clean lines, open spaces, and a thoughtful play of light, which creates an inviting atmosphere for inhabitants and visitors alike. Darvish emphasizes the importance of contextual design, ensuring that his buildings are harmonious with their surroundings and reflect the cultural heritage of the region. Elements such as intricate geometric patterns, arches, and domes are significant in his works, echoing the rich history of Iranian architecture while still embracing contemporary materials and construction techniques. Additionally, his designs often include communal spaces that foster social interaction, highlighting his belief in architecture as a tool for enhancing community engagement. (Fig. 3 and 4)

Methodology

This research is of a descriptive-analytical type, which has a development aim, but its fundamental characteristic can be pointed out, especially in explaining the depth of the theoretical foundations, the proposed model and framework. The method of collecting information is in the form of a library and field from references

such as the architecture department of academic institutions and international data and web sources. First, after examining the theoretical foundations as well as the history of the research in the two darchitectural history of iranian architects particullary Darvish and Froughi's works and imensions of procedure and content, where there is an emphasis on clarifying the aim, not repeating it, factors are extracted as the result of the research framework and using the Delphi method as the final indicators proposed in the form of a model. In the Delphi method, in successive courses, by forming an elite board consisting of specialists in the field of architecture, university professors, researchers in the field of architecture in the number of 15 people[1], in the form of a digital questionnaire using Google tools and sending the answers in the form of a link. is received, the type of answers is also set based on the Likert spectrum as very low, low, medium, high and very high impact. The number of influencing factors on the subject of the perception of the architectural form is mentioned with regard to the fall of the shadow, which after going through stages including the specified average limit and also calculating the Kendall coefficient for the answers, polling is stopped when a certain average is reached and the final indicators are proposed as a research framework. It will be given. In the following, the extracted indicators are explained as the main model of the research as a result using intermediate analysis.

1. The panel of elites and experts includes 15 faculty members of Tehran University, Tabriz University of Arts, Isfahan University of Arts, as well as researchers of Islamic Azad University and Karaj University of Arts Research Institute.

DISCUSSION AND FINDINGS

Explanation of influential indexes in the architectural designs of Darvish and Foroughi in the architectural design in European countries

Description of the Delphi method

The Delphi method is known as a qualitative research method for solving complex problems and reaching consensus in various fields, including sustainable development and policy making. This method has been well implemented especially in the review and evaluation of factors in

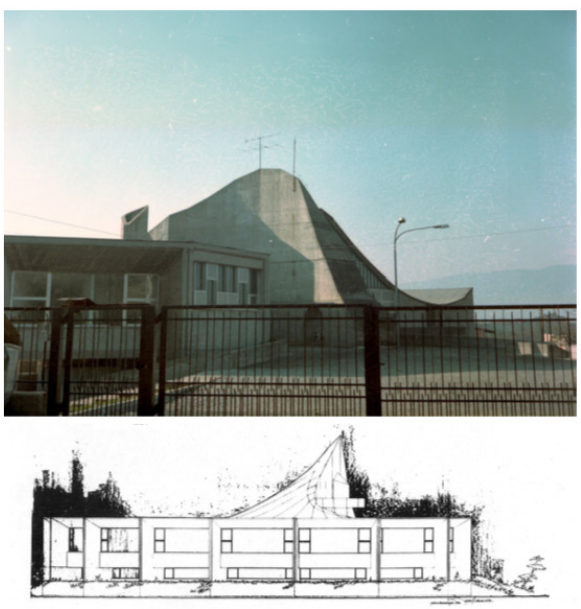

Figure 3: (Left). Car Dealership (Mercedes Benz), Turin-Italy Figure 4 (Right). Montalto Dora School, Turin-Italy

research related to sustainable and low-carbon buildings in other countries and has obtained acceptable results.The fuzzy Delphi method is a research technique that aids in analyzing and gathering expert opinions across various fields. This method is particularly useful for examining complex and multifaceted issues. In the context influential indexes in the architectural designs of Darvish and Foroughi in the architectural design in European countries, the fuzzy Delphi method can help identify and prioritize the factors that impact the design and construction. As defined, this method involves multiple rounds of questionnaires where expert opinions are collected and analyzed. Utilizing the fuzzy Delphi method allows researchers to achieve a consensus on the importance and necessity of specific factors while evaluating diverse opinions. This method accounts for the uncertainties stemming from varied perspectives by employing fuzzy techniques, thus facilitating decision-making under conditions of ambiguity. Research focusing on identifying selected factors influential indexes in the architectural designs of Darvish and Foroughi in the architectural design in European countries can achieve a more precise understanding through the application of the fuzzy Delphi method. These factors may encompass various aspects of design, construction materials, and renewable energy technologies. For instance, studies that investigate challenges reveal that expert opinions can significantly influence the development of new and effective solutions. This approach enables researchers to gather diverse viewpoints and reach comprehensive conclusions. Ultimately, the fuzzy Delphi method serves as an effective tool for identifying and prioritizing the factors in the architectural designs of Darvish and Foroughi in the architectural design in European countries. This method allows researchers to thoroughly consider the insights and experiences of experts and contribute to the development of strategies aimed at achieving influential indexes.

Steps to implement the Delphi method

The Delphi method involves a series of questionnaires or stages that are carried out sequentially with controlled feedback. These stages generally include five steps. In each stage of the research, the Delphi panel members, consisting of experts in the field of architectural history of iraninan architects, respond to questions. One notable feature of this method is the anonymity of the panel members, which allows them to express their opinions freely without being influenced by friendly or competitive judgments. In practice, Delphi panel members participate more than once in answering questions. This repetition provides them with an opportunity to reconsider their decisions by reviewing feedback from other experts on each indicator. The exchange of data between panel members is controlled by the researcher. The researcher collects individuals' responses and, after evaluating them, passes the results on to the next round. This process prevents personal discussions among individuals and thus helps facilitate and streamline the work and research process.

Implementation of the Delphi method

After identifying the areas and factors in the architectural designs of Darvish and Foroughi in the architectural design in European countries, the Delphi process for evaluating these factors began. The Delphi process includes several fundamental stages and each of the stages will be described. In the first step of the research, factors and areas were identified through a literature review, followed by the initial classification of these factors. After this stage, the first round questionnaire was prepared. To ensure the validity of the questionnaire, copies were delivered in person before final distribution. In this meeting, discussions and exchanges of views regarding the factors mentioned in the questionnaire took place. After analyzing the first round questions, the second round questionnaire was prepared and sent to those individuals. The results confirmed the validity of the questionnaire. For assessing the reliability of the questionnaire, Cronbach's alpha coefficient was used, with

a value of 0.982, indicating high reliability. In the second step, based on the characteristics mentioned in the previous section, the Delphi panel members were identified, and they were invited to participate. In the first meeting, they were given the necessary explanations regarding their responsibilities to respond to the questionnaires in several stages and to continue their collaboration until the end of the process. They were also assured that their responses would remain confidential throughout all stages. In the third step, the first round questionnaire was distributed among 30 panel members, and all individuals responded to the questionnaire. The panel members evaluated the factors derived from the literature review based on their importance in influential indexes in the architctural design in European countries using a Likert scale (from 1 to 5, including very low importance, low, medium, high, and very high). To facilitate brainstorming, the questionnaire included the option for panel members to add their suggested factors based on their professional backgrounds. Additionally, panel members could propose that some factors be combined and presented as a single overall indicator. After collecting and analyzing the responses with SPSS software, statistical factors such as mean, standard deviation, and interquartile range were extracted for each indicator. In the fourth step, the second round questionnaire was prepared based on the feedback received from the first round questionnaire. The aim of this questionnaire was to reassess the factors that achieved consensus as well as to reach consensus on factors that did not, and to evaluate the factors raised by the panel members in the first round questionnaire. This questionnaire was similar to the first round, with the difference that the mean responses were listed for each indicator. Experts could evaluate the importance of each indicator and revise their responses based on the opinions of other experts. It is an important step of the Delphi method. Consensus means the agreement of opinion among experts on a specific topic, and its achievement is measured using data dispersion measurement methods.

Interquartile range

Interquartile Range (IQR) is one of the most commonly used methods for measuring data dispersion in assessing the level of consensus in the Delphi method. The interquartile range indicates the distance between the third quartile (Q3) and the first quartile (Q1) and is calculated using the following formula: IQR = Q3 − Q1 (Relation 1) The acceptable range in the interquartile range depends on the spectrum of responses from the Delphi panel. In this research, experts evaluate each indicator based on a 7-point Likert scale (Shields et al., 1987) from 1 to 5 according to its importance. In studies where responses are provided on a five-point Likert scale, an interquartile range of IQR ≤ 1 indicates the establishment of consensus.

Standard Deviation

To determine the level of consensus and demonstrate data dispersion relative to the mean for each indicator, the standard deviation (SD) is also calculated. The standard deviation is the square root of the average squared distance of values from the mean and is calculated using the following formula:

$$SD = \sqrt{(\sum(Xi - \overline{X})^2 / n)} \quad \text{(Relation 2)}$$

Where in this relation:

- SD: Standard Deviation
- Xi: Value of data point i
- $\overline{X}$: Mean of the data
- n: Number of data points

These two tools (interquartile range and standard deviation) help researchers easily assess the level of consensus among respondents and obtain a more precise analysis of the data.

$$SD(x) = \sqrt{(\sum(Xi - \overline{X})^2 / (n - 1))} \quad \text{(Relation 2)}$$

In this research, two factors of standard deviation and interquartile range were used to evaluate the consensus of Delphi panel members. This approach helped us to determine which factors were agreed upon by the Delphi panel members in achieving indexes in the architectural designs of Darvish and Foroughi in in European countries and which should be

removed from the list of factors.

Importance evaluation of factors

In this research, the mean was calculated to measure the importance of each indicator. The weighted average of each indicator is also reported in the findings section. This criterion was used as a key tool for understanding the relative value of each factors. This approach allows us not only to assess consensus among panel members but also to aid in the evaluation and prioritization of key factors, leading to more informed and efficient decision-making in this area. (Tab. 1)

Based on the consensus among the Delphi panel, the factors for in the architectural designs of Darvish and Foroughi in the architectural design in European countries were classified into seven areas and 20 factors as shown in Tab. 2.

Findings of primary evaluation step

According to the consensus among the Delphi panel, the factors for the architectural designs of Darvish and Foroughi in the architectural design in European countries were classified into three phases and 20 factors. (Fig. 5 to 7)

Findings of the implementation of the Delphi method

In the first round, the panel members identified 15 factors of 20 factors that were extracted from successful researches as having a great and very great effect in formulating the framework of the indicators affecting of factors according

Tabel. 1: Factors in the architectural designs of Darvish and Foroughi in the architectural design in European countries

Concept	Factor	Description
Technical	1. Alignment with Indigenous Architecture	Utilization of local architectural patterns in design.
	2. Environmental Sustainability	Use of sustainable materials and green techniques.
	3. Innovation in Design	Implementation of new ideas and technologies.
	4. Functionality of Space	Design of usable and flexible spaces.
	5. Quality of Natural Light	Maximizing natural light to reduce costs.
	6. Technical Compatibility	Adherence to construction and engineering standards.
	7. Role of Technology	Integration of smart systems in buildings.
	8. Creation of Green Spaces	Design of green spaces and gardens within and around buildings.
Human	1. Understanding Local Culture	Study and respect for local traditions and customs.
	2. Attention to User Needs	Tracking the social and psychological needs of residents.
	3. Collaborative Design Process	Engagement with the community and users during the design stages.
	4. Social Aspects Consideration	Support for public spaces and social interactions.
	5. Cultural Identity Preservation	Displaying and maintaining Iranian cultural identity.
	6. Diversity in Spaces	Creation of diverse spaces for various uses.
	7. Education and Awareness	Sharing knowledge and Iranian culture with others.
Environmental	1. Establishing Connection with the Environment	Creating a close relationship with natural surroundings and memories.
	2. Climate Consideration	Design suitable for the climatic conditions of the area.
	3. Dynamism in Design	Creation of spaces that can easily be modified.
	4. Consideration of Regional History	Study of the architectural and spatial history of the area for inspiration.
	5. Adherence to Aesthetic Principles	Design with an emphasis on beauty and visual appeal.

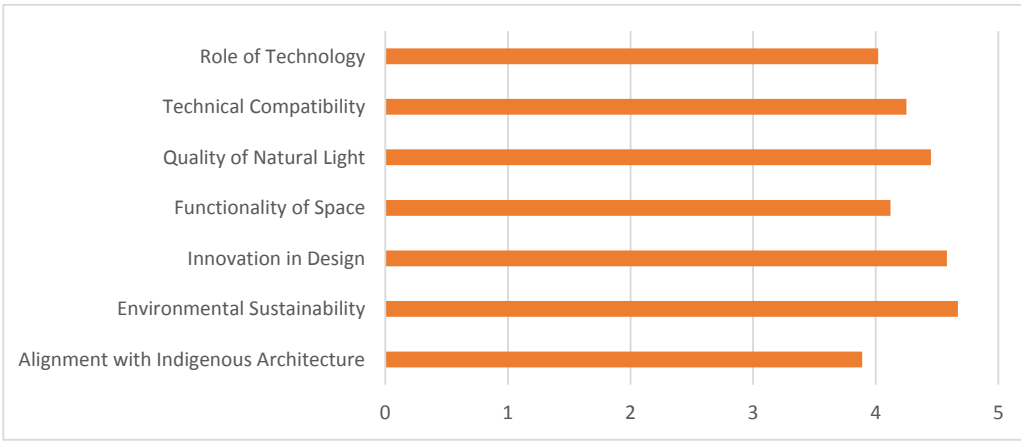

Figure. 5: Average weight of technical phase factors according to the importance of the architectural designs of Darvish and Foroughi in the architectural design in European countries

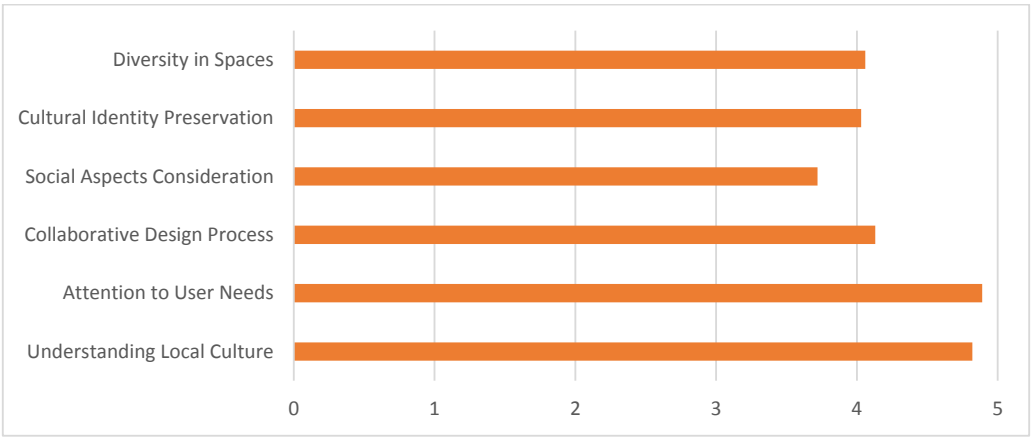

Figure. 6: Average weight of human phase factors according to the importance of the architectural designs of Darvish and Foroughi in the architectural design in European countries

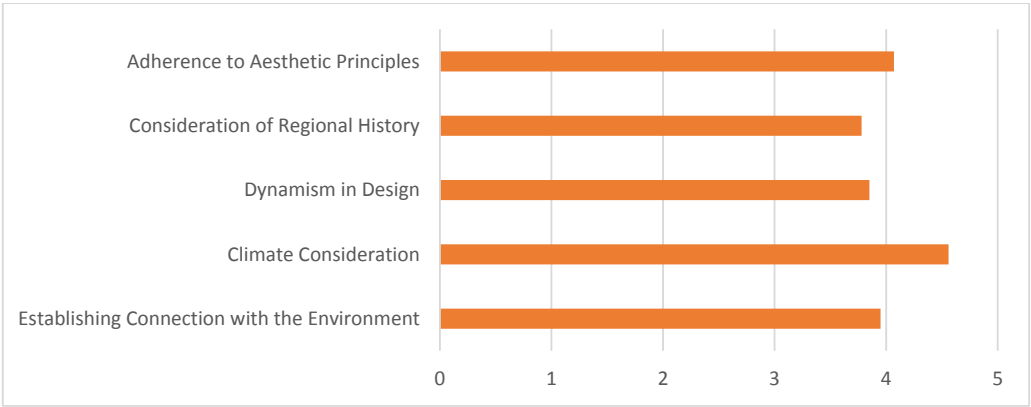

Figure. 7: Average weight of environmental phase factors according to the importance of the architectural designs of Darvish and Foroughi in the architectural design in European countries

to the importance of the architectural designs of Darvish and Foroughi in the architectural design in European countries. The detailed and extended results related to the implementation of the first stage of questionnaire distribution are given in the following table. The factors of Dynamism in design, establishing connection with the environment, Consideraton of regional istory, Alignment with Indigenous Architecture and Social Aspects Consideration has been removed have from the Delphi process due to their average importance of less than 4.0. (Tab. 2)

After the implementation of the first stage of investigation and evaluation of the opinion of the experts of the panel regarding the factors proposed and extracted from the theoretical bases and also receiving the suggestions of the panel members, in this round, in order to observe caution, all the factors extracted from the theoretical bases are again Together with the average opinion of the members in the first round and the previous opinion of the same member, it was provided to all the experts of the panel. The panel members identified 14 factors out of 20 factors that were presented in the second round as having a high and very high impact (with an average greater than 4.50) on the proposed framework of the concept of the role of shadows on the perception of architectural form. The detailed and extended results related to the implementation of the second stage of questionnaire distribution are given in the following table. Kendall's coefficient of coordination for the members' answers about the order of the

Table. 2: Round 1 of the fuzzy method in compiling the proposed indexes according to the importance of the architectural designs of Darvish and Foroughi in the architectural design in European countries

No.	Factors	Number of responses	Average	Standard deviation	Min.	Max.
1	Alignment with Indigenous Architecture	13	3.89	0/35	1	5
2	Environmental Sustainability	13	4.67	0/37	1	5
3	Innovation in Design	14	4.58	0/55	1	3
4	Functionality of Space	14	4.12	0/37	1	4
5	Quality of Natural Light	15	4.45	0/40	1	4
6	Technical Compatibility	15	4.25	0/25	1	5
7	Role of Technology	15	4.02	0/45	1	4
8	Creation of Green Spaces	15	4/08	0/38	1	5
9	Understanding Local Culture	14	4.82	0/47	1	5
10	Attention to User Needs	14	4.89	0/60	1	4
11	Collaborative Design Process	15	4.13	0/28	1	5
12	Social Aspects Consideration	15	3.72	0/41	1	5
13	Cultural Identity Preservation	14	4.03	0/32	1	5
14	Diversity in Spaces	14	4.06	0/35	1	5
15	Education and Awareness	15	3/08	0/69	1	4
16	Establishing Connection with the Environment	15	3.95	0/42	1	5
17	Climate Consideration	15	4.56	0/45	1	5
18	Dynamism in Design	15	3.85	0/50	1	5
19	Consideration of Regional History	14	3.78	0/45	1	5
20	Adherence to Aesthetic Principles	13	4.07	0/55	1	5

factors that had a high and very high influence in this round was 0.765, among which the factor of Ratio of transparent to opaque surfaces, Technical Compatibility, Role of Technology, Collaborative Design Process, Cultural Identity Preservation, Adherence to Aesthetic Principles has been removed. (Tab. 3)

In the third round of compiling the framework of the proposed indicators, the indicators affecting indexes according to the architectural designs of Darvish and Foroughi in the architectural design in European countries together with the average opinion of the members in the second round and the previous opinion of the same member, was provided to all panel experts. The detailed and extended results related to the implementation of the third stage of questionnaire distribution are given in the table below. Kendall's correlation coefficient for members' answers about the order of the six factors was 0.790. (Tab. 4)

RESULT AND CONCLUSION

The results of the three rounds of implementing the Delphi method in the research show that a consensus has been reached among the panel

Table. 3: Round 2 of the fuzzy method in compiling the proposed indexes according to the importance of the architectural designs of Darvish and Foroughi in the architectural design in European countries

No.	Factors	Number of responses	Average	Standard deviation	Min.	Max.
1	Environmental Sustainability	14	4.77	0/32	2	5
2	Innovation in Design	14	4.69	0/42	2	3
3	Functionality of Space	14	4.56	0/25	2	4
4	Quality of Natural Light	15	4.55	0/35	2	4
5	Technical Compatibility	15	4.35	0/20	2	5
6	Role of Technology	15	4.12	0/41	2	4
8	Understanding Local Culture	14	4.93	0/40	2	5
9	Attention to User Needs	14	4.95	0/45	2	4
10	Collaborative Design Process	14	4.25	0/22	2	5
11	Cultural Identity Preservation	14	4.13	0/21	2	5
12	Diversity in Spaces	14	4.16	0/20	2	5
13	Climate Consideration	14	4.66	0/35	2	5
14	Adherence to Aesthetic Principles	13	4.18	0/40`	2	5

Table. 4: Round 3 of the fuzzy method in compiling the proposed indexes according to the importance of the architectural designs of Darvish and Foroughi in the architectural design in European countries

No.	Factors	Number of responses	Average	Standard deviation	Min.	Max.
1	Environmental Sustainability	15	4.79	0/25	3	5
2	Innovation in Design	14	4.72	0/26	3	5
3	Functionality of Space	15	4.62	0/20	3	5
4	Quality of Natural Light	15	4.53	0/31	3	5
5	Understanding Local Culture	14	4.94	0/35	3	5
6	Attention to User Needs	14	4.96	0/38	3	5
7	Climate Consideration	15	4.68	0/32	3	5

members for the following reasons and the repetition of the rounds can be ended:

In the second round, more than 50% of the members, 20 influential factors in developing the framework of the proposed indicators, chose the indicators of indicators affecting of indoor air quality in central courtyard houses in a hot and humid climate emphasizing the concept of natural ventilation, which had an average greater than 2.5 among their factors.

- The standard deviation of the members' answers about the importance of the factors in the third round has decreased significantly compared to the previous rounds.
- Kendall's coordination coefficient for members' answers about the order of factors in the third round is 0.790. Considering that the number of panel members was more than ten people, this amount of Kendall's coefficient is considered quite significant.
- Kendall's coordination coefficient for the arrangement of the 6 influential factors in compiling the proposed indicators of the role of cast shadow on the perception of architectural form in the third round compared to the second round only increased by 0.025. This coefficient or the degree of consensus between the panel members Consecutive rounds do not show significant growth.
- The points given to the factors by the experts and elites indicate that the indexes of attention to user needs, understanding local culture and environmental sustainability have the highest score and as a result the most impact in explaining the indicators affecting the architectural designs of Darvish and Foroughi in the architectural design in European countries in the process of developing the framework of indicators. There are suggestions in form perception, which can be based on the structural model and the research framework.

In conclusion, Iranian architecture, as a rich and historical art form, has achieved remarkable accomplishments not only domestically but also through its influence in European countries. Characteristics such as attention to light, the design of public spaces, and the use of artistic ornamentation all demonstrate the efforts of Iranian architects to enhance the quality of life and promote Iranian culture internationally. Innovative designs that draw upon traditional principles have fostered social and cultural interactions in host communities and, on the other hand, contribute to the continuation and expansion of Iranian architectural art. Consequently, research into the impact of the works of Darvish and Foroughi on the architectural design of European countries can provide a deeper understanding of cultural and artistic exchanges and inspire contemporary architects.

REFERENCES

Ahmad, M., Hossein, M. M., & Kalantari, K. H. (2020). MOHSEN FOROUGHI (1907-1983): THOUGHTS AND SUSTAINABILITY IN THE WORKS OF AN IRANIAN MODERNIST ARCHITECT. Architecture and Engineering, 5(4), 28-34.

Akbari, A. (2020). A Study of Transformation of Iranian Modern Architecture: Evolution of Façade Design in Public Building in Tehran Since 1920s to Present (Master's thesis, Eastern Mediterranean University (EMU)-Doğu Akdeniz Üniversitesi (DAÜ)).

Akhgar, P., & Moulis, A. (2021). The legacy of the École des Beaux-Arts in twentieth-century Iran: the architecture of Mohsen Foroughi. The Journal of Architecture, 26(7), 945-968.

Canepa, M. P. (2020). The Iranian expanse: Transforming royal identity through architecture, landscape, and the built environment, 550 BCE–642 CE. University of California Press.

Dariush, B., Dastyar, F., & Dastyar, M. (2021). The impact of globalization on urban housing architecture in Iran. Journal of Art and Civilization of the Orient, 9(33), 21-32.

Diba, Darab. "Contemporary architecture of Iran." Architectural Design 82, no. 3 (2012): 70-79.

Eiraji, J., & Fard, S. A. R. Y. (2021). An evaluation of Iran architecture during first Pahlavi Era: A transition from tradition to modernity. Journal of De-

sign for Resilience in Architecture and Planning, 2(2), 222-233.

Fresku, L. (2024). What are the reasons leading iranian contemporary architects towards traditional know-hows? Rediscovering the Sustainable and Affordable Character of implementing such elements (Doctoral dissertation, Technische Universität Wien).

Ghafari, P. M., Ayvazian, S., & Khansari, S. The Impact of European Expressionism Art Movement on the Architecture of Administrative-Service Buildings in Iran during the Pahlavi Era.

Hensel, M., & Gharleghi, M. (2012). Iran: past, present and future. John Wiley & Sons.

Mahdavinejad, M., & Abazari, T. (2015). Transmitting Architectures: Analysis of the Projects of Iranian Architectures in Foreign Countries. https://www.ojceu.ir/main/attachments/article/43/J.%20Civil%20Eng.%20Urban.,%205%20(6)%20249-256,%202015.pdf

Miryounessi, M. (2017). The Impact of Local Values on Façade Design; A Comparative Study on North Cyprus and Iran Contemporary Residential Buildings (Master's thesis, Eastern Mediterranean University (EMU)-Doğu Akdeniz Üniversitesi (DAÜ)).

Mohamadi, S. H., Ahmadi, V., Tabassi, M., & Alhosseini, S. M. S. (2021). An Investigation of the Effect of Cultural Consumption Index on the External Façade in Residential Architecture: A case studies of the City of Tehran in Transition Period. Creative City Design, 4(3), 117-131.

Nari Ghomi, M., & Momtahen, M. (2023). Finding the roots of a technical evolution of architecture at the beginning of the modern period in Iran: examining the late Latif Abolghasemi's hypothesis about the technique of Iranian Jack Arch. Journal of Fine Arts: Architecture & Urban Planning, 28(3), 7-22.

Payamifar, A. (2022). The impact of ancient Iranian doorways on contemporary architecture (Doctoral dissertation, Technische Universität Wien).

Rahbar, P., & Ebrahimbaysalami, O. THE INFLUENCE OF TRADITIONAL ARCHITECTURE ON MODERN ARCHITECTURAL HERITAGE OF IRAN.

Roudbari, S. (2013). The Transnational Transformation of Architecture Practice: Iranian architects in the new geography of professional authority, 1945-2012. University of California, Berkeley.

Shirazi, M. R. (2018). Contemporary Architecture and Urbanism in Iran. Tradition, Modernity, and the Production of'Space-In-Between.[DOI: 10.1007/978-3-319-72185-9].

Soltanzadeh, S., Yousefi Tazakor, M., Raeisi, I., & Kiani, M. (2019). Analyzing the Intellectual Evolutions of Architectural Design during the Pahlavi Era. Space Ontology International Journal, 8(1), 53-65.

Stojkov, B. (2023). New interpretations of tradition in contemporary residential design as part of a new architectural movement with focus on Iranian projects (Doctoral dissertation, Wien).

Wang, X., Zhang, J., Cenci, J., & Becue, V. (2021). Spatial distribution characteristics and influencing factors of the world architectural heritage. Heritage, 4(4), 2942-2959.

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