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### Original Research Article

## An Examination of the Presence of Nature in Post-Revolutionary Contemporary Iranian Architecture Based on the Critique and Ideas of Christopher Alexander

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### Abstract

**Problem statement:** Today, attention has been paid to the diverse presence of natural elements in the contemporary architecture of Iran, especially in the post-revolution era, as part of a broad movement towards sustainability and human-centered design, and this presence has been examined based on different perspectives and attitudes, with However, less attention has been paid to the order of nature and its fundamental features that increase vitality and stability in buildings.

**Research objective:** The purpose of this research is to examine the Iranian architectural buildings based on the opinions of Christopher Alexander to create structural integrity and order and increase harmony with the environment, as mentioned in her main works “Language of Patterns” and “The Nature of Order.

**Research method:** To achieve this objective, 24 significant contemporary Iranian buildings from three distinct post-revolutionary periods were systematically evaluated. A questionnaire based on Alexander’s 15 principles of “Living Structures” was utilized, and responses were analyzed by a group of architectural and urban planning experts. The evaluation focused on the presence and effectiveness of natural elements within these architectural designs.

**Conclusion:** The results show that buildings such as Tehran Book Garden and Mellat Cinema Campus are more consistent with Alexander’s principles, especially in elements such as simplicity and inner peace, contrast and good shape that contribute to the well-being and comfort of the user and more harmony with the environment and vice versa. Structures such as the library and the national museum are less consistent in characteristics such as grading and ambiguity; Therefore, paying attention to a comprehensive approach in architectural design and balancing traditional elements with modern innovations and paying attention to the characteristics of nature and using them for future projects seems necessary.

**Keywords:** *Contemporary Iranian Architecture, Nature, Natural Elements, Sustainability, Christopher Alexander.*

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## Introduction

In recent years, the integration of nature into architectural design, particularly within the realm of contemporary Iranian architecture, has garnered significant attention. This trend aligns with a broader global movement towards sustainability and human-centered design, aiming to create built environments that resonate with the natural world while meeting functional requirements. This research, grounded in Christopher Alexander's theoretical framework, examines the presence of natural elements in contemporary Iranian architectural works. Alexander's seminal texts, such as *A Pattern Language* and *The Nature of Order*, offer a comprehensive set of principles emphasizing harmony, coherence, and the seamless incorporation of natural elements in architectural design (Alexander, 1999; Alexander, 2023).

Since the year 1380 in the Iranian calendar (2001-2002), landscape architecture in Iran has undergone significant transformations, profoundly influencing contemporary architectural practices. This period witnessed the evolution of traditional landscape approaches into more structured and academically informed practices, aligned with global standards. The establishment of formal landscape architecture education in Iranian universities, such as programs at Shahid Beheshti University, played a crucial role in this transformation (Alehashemi & Mansouri, 2018). The interplay between this evolving field and Alexander's ideas is evident in how Iranian architects incorporate natural elements, not merely as aesthetic advancements but as integral components that define the spatial organization and user experience (Taghvaei & Semiari, 2022). This study explores how the maturation of landscape architecture in Iran parallels the application of Alexander's principles, fostering environments that reflect both cultural heritage and contemporary needs. Despite the challenges, many Iranian architects strive to blend Alexander's principles with modern aesthetics. For instance, the principle of "Strong Centers" may seem in contrast to minimalism, yet contemporary Iranian architects have found innovative ways to reinterpret these principles to create spaces that are both visually appealing and user-relevant (Levin et al., 2023; Wijesooriya et al., 2023). The primary

research question is how natural elements are integrated into contemporary Iranian architectural works in accordance with Alexander's 15 properties of wholeness and how these design choices impact sustainability and cultural continuity. The study hypothesizes that the integration of Alexander's principles not only enhances the quality of spaces but also strengthens cultural continuity. This research suggests that Alexander's principles in contemporary Iranian architecture can lead to the creation of sustainable, human-centered spaces that are also culturally aligned. However, some critics argue that Alexander's focus on fixed patterns may be overly simplistic for modern architecture, and alternative theories such as biophilic design and sustainable architecture offer other approaches that should be considered alongside Alexander's principles (Salingaros, 2020; Kabinesh et al., 2024).

## Theoretical Framework

### • Christopher Alexander's Theories

Christopher Alexander has had a profound influence on architectural theory. His works, such as *A Pattern Language* and *The Nature of Order*, emphasize the concept of wholeness, aiming to create environments that align with human psychological and physiological needs (Alexander, 1999). In *A City is Not a Tree*, Alexander critiques modern urban planning and advocates for designs that reflect the interconnectedness found in nature (Alexander, 2023). These theories emphasize the importance of patterns that repeat across different scales, which can create functional and aesthetically pleasing environments (Sarami et al., 2021; Seamon, 2024). However, some critics argue that Alexander's theories require revision to adapt to contemporary conditions (Galle, 2020). In addition to Alexander's theories, approaches such as biophilic design and sustainable architecture also emphasize the integration of nature into architectural design. Biophilic design focuses on the innate human connection to nature, enhancing the psychological and physical well-being of users through natural elements such as light and plants (Kellert & Calabrese, 2015). In contrast, sustainable architecture emphasizes technical aspects such as

reducing energy consumption and improving resource efficiency (Du Plessis & Cole, 2011). Recent studies show that combining sustainability principles with Alexander's theories can result in environmentally and human-centered spaces (Kabinesh et al., 2024). While Alexander's theories, biophilic design, and sustainable architecture all address the integration of nature into architecture, they each approach this goal differently: Alexander focuses on overall structures and order, biophilic design on sensory experiences, and sustainable architecture on environmental efficiency (Salingaros, 2020). Combining these approaches can create comprehensive and efficient spaces that are both environmentally sustainable and humanly pleasing (Table 1).

#### • Christopher Alexander's theory of living structure

Christopher Alexander's theory of living structure addresses how natural elements can be integrated to create harmonious and vibrant environments. He believes that living structures should resonate with humans, promoting a sense of well-being and coherence (Alexander, 1999). This theory is based on the concept of wholeness, which organizes the various parts of a design in a way that creates an overall sense of life and harmony. Alexander introduces 15 fundamental properties for designing living structures, which architects can use to create functional spaces in harmony with their surroundings and users (Table 2) (ibid.).

1. Levels of scale: A hierarchy of scales, from the largest to the smallest details, contributes to the overall coherence of the design (Petrusevski, 2012).
2. Strong centers: Focal points organize space and create a sense of place.
3. Boundaries: Effective boundaries define spaces and create a sense of enclosure.
4. Alternating repetition: The repetition of elements with slight variations enhances rhythm and interest in design.
5. Positive space: Spaces should be designed to evoke a sense of satisfaction and completeness.
6. Good shape: Aesthetic forms contribute to the overall harmony of the design.

7. Local symmetry: Symmetry at a local level helps integrate and unify the design.

8. Deep interlock and ambiguity: Complex connections between elements enhance the richness and dynamism of spaces.

9. Contrast: Contrasts between elements add clarity and vitality to the overall design.

10. Gradients: Gradual transitions between spaces reinforce a sense of flow and continuity.

11. Roughness: Irregularities and imperfections give the design character and authenticity.

12. Echoes: The repetition of patterns and motifs creates a sense of unity and connection in the design (Alexander, 1999).

13. Void spaces: Empty spaces enhance balance and contrast (Sarami et al., 2021).

Simplicity and inner calm: Simplicity in design enhances a sense of inner tranquility.

14. Coherence: Harmonious integration of the various parts of a design creates a sense of wholeness and unity (Alexander, 1999).

This theory emphasizes the importance of coherence and harmony with human needs, yet critics argue that it requires revision and adaptation for modern architectural conditions. Some principles, such as wholeness and traditional structures, may be limiting when faced with the challenges of contemporary architecture (Angel & Salingaros, 2022). Therefore, architects should critically approach this theory and adapt it to meet new demands.

Primary natural elements (Water, Light, Air and Plants)

Primary natural elements such as water, light, air, and plants play a significant role in architecture, directly impacting human well-being and the quality of indoor and outdoor spaces. Alexander considers these elements essential, as they not only serve functional purposes but also have positive psychological effects, improving the quality of life for users (Alexander, 1999).

Water: Alexander views water not only as an aesthetic element but as a dynamic center within a space. He believes that water features like fountains enhance the sense of life and tranquility (Alexander, 1999; Petrusevski, 2012), although some

Table 1. Summary of research on Christopher Alexander’s theories. Source: Authors.

References	Research field	Variables	Research method	Type of analysis	Summary of findings
Alexander, 1999	Architectural theory	Wholeness, Patterns	Theoretical	Qualitative	Developed the 15 fundamental properties of wholeness, emphasizing the integration of natural elements in design.
Petrusevski, 2012	Generative design	15 Fundamental Properties	Theoretical, Case Studies	Qualitative	Applied Alexander’s properties in practical design and demonstrated their relevance in modern architecture.
Sarami et al., 2021	Conceptual analysis	Void	Theoretical	Qualitative	Explored the importance of “void” in creating open and connected spaces, highlighting its role in fostering a sense of openness.
Seamon, 2024	Architectural theory	Wholeness, Synergistic design	Theoretical	Qualitative	Examined the concept of wholeness and its application in creating synergistic relationships between built environments and their inhabitants.
Bembel, 2023	Architectural heritage	Alexander’s influence	Historical analysis	Qualitative	Discussed the lasting impact of Alexander’s principles on contemporary design practices.
Moeat et al., 2020	Sustainable architecture	15 Fundamental properties	Case studies	Mixed (Qualitative & Quantitative)	Demonstrated the application of Alexander’s properties in creating environmentally friendly and health-conscious office buildings.
Galle, 2020	Architectural aesthetics	Beauty, Design complexity	Theoretical	Qualitative	Critiqued Alexander’s approach to beauty in architecture, highlighting the need to update his principles to address modern aesthetic challenges.
Angel & Salingaros, 2022	Architectural critique	Insights, Limitations	Theoretical	Qualitative	Analyzed the strengths and limitations of Alexander’s architectural insights, emphasizing the need to adapt his theories for contemporary urban contexts.
Iwanczak & Lewicka, 2020	Urban landscape analysis	Pattern language, Urban form	Case studies	Qualitative	Tested Alexander’s pattern language theory in urban landscapes, finding that some patterns may not fully apply in complex modern urban settings.
Hatefishojae et al., 2021	Social interaction in architecture	Centers of life, Urban fabrics	Case studies	Qualitative	Explored how local and urban fabrics can enhance social interactions, emphasizing the importance of Alexander’s “Centers of Life,” while suggesting modifications for modern urban contexts.

critics raise concerns about water resource wastage in arid regions (Galle, 2020).

**Light:** Natural light, as a key component, creates strong centers within a space and strengthens the connection between interior and exterior environments (Alexander, 1999; Mehaffy, 2007). However, critics argue that such interactions can pose challenges in terms of cost and execution complexity (Angel & Salingaros, 2022).

**Air:** Natural ventilation is one of Alexander’s core principles, improved through architectural elements such as windcatchers and courtyards, providing thermal comfort (Alexander, 1999; Mahmoodi, 2004). Some believe that natural ventilation may be insufficient for high-rise buildings and certain climatic conditions (Kellert & Calabrese, 2015).

**Plants:** By introducing color and texture, plants add dynamism to spaces and have positive psychological effects (Alexander, 1999). However, high maintenance requirements can be challenging (Iwanczak & Lewicka, 2020).

• **Secondary natural elements (Porches, Facades and Natural forms)**

Secondary natural elements, including porches, facades, and natural forms, establish meaningful connections with nature.

**Porches:** As important transitional spaces, porches connect the indoors and outdoors, providing areas to enjoy nature (Alexander, 1999; Mousavi & Mahdavinejad, 2013).

**Facades and views:** Designing buildings to take advantage of natural views integrates the built environment with nature (Taghizadeh, 2005; Alexander, 1999), although this principle may face limitations in densely populated urban areas (Angel & Salingaros, 2022).

**Natural forms and patterns:** Using organic forms inspired by nature enhances the visual and tactile harmony of spaces (Alexander, 1999; Zamani, 2008), but some innovative architects may find this approach limiting (Dickinson, 2020).

### • **Abstract natural elements (Natural structure, Geometry, Materials and Symbols)**

Abstract natural elements refer to the symbolic and conceptual integration of natural principles into architectural design. This includes biomimicry, where design solutions are inspired by natural processes and forms (Sarami et al., 2021).

**Natural structure:** Alexander believes that architectural structures inspired by natural forms can provide innovative solutions that are both efficient and aesthetically pleasing (Alexander, 1999). However, critics question whether natural forms are always suitable for architectural contexts, pointing to the limitations of this approach in addressing the specific needs of modern projects (Iwanczak & Lewicka, 2020).

**Geometry and form:** Alexander emphasizes using geometric patterns derived from natural forms such as fractals and spirals, contributing to the harmony and functionality of the design (Alexander, 1999; Mehaffy, 2007). However, some modern architects seeking new and innovative forms may find these principles restrictive, opting for alternative approaches more aligned with contemporary architectural views (Angel & Salingeros, 2022).

**Materials:** Alexander advocates for the use of natural materials such as wood, stone, and clay, as they ensure sustainability and a connection with the local context (Alexander, 1999). However, using these materials may lead to challenges such as high costs and maintenance issues, particularly in projects with limited budgets or resources (Galle, 2020).

**Symbolism:** Alexander believes that symbolic elements related to nature, such as sacred geometry and natural motifs, imbue architectural designs with deeper meaning, enhancing the spiritual quality of spaces (Sarami et al., 2021; Alexander, 1999). However, critics argue that emphasizing symbolism may introduce unnecessary complexity into designs, which may not be suitable for all projects (Dickinson, 2020).

By integrating these natural elements based on Alexander's principles, architects can create living structures that are not only aesthetically pleasing but also deeply connected to their users and the

surrounding environment. This holistic approach ensures that the built environment promotes well-being, sustainability, and harmony. However, there is a pressing need to review and adapt some of these principles to contemporary conditions and demands to continue benefiting from them in addressing new architectural challenges.

### • **Contemporary architecture of Iran**

Contemporary Iranian architecture represents a blend of traditional elements and modern innovations, continually adapting to meet cultural and environmental needs. Elements such as the central courtyard and gardens, which are prevalent in traditional Iranian architecture, remain visible in contemporary designs, signifying cultural continuity and the acceptance of principles aligned with present-day requirements.

#### - **The influence of Christopher Alexander's ideas on contemporary Iranian architecture**

Christopher Alexander's theories, particularly his emphasis on "living spaces" and human-centered design, are evident in certain aspects of contemporary Iranian architecture. The use of central courtyards in modern architecture aligns with Alexander's principle of "Strong Centers" (Mousavi & Mahdavinejad, 2013; Shirazi, 2018). These principles have had a significant impact, especially in the realm of sustainability and efforts to minimize the environmental impact of buildings (Mousavi & Mahdavinejad, 2013). However, some critics argue that these principles require further adaptation and innovation to align with emerging technologies (Angel & Salingeros, 2022).

#### - **Intersection of Alexander's principles with contemporary aesthetic concerns in Iran**

Contemporary Iranian architects have endeavored to adapt Alexander's principles to modern aesthetic approaches. While some designers may consider these principles restrictive, particularly in the context of minimalist forms (Dickinson, 2020), many contemporary works strive to balance tradition and innovation, creating spaces that enhance human interaction (Kamilnia & Hanachi, 2022). **Table 3** These adaptations demonstrate that Alexander's principles can serve as a useful framework in contemporary Iranian architecture, although they require further adjustment to meet current conditions and needs.

Table 2. Alignment of Alexander’s 15 principles with elements of nature. Source: Authors.

Alexander’s 15 principles	Elements of nature	Compatibility	References
Levels of scale	Primary elements (Water, Light, Air, Plants)	High: Hierarchical organization of natural elements at various scales enhances overall spatial experience and environmental quality.	Alexander, 1999; Mahmoodi, 2004
Strong centers	Primary and secondary elements (Water, Light, Air, Plants, Porches)	High: Natural elements like water and plants can act as focal points or centers, enhancing the cohesion and meaning of spaces.	Alexander, 1999; Mahdaviinejad et al., 2013
Boundaries	Primary and secondary elements (Water, Light, Air, Plants, Porches)	High: Defining spaces using natural elements like plants and water features creates clear and cohesive boundaries in design.	Alexander, 1999; Petrusovski, 2012
Alternating repetition	Primary and secondary elements (Water, Light, Air, Plants, Porches)	High: Repetitive use of natural elements with variations introduces rhythm and visual interest in architectural designs.	Alexander, 1999; Zamani, 2008
Positive space	Primary elements (Water, Light, Air, Plants)	High: Natural elements contribute to creating spaces that feel complete and satisfying, enhancing the overall experience.	Alexander, 1999; Petrusovski, 2012
Good shape	Abstract elements (Natural Structure, Geometry)	High: The use of geometric patterns inspired by nature ensures well-proportioned and aesthetically pleasing forms.	Alexander, 1999
Local symmetries	Primary and secondary elements (Water, Light, Air, Plants, Porches)	High: Symmetry in the arrangement of natural elements at a local level helps unify different parts of the design.	Alexander, 1999; Petrusovski, 2012
Deep interlock and ambiguity	Primary and abstract elements (Water, Light, Air, Plants, Natural Structure)	High: Interwoven natural elements and abstract forms create complex and engaging spaces that enhance the sense of place.	Alexander, 1999)
Contrast	Primary and secondary elements (Water, Light, Air, Plants, Porches)	High: Using contrasting natural elements, such as light and shadow or water and stone, highlights differences and increases clarity and vitality.	Alexander, 1999; Taghizadeh, 2005
Gradients	Primary and secondary elements (Water, Light, Air, Plants, Porches)	High: Gradual transitions between different natural elements create a sense of flow and continuity in design.	Alexander, 1999; Mehaffy, 2007
Roughness	Primary and abstract elements (Natural materials)	High: The integration of natural materials and textures adds character and authenticity, aligning with the principle of roughness.	Alexander, 1999
Echoes	Abstract elements (Natural patterns)	High: Repetition of natural patterns and motifs throughout the design creates unity and coherence, improving the overall aesthetic.	Alexander, 1999; Zamani, 2008
Void	Primary and abstract Elements (Open spaces, Natural forms)	High: Creating voids or empty spaces in design provides balance and contrast, essential for achieving harmony and coherence.	Alexander, 1999; Sarami et al., 2021
Simplicity and inner calm	Primary and abstract Elements (Natural light, Simple forms)	High: Striving for simplicity in the use of natural elements fosters inner peace and calm while avoiding unnecessary complexity.	Alexander, 1999; Petrusovski, 2012
Not-separateness	All elements (Integrated natural environment)	High: Ensuring that all natural elements are interconnected and part of a larger whole promotes not-separateness and creates an integrated and harmonious design.	Alexander, 1999; Mehaffy, 2007

## Methodology

This study evaluates 24 significant contemporary buildings across Iran, selected based on their architectural importance. The selection process ensured a representative sample of post-revolutionary architecture using a critical sampling technique, identifying buildings likely to provide valuable insights. These buildings were analyzed through Christopher Alexander’s theory of living structures, using a qualitative approach to assess the presence and role of nature in their design. The case selection technique was based on critical case sampling. This technique involves choosing cases with the potential to offer the most valuable information and

insights into the research question, particularly useful when the goal is to explore and deeply understand complex phenomena. The selected buildings for this study shown in Fig.1.

A systematic evaluation of these buildings was conducted using a Likert-scale questionnaire with 5 levels. The questionnaire was designed to assess the degree of adherence of each building to the 15 principles of Christopher Alexander’s living structure theory. The scale ranged from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was distributed to a panel of 10 experts in architecture and urban planning to ensure robust and informed assessments. The expert panel

Table 3. Summary of research on contemporary Iranian architecture. Source: Authors.

References	Research area	Variables	Research method	Type of analysis	Summary of findings
Daneshjoo et al. 2014	Contemporary Iranian architecture	Natural elements	Case studies	Qualitative, Quantitative	Methods of inspiration from nature in contemporary Iranian architecture with emphasis on cultural continuity
Mousavi & Mahdavinejad, 2013	Sustainable architecture	Sustainability, Design practices	Case studies	Qualitative, Quantitative	Investigated sustainability practices in Iranian architecture, aligned with global environmental trends.
Mahdavinejad & Taleb Hashemi, 2017	Architectural revival	Design quality	Historical analysis	Qualitative	Attention to the quality of design and implementation and its role in realizing the concept of identity
Diba, 2012	Contemporary architecture	Tradition, Modernity	Theoretical	Qualitative	Discussed the combination of traditional and modern elements in Iranian architecture.
Ghobadian, 1392	Contemporary architecture	Tradition, Modernity	Case studies	Qualitative	The styles and trends of Iranian contemporary architecture were introduced and analyzed important buildings.

consisted of seven PhDs in Architecture and three PhDs in Urban Planning.

The sampling method for the research population (respondents) was snowball sampling. Snowball sampling is a non-probability sampling method in which existing study participants recruit future participants from among their acquaintances. As a result, the sample group grows like a rolling snowball. This method is particularly effective in identifying respondents who are experts in specialized fields or topics, ensuring that the panel comprises individuals with relevant expertise.

### Data Analysis Method

The responses were collected and analyzed to rank the buildings from highest to lowest based on their alignment with Alexander’s principles. Each building was scored according to each of the 15 principles, and the total scores were used to determine the overall ranking. The highest-scoring buildings were identified, and the top three were selected for in-depth analysis. This analysis included a comprehensive review of how each building embodied Christopher Alexander’s principles of living structures. Statistical analyses were then conducted based on the components introduced by Alexander, leading to concrete findings regarding the presence of nature and its elements in contemporary Iranian buildings.

### Results

After collecting expert opinions, the final matrix of contemporary buildings was compiled based on the average ratings, as shown below:

The findings of this research indicate that post-revolution contemporary Iranian architecture has incorporated Christopher Alexander’s “living structure” principles to varying degrees in its designs. Overall, component analysis reveals that some buildings have successfully integrated natural elements, creating spaces with coherence and harmony. However, some buildings require revisions to establish a stronger connection with the natural environment.

#### • Prominent components in successful designs

Buildings such as Tehran Book Garden and Mellat Cinema Complex have effectively implemented important principles like simplicity and inner calm, contrast, and gradient. For instance, Tehran Book Garden uses open spaces and gradual transitions between different sections (gradient), creating a fluid and pleasant spatial experience for users. Similarly, Mellat Cinema Complex employs symmetry and smart contrasts, creating a space that not only appeals aesthetically but also integrates different functions effectively.

#### • Low-Scoring components and areas for improvement

Some buildings, like the Malek National Library

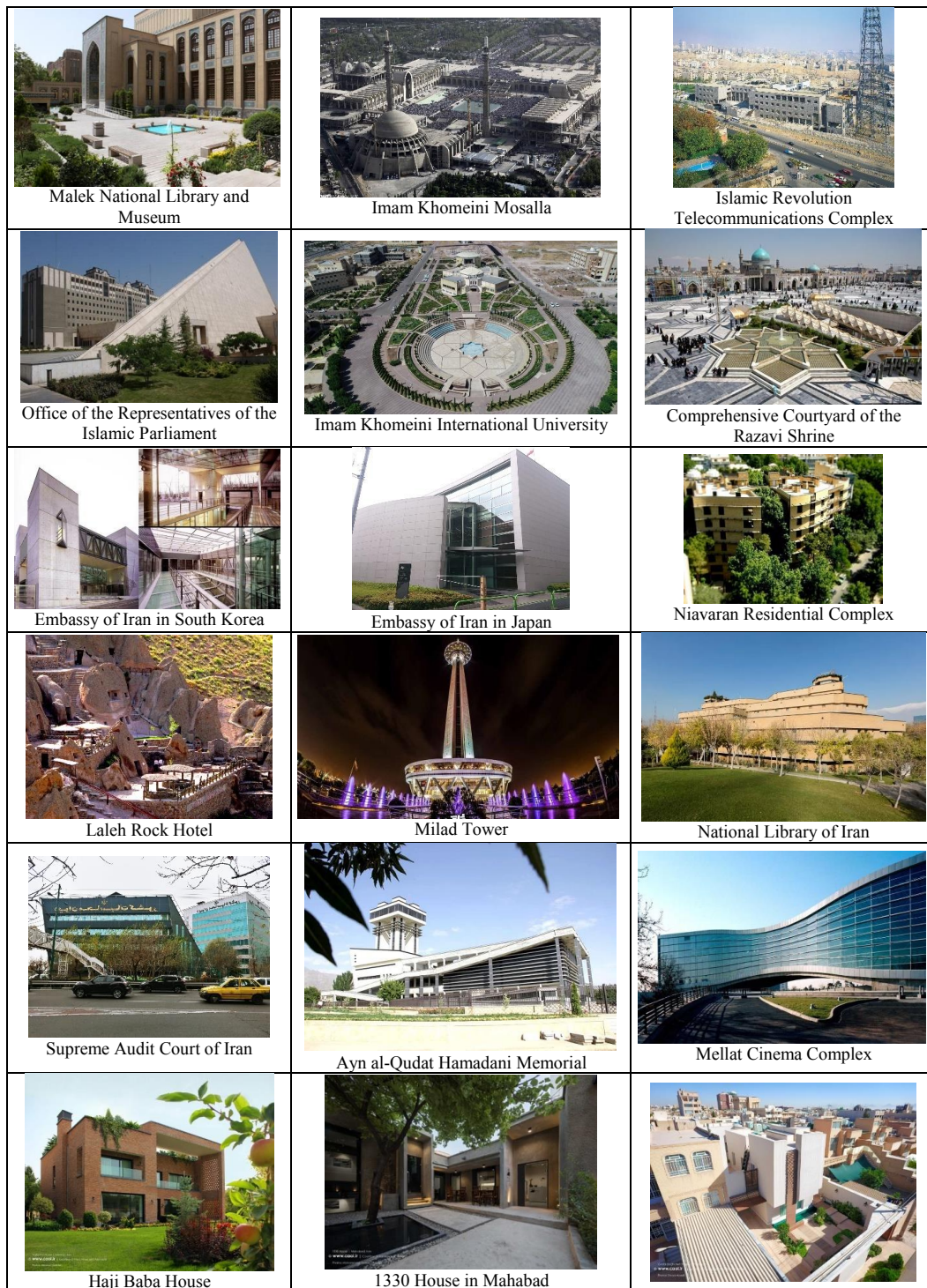


Fig. 1. Pictures of selected buildings. Source: Authors archive.

and Museum and the Islamic Revolution Telecommunications Complex, performed poorly in components such as contrast, good form, and ambiguity. These buildings lack the necessary complexity in design, which could enrich spatial experience and improve

interactions between users and the environment. For example, the *Malek National Library and Museum* fails to sufficiently draw inspiration from natural patterns in its form, creating a monotonous space with minimal connection to nature.

### • Interpretation of components and correlations

Correlation analysis among the various components in this study reveals that certain components are significantly related. For example:

The Strong centers and Void spaces components have a high correlation. This indicates that buildings with strong centers often make effective use of empty spaces to draw the user's attention to focal points. For instance, in *Tehran Book Garden*, the use of open spaces alongside strong focal points creates a sense of continuity and cohesion in the space.

The components of Symmetry and Ambiguity show a moderate correlation, meaning that symmetrical designs can also incorporate layers of complexity and ambiguity, adding spatial depth. For instance, *Mellat Cinema Complex* uses symmetry alongside more intricate elements, enhancing the dynamic interaction between the user and the space.

A weak correlation between good form and coherence suggests that although many buildings have good forms, these forms do not necessarily contribute to the overall coherence of the design. For example, the *Islamic Revolution Telecommunications Complex*, despite having distinct forms, has not achieved a coherent and dynamic structure.

The analysis of components and correlations indicates that certain architectural elements naturally interact and reinforce each other. For example, the use of strong centers and void spaces can contribute to the overall balance of a design, whereas the lack of coherence between good form and overall cohesion demonstrates that beautiful forms do not always translate into effective and functional spaces. Architects are advised to pay closer attention to these correlations and consciously utilize them in future designs to create more cohesive and nature-aligned spaces.

### Discussion

The integration of natural elements in contemporary Iranian architecture, guided by Christopher Alexander's theoretical framework, reveals both successes and areas for improvement. This discussion addresses the implications of the results obtained

from the evaluation of 24 selected buildings across three distinct periods.

The findings show that Tehran Book Garden and Mellat Cinema Complex, with scores of 60.5 and 59.2 respectively, rank the highest. These buildings exemplify the successful integration of Alexander's principles, particularly in simplicity and inner calm, contrast, and gradient. High scores in these components suggest that these buildings have effectively created balanced designs that resonate with human psychological and physiological needs. The thoughtful combination of natural elements such as light, air, water, and plants has significantly enhanced the aesthetic and functional quality of these spaces, increasing overall user satisfaction and well-being.

In contrast, the Malek National Library and Museum and the Office of the Representatives of the Islamic Parliament, with lower scores of 42.7 and 44.5 respectively, exhibit deficiencies in components like Contrast, good form, and Ambiguity. These buildings lack the complexity and layered meanings that are crucial for creating dynamic and engaging architectural spaces. The lower scores in these components highlight the need for greater attention to aesthetic coherence and the subtle application of natural elements to enhance the architectural narrative and user experience.

The correlation analysis provides further insights into how different elements interact in architectural designs. Strong correlations, such as between strong centers and void spaces (0.84) and between strong centers and ambiguity (0.77), indicate that well-defined centers are often associated with the effective use of open and complex, layered spaces. These relationships suggest that focusing on creating strong focal points in a design can naturally lead to more cohesive and engaging spaces. Standard deviation analysis reveals which components are consistently applied and which vary significantly across different buildings. For instance, "Positive Space" and "Ambiguity" show greater variation, indicating that their implementation varies widely, possibly due to differing architectural interpretations and contextual adaptations. On the other hand, components such as "Alternating Repetition" and "Contrast" show less

variation, suggesting that these foundational elements are consistently integrated into contemporary Iranian architecture.

In examining how Alexander's principles intersect with contemporary aesthetic concerns in Iran, it can be concluded that Alexander's emphasis on human-centered design and the integration of nature aligns with contemporary needs. This approach resonates with many efforts by Iranian architects to combine traditional elements with modern innovations. However, some critiques suggest that an overemphasis on Alexander's traditional principles may be restricting when confronted with more modern and minimalist design trends. As a result, there may be tensions between these principles and some contemporary aesthetic movements that seek simpler, less ornamental forms. This study shows that in contemporary Iranian architecture, integrating Alexander's principles can result in spaces that are both functionally and aesthetically rich. Successful examples demonstrate that thoughtful application of these principles can create spaces that not only connect with their users but also promote sustainability and cultural continuity. However, for future projects, it is necessary to apply these principles with a critical perspective, considering current needs and trends, to create more harmonious and cohesive designs.

## Recommendations

**Advanced education and awareness:** Architects should receive more training on the practical application of Alexander's principles, focusing on components that scored lower in the evaluation, such as good form and Ambiguity.

**Design guidelines:** Developing comprehensive design guidelines that emphasize the integration of natural elements and Alexander's principles could standardize and enhance the quality of architectural practices across Iran.

**Continuous evaluation:** Implementing a system for continuous evaluation and feedback throughout the design process could help identify areas for improvement early on, ensuring that final designs are more cohesive and aligned with the principles of living structures.

This study highlights the current state of natural element

integration in contemporary Iranian architecture and offers valuable insights for future developments. By fully embracing Christopher Alexander's framework, architects can create environments that are not only sustainable but also harmonious and enriching for their users.

## Conclusion

This research investigated the integration of natural elements in post-revolutionary contemporary Iranian architecture within the framework of Christopher Alexander's theoretical principles. The primary aim of this study was to understand how Alexander's principles, particularly those expressed in his seminal works *A Pattern Language* and *The Nature of Order*, have been applied in modern Iranian architecture to promote sustainability, cultural continuity, and human well-being. The study began with a review of the growing trend of integrating natural elements into Iranian architectural design. This trend, aligned with the global movement towards sustainable and human-centered design, aims to create environments that are both functional and connected to the natural world. Alexander's principles, which emphasize harmony, coherence, and the seamless integration of natural elements, formed the theoretical basis of this research. Concepts such as Strong centers, Boundaries, Positive space, and Not-separateness support designs that resonate with their surroundings and users, promoting sustainability and well-being. To examine the presence of nature in contemporary Iranian architecture, this study selected 24 significant buildings from the post-revolutionary period across three distinct timeframes and evaluated them according to Alexander's 15 principles of living structures. This evaluation was conducted by a group of architecture and urban planning experts, providing a robust framework for analyzing how these principles have been integrated into modern designs.

The analysis of the research results revealed that the integration of Alexander's principles in contemporary Iranian architecture has seen successes, but also areas that need improvement. Successful examples like Tehran Book Garden and Mellat Cinema Complex demonstrated that thoughtful application of Alexander's

principles can lead to spaces that are both functionally and aesthetically successful. These spaces, incorporating components such as Simplicity and inner calm, Contrast, and Gradients, offer users a harmonious and pleasant experience, aligning with their psychological and physiological needs. Conversely, some buildings, such as the Malek National Library and Museum and the Office of the Representatives of the Islamic Parliament, exhibited shortcomings in components like contrast, good form, and ambiguity. These deficiencies highlight the need for greater attention to aesthetic coherence and a more precise application of natural elements. Moreover, the findings suggest that Alexander's principles must be adapted to the specific architectural and cultural contexts of Iran to achieve better outcomes. The analyses also show that Alexander's emphasis on human-centered design and nature integration aligns with current aesthetic trends in Iran, particularly in efforts to combine traditional elements with modern innovations. However, some criticisms indicate that overemphasis on Alexander's traditional principles may be restricting when confronted with more modern, minimalist trends. Therefore, achieving a balance between Alexander's principles and contemporary aesthetics requires rethinking and adapting these principles to current needs and trends.

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