АРХИТЕКТУРА ЗДАНИЙ И СООРУЖЕНИЙ. ТВОРЧЕСКИЕ КОНЦЕПЦИИ АРХИТЕКТУРНОЙ ДЕЯТЕЛЬНОСТИ / ARCHITECTURE OF BUILDINGS AND STRUCTURES. CREATIVE CONCEPTS OF ARCHITECTURAL ACTIVITY

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PRINCIPLES OF ECOLOGICAL AND BIOPHILIC ARCHITECTURE IN THE DESIGN OF IRANIAN RESIDENTIAL COMPLEXES IN ORDER TO IMPROVE THEIR QUALITY

Research article

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Abstract

The contemporary era grapples with a notable disconnection from nature among urban dwellers, a concern of paramount importance. Architectural and urban spaces, ostensibly designed for direct communion with the natural world, have regrettably fallen short in the face of environmental repercussions, sterile urban landscapes, and architectural structures bereft of alignment with human natural needs. Among these spaces, housing, a pivotal element of daily life, has suffered a pronounced decline in spatial quality throughout the processes of modernization and industrialization. A promising avenue to enhance the quality of residential environments in our current epoch lies in the adoption of modern architectural paradigms, notably ecological and biophilic designs. These innovative architectures, rooted in a profound connection with nature, stand poised to address the spiritual and psychological needs of contemporary individuals, offering a transformative approach to crafting living spaces that align with the natural world and cater to the well-being of inhabitants. This study employs an applied research methodology, focusing on the descriptive-analytic approach, with data collection centered on the scrutiny of library resources and subsequent content analysis. The findings underscore the potential for elevating the qualitative standing of residential complexes in Iran by localizing the principles and criteria of ecological and biophilic architecture. Through the assimilation of these indigenous principles into the design and implementation of housing projects, a qualitative upgrade is achievable. Such an approach not only enhances the overall quality of residential complexes but also fosters more favorable conditions for the well-being and satisfaction of their occupants.

Keywords: residential architecture, biophilic, ecologic, environmental quality.

ПРИНЦИПЫ ЭКОЛОГИЧЕСКОЙ И БИОФИЛЬНОЙ АРХИТЕКТУРЫ В ПРОЕКТИРОВАНИИ ИРАНСКИХ ЖИЛЫХ КОМПЛЕКСОВ С ЦЕЛЬЮ ПОВЫШЕНИЯ ИХ КАЧЕСТВА

Научная статья

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Аннотация

Современная эпоха сталкивается с заметным отрывом городских жителей от природы, и эта проблема имеет первостепенное значение. Архитектурные и городские пространства, якобы предназначенные для непосредственного общения с миром природы, к сожалению, не оправдали ожиданий: экологические последствия, стерильные городские ландшафты и архитектурные сооружения не соответствуют естественным потребностям человека. Среди этих пространств жилье, являющееся ключевым элементом повседневной жизни, подверглось заметному снижению качества пространства в ходе процессов модернизации и индустриализации. Перспективным направлением повышения качества жилой среды в нашу эпоху является внедрение современных архитектурных парадигм, в частности экологического и биофильного дизайна. Эти инновационные архитектуры, основанные на глубокой связи с природой, способны удовлетворить духовные и психологические потребности современных людей, предлагая трансформационный подход к созданию жилых пространств, которые соответствуют миру природы и заботятся о благополучии обитателей. В данном исследовании использована прикладная методология, сфокусированная на описательно-аналитическом подходе, а сбор данных сосредоточен на изучении библиотечных ресурсов и последующем контент-анализе. Полученные результаты подчеркивают потенциал для повышения качественного уровня жилых комплексов в Иране путем локализации принципов и критериев экологической и биофильной архитектуры. Благодаря внедрению этих местных принципов в проектирование и реализацию жилищных проектов можно добиться качественного улучшения. Такой подход не только повышает общее качество жилых комплексов, но и создает более благоприятные условия для благополучия и удовлетворенности их жильцов.

Ключевые слова: жилая архитектура, биофилическая, экологическая, качество окружающей среды.

Introduction

In the realm of constructing residential buildings today, a notable concern arises from the disproportionate focus on quantity at the expense of addressing human needs, both psychologically and structurally. This emphasis on sheer volume has led to a decline in the overall quality of built environments. The oversight in fostering harmonious coexistence among individuals, architecture, and nature has resulted in a failure to meet spiritual and psychological human needs. The inadequate integration of nature into the physical living environment has contributed to the rise of various mental, physical, and social

ailments in societies, making it a pivotal factor in contemporary urban human challenges. Addressing these issues, innovative approaches in architecture have surfaced, characterized by ecological and biophilic principles. Ecological architecture proposes a design approach that establishes a symbiotic relationship between architecture and the natural environment, minimizing harm to the ecosystem and mitigating negative environmental impacts. In tandem, biophilic architecture aims to cater to diverse biological and psychological human needs. This research delves into the application of these principles within the context of designing residential complexes in Iran. The study employs an applied research method with a descriptive-analytic research nature. The findings underscore that by localizing the principles and criteria of ecological and biophilic architecture, aligning them with the quality indicators of housing in Iran, and integrating these native principles into the design and implementation of residential complexes, a substantial enhancement in their qualitative status can be achieved.

Main results

2.1. Ecological architecture

Ecological architecture, alternatively referred to as sustainable or green architecture, embodies a design and construction philosophy geared towards mitigating the adverse effects of buildings on the environment. This approach entails the development of structures that exhibit environmental responsibility and resource efficiency at every stage of their existence, spanning from initial planning and design through construction, operation, maintenance, renovation, and eventual demolition [1]. In alignment with this ethos, ecological architecture places emphasis on the following principles:

Designing to imbue significance into the surroundings, Formulating solutions for challenges and design issues rooted in environmental considerations, Crafting designs that respond to both environmental conditions and human needs, Integrating nature into the design process, with a keen focus on evaluating the impact of design choices on the environment.

2.2. Principles of ecological architecture

Luis De Garrido has developed certain ecological indicators to carry out green architecture that fits perfectly into the natural ecosystem. So principles that can nurture ecological architecture are given in the table below (Table 1)

Table 1 - Principles of ecological architecture with examples [2]

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Principles of ecological architecture	Example
Optimal use of natural and artificial resources	Management of Water Resources: Gathering rainwater and repurposing wastewater
Reduction in level of energy consumption	Application of Smart Systems: Adjusting shade angles, regulating ventilation systems, and controlling lighting in response to external environmental changes
Promoting the use of renewable resources	Renewable Energy Systems, like solar panels and wind turbines
Cutting back on waste and emissions	Utilization of Ecological Materials: Incorporating environmentally friendly, recyclable, and intelligent materials
Limiting maintenance and building cost of buildings	Synchronizing with Nature and Climate: Employing natural ventilation, optimal positioning of openings, appropriate lighting, and environmentally conscious design
Improve the quality of life of occupants	Fusion of Architecture and Green Spaces: Incorporating green roofs, verdant facades, and expanding ground-level greenery. This involves shading, preserving sunlight, minimizing and adjusting temperature, and managing humidity levels

2.3. Biophilia and biophilic architecture

Biophilia refers to the natural and inherent human bond with the environment and living entities. Coined by biologist Edward O. Wilson in the 1980s, the concept suggests that humans possess an instinctive attraction to nature and various life forms. This affinity is thought to have its roots in our evolutionary past when humans lived in closer proximity to the natural world. On the other hand, biophilic architecture is a design approach that strives to infuse aspects of nature into constructed spaces. Its objective is to develop environments that promote well-being, alleviate stress, and elevate overall quality of life by integrating natural elements, patterns, and materials. The aim is to craft surroundings that resonate with our intrinsic connection to the natural world [3].

2.4. Biophilic design approaches

Biophilic principles can manifest in design through various methods, broadly categorized into two main approaches.

The initial approach involves the direct integration of nature into design. This entails maximizing the presence of nature within human spaces by incorporating elements such as plants, natural light, and ventilation. Traditional construction materials

like stone and wood can be replaced with their natural counterparts. Interior and exterior spaces can feature images, symbols, and signs inspired by natural landscapes, fostering a direct and unmediated connection to nature [4].

On the other hand, the second approach focuses on the indirect utilization of nature's features and properties in design. This involves researching intricate geometric patterns found in natural elements and applying them to architectural structures. By creating complexity reminiscent of the natural environment, designers aim to evoke the appreciation humans have for such intricacy. This form of connection to nature is experienced more indirectly and on a cognitive level [5].

2.5. Principles of biophilic architecture

After studying and examining biophilic architecture some of the basic principles of this type of Architecture have been identified as described in Table 2:

Table 2 - Principles of biophilic architecture and examples [6]

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Principles of biophilic architecture	Example
Prospect	Lighting in the field of vision (windows - bright walls); the possibility of going to a far point for a better view; Horizon - the presence of the image of the sky (sun, mountains and clouds); The existence of the vision corridor
refuge	The pattern of the tents (short roof and the view similar to tree branches on top
presence of water	low brightness with reflective surfaces (association of clean water); running water (representing cleanliness and the presence of oxygen in water) symbolic forms of water;
Biodiversity	Variety of plants inside and outside the building (tall trees, plants, flowers); windows designed to see nature scenery; outdoor nature with thick plants and animals;
Variability of the senses	Changing the color of the environment, temperature, air flow, texture and light over time and in different spaces; natural rhythms and processes (ventilation and natural lighting)
Imitation of nature	Designs inspired by nature; Using patterns - natural forms and textures; fractal patterns;
Feeling alive	Use of decor, natural materials, decorations, objects and spaces whose main purpose is to create a feeling of joy, surprise and fun.
Mystery	Complexities discovered by people, The richness of information that encourages exploration; curved surfaces that gradually open the exponential

2.6. Components of housing quality assessment and their principles

Ensuring housing quality stands as a primary objective within housing programs of developed nations. In Iran, a country propelled through the modernization process, the challenge lies in effectively delivering high-quality housing amidst accelerated changes. The focal point of housing programs and policies revolves around overcoming this challenge. The overarching aim is to facilitate each household's access to housing that aligns with their specific needs, characterized by superior quality, within an environment as conducive as possible, and with the desired occupancy [4]. These aspirations are encapsulated in the "Choosing Quality: Homes that are Suitable for All" housing statement, issued in December 2000. Formerly conducted on a quinquennial basis, inspections have been an annual affair since 2002, ensuring a regular assessment of implemented measures. The comprehensive evaluations encompass a spectrum of qualitative facets. In the pre-1990s era, the Housing Survey primarily focused on scrutinizing adherence to appropriate housing standards, encompassing fundamental prerequisites for housing units [7]. Subsequently, diverse evaluation frameworks emerged, such as the housing health and safety rating system, along with the housing quality component system [8]. These standards, in turn, delineate criteria for both housing and residential environments. The housing quality component system proves versatile, applicable not only to social housing but also across various housing types, serving to enhance residential designs. Consequently, a continual critique of residential space quality is imperative to attain desirability in this realm. The significance of this evaluation extends to all internal and external spaces related to housing. The evaluation involves assessing the satisfaction, comfort, or well-being levels

of residents. Leveraging these components allows for a comprehensive examination spanning individual, collective, and national levels (Table 3).

Table 3 - Housing Quality indicators and their criteria

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Quality indicator	Criteria
Physical and spatial	The qualitative examination of housing necessitates a thorough consideration of its physical attributes. These elements extend beyond mere compliance with minimum standards for factors like household density, individual housing density, individual rooms density, and per capita floor area. Given that much of our environmental perception is visually driven, and visual perception is fundamentally rooted in the physical realm, the physical quality of housing holds a significant role. This quality is intimately tied to critical concepts such as identity, vitality, familiarity, and memorability. Essentially, the physical components of housing serve as the framework for life, shaping the landscape in which social interactions unfold. Consequently, enhancing physical quality requires a comprehensive assessment of factors like land size and shape, financial resources, human resources, building materials, technology, and effective management and supervision.
Structural	Designing and overseeing technical aspects, as well as adhering to engineering standards during the implementation of structures, underscores the importance of a well-conceived structure. The scrutiny involves assessing the resilience of building materials relative to climatic conditions and the production state, employing methods for reinforcement, and ensuring compliance with statutes and regulations. It is imperative to acquaint engineers with contemporary construction techniques, continually updating their knowledge in the realms of design and implementation. Within this framework, the evaluation encompasses the structure itself, the materials used, equipment considerations, maintenance standards, and the cost associated with housing repairs. This comprehensive approach ensures that the technical aspects align with established engineering standards, promoting effective and sustainable structures.
Functional	Functional quality encompasses various aspects, including the quantity and dimensions of rooms, as well as the appropriateness of housing and its suitability for the needs of family members. Evaluation systems often incorporate an examination of housing from an energy perspective within this category. By taking into account the provision of adequate facilities and services, the overall acceptability of housing improves, contributing to both housing health and, consequently, the well-being of its residents. Prioritizing these factors enhances the functional quality of housing, making it more conducive to a healthy and comfortable living environment.
Environmental	The assessment of housing is significantly influenced by the residential environment, serving

	as a pivotal factor in all evaluations. A residence situated in an unsuitable environment is unable to fulfill the secondary needs of its occupants, particularly in terms of environmental quality. Environmental quality encompasses diverse facets of the living environment, spanning the standards of housing facilities, safety, security, access, housing types, and surrounding features, considering aspects such as functionality, visual appeal, and physical characteristics. Urban facilities and infrastructures form an integral part of this evaluation, constituting a broad spectrum of physical elements that facilitate various urban functions. These elements contribute to the composition and formation of urban spaces, playing a crucial role in various aspects of residence, activity, rest, leisure, and, overall, in enhancing the quality of urban life. In essence, the quality of the residential environment and its associated facilities is a cornerstone in determining the overall quality of housing and the urban living experience.
The human needs	Assessing the quality of housing involves a comprehensive evaluation of satisfaction across various dimensions. These include the physical, functional, social, cultural, identity, aesthetic, security, facilities, equipment, accessibility, and neighbor-related aspects [8]. Satisfaction in these diverse categories forms a critical component of the overall quality assessment of housing. By considering these multifaceted elements, a more nuanced and holistic understanding of the living experience is achieved, encompassing not only the tangible features of the dwelling but also its social and cultural context, ultimately contributing to a more accurate and inclusive measure of housing quality.

2.7. Compilation of housing quality components based on ecological and biophilic principles

As mentioned, The Housing Quality Assessment involves a thorough examination and measurement of a housing's desirability across five distinct yet interconnected areas. Meeting the standards set in all these components signifies that a housing unit is qualitatively desirable and appropriate. However, the current research goes beyond merely assessing the desirability of Iranian urban housing based on existing standards. It seeks to elevate the quality of domestic residential complexes by incorporating ecological and biophilic architectural approaches. The aim is to align the principles advocated by the global field of ecological and biophilic architecture with the components of Housing Quality Assessment in Iran. This localization process involves adapting these principles to the specific indicators of housing quality in the Iranian context. By doing so, the research contends that the quality of Iranian residential complexes can be enhanced, fostering a synergy between internationally recognized ecological and biophilic architectural principles and the unique criteria used in the assessment of housing quality in Iran (Table 4). This approach represents a comprehensive strategy to not only evaluate but also improve the quality of residential complexes within the Iranian urban landscape.

Table 4 - Compilation of qualitative indicators of residential complexes based on the principles emphasized by ecological and biophilic architecture

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Indicators of housing quality assessment and its criteria		Ecological architecture	Biophilic architecture
Physical and spatial quality indicator	Identity, life, acquaintance and memorabilia, scope and shape of the land, financial resources, human resources,	**Optimal use of natural and artificial resources** (Buildings with ecological architecture should pay attention to	**Feeling alive** (Incorporating design, organic elements, embellishments, items, and environments primarily intended to

	building materials, technology,management and supervision	optimal resource management. For example, using intelligent systems to control ventilation, lighting and energy consumption in buildings can help this goal*)*	evoke sensations of joy, delight, and amusement: an outlook on the components of nature, living systems, and natural phenomena; sensory experiences involving hearing, touch, smell, or taste, eliciting purposeful and positive perspectives towards nature, living systems, or natural processes; unpredictable and transient connections with nature that can be statistically examined but resist precise prediction; raw materials and elements reflecting local ecology or geology with minimal alteration, establishing a distinctive sense of location) **Mystery** (The prospect of gaining additional insights through indistinct panoramas that inspire further exploration into the surroundings; intricacies unearthed by individuals; gently unfolding curved surfaces that progressively reveal exponential complexities)
Structural Quality Indicator	Structure, materials, standard maintenance equipment and housing repair costs	**Limiting maintenance and building cost of buildings** (Rainwater collection and wastewater recycling)	**Refuge** (Canopy design: a low ceiling providing a confined space with a comparable overhead view of tree branches; a secluded spot offering protection from environmental elements or routine activities, ensuring shielding from both behind and above) **Imitation of nature** (Organic shapes and designs: Raw materials and elements from nature, minimally processed to mirror the surrounding ecology or geology, thereby crafting a distinct sense of location)

Functional Quality Indicator	Number of rooms, dimensions of rooms, access to housing and its suitability for family members, examination of housing from the energy aspect	**Reduction in level of energy consumption** Promoting the use of renewable resources. (reduction of energy losses through the installation of effective thermal insulation, in particular through the judicious use of materials,minimization of energy needs, in particular through the orientation of the building according to its exposure to the sun and the location of the site,collection of natural energies, for example with the installation of natural ventilation and cooling systems production of alternative energies such as solar or wind power to reduce external energy inputs and, if possible, create energy-positive buildings	**Presence of water** (Dim lighting paired with reflective surfaces; Flowing water; symbolic representations of water. A space with a notable water presence feels engaging and enchanting. Fluidity, sound, lighting, proximity, and accessibility collectively influence whether a space is invigorating, soothing, or a combination of both.Thermal & Airflow: Subtle shifts in air temperature, relative humidity, and air currents affecting skin and surface temperature that emulate a natural environment)
Environmental Quality Indicator	Various aspects of the living environment, standard of housing facilities,safety,security, accesses, type of Housing and its surrounding features functionally, visually, physically	**Cutting back on waste and emissions** Recycled and environmentally friendly materials should be used to reduce waste production in the building.	**Biodiversity Variability of the senses** Observation of natural elements, living systems, and processes; Sensory experiences including auditory, tactile, olfactory, or gustatory stimuli fostering deliberate and positive perspectives toward nature, living systems, or natural processes; Unpredictable and transient connections with nature that can be statistically analyzed but defy precise prediction; Subtle fluctuations in air temperature, relative humidity, and air currents impacting skin and surface temperature to emulate a natural environment; The opportunity to reach a distant point for an enhanced view of the horizon; Utilization of varying intensities of light and shadow that evolve over time,

			replicating natural conditions; Consciousness of natural processes, particularly the seasonal and temporal changes characteristic of a healthy ecosystem; Natural materials and elements, minimally processed to mirror the local ecology or geology, establishing a distinct sense of place. **Presence of Water**
The human needs Quality indicator	satisfaction with housing in terms of physical, functional, social, cultural, identity, aesthetic, security, facilities, and equipment, how to access,neighbors	**Improve the quality of life of occupants** (Creating green roofs, green facades and increasing green space on the ground.Shading, maintaining sunlight, reducing and modulating temperature and humidity)	**All of the above: Feeling alive, Imitation of nature Mystery Presence of Water Biodiversity Variability of the senses Presence of Water Prospect**

Conclusion

For years, ecological and biophilic architectural principles have been integral to designing diverse building types in developed countries, spanning residential, educational, cultural, commercial, and service structures. Extensive research and projects have demonstrated that applying these principles enhances buildings environmentally, functionally, and structurally. This study, however, focuses on the unique challenge of implementing these principles in Iranian residential architecture to elevate the quality of domestic housing complexes, considering existing infrastructure limitations. The solution proposed involves localizing ecological and biophilic architecture principles, adapting them to the design of contemporary residential complexes in Iran, and thereby enhancing their overall quality. The author establishes a specific model incorporating global principles of ecological and biophilic architecture, aligning them with qualitative housing components such as Physical and Spatial Quality, Structural Quality, Functional Quality, Environmental Quality, and Human Needs. Each principle is integrated into its corresponding indicator, resulting in a native model tailored for evaluating Iranian residential complexes. This model, outlined in Table 4, can be effectively employed in the design and implementation process of modern Iranian residential complexes to elevate their quality and create more favorable living conditions for residents.

Конфликт интересов

Не указан.

Рецензия

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Conflict of Interest

None declared.

Review

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Список литературы на английском языке / References in English

1. Mohamadpour A. Exploring the Climatic Solutions of Ecological Architecture in Iran / A. Mohamadpour, F. Fandarski // First National Conference on Sustainable Architecture and Urban Spaces. — 2015. — P.1-11.

2. Oxford Advanced Learner's Dictionary. — Oxford, 2010.

3. Sharifi A. Examination of the Pattern of Natural Environment in Urban Architecture and the Use of Biophilica Theory (City In the Garden) and Its Comparison with the Approach of Urbanism in the Isfahan School / A. Sharifi, M. Azarpira // Second National Conference on Sustainable Urban Architecture and Landscape. — 2017. — P. 1-11.

4. Jafari Kh. Biophilic Architecture and Sustainable Development / Kh. Jafari, A. Yousofi. — Published by Sima Danish, first edition, Tehran, Iran. — 2018. — P. 1-27.

5. Kellert S.R. Biophilic for Life / S.R. Kellert. — Island Press, Washington. — 2005. — P. 8-28.

6. Kellert S.R. Biophilic Design / S.R. Kellert // The Theory, Science, and Practice of Bringing Buildings to Life. — NewJersy. — John Wiley & sons, Inc. — 2008. — 5-30 p.

7. Ahari Z. Aminizadid Sh. Experiences of Different Countries in Housing Supply / Z. Ahari, Sh. Aminizadid // the National Land and Housing Agency. — 2000. — P. 797.

8. Molalzade M. Review of Social Housing Policies in the World / M. Molalzade // Collection of articles of the second seminar on housing development in Iran, Tehran, publications of the National Land and Housing Organization. — Ministry of Housing and Urban Development, 2010. — № 2. — P. 30-45.

9. Zebardast E. Comparison of Housing Policies / E. Zebardast // Human Housing Conference Habitat One and Two. — 2010. — P. 1-16.

10. Zahri S. Comparison of the Compatibility of Indigenous Architectural Components with the Principles and Criteria of Ecological Design / S. Zahri // National Conference on Knowledge and New Technology in Engineering Sciences in the Technological Age. — 2018. — P. 1-8.

11. Khoshfar Gh. Application of Social Indicators in Housing Development, collection of articles of the second seminar on housing development policies in Iran / Gh. Khoshfar // Tehran: Ministry of Housing and Urban Development, National Land and Housing Organization. — 2010. — № 2. — P. 7-14.

12. Asefi M. Redefining the Design Patterns of Desirable Contemporary Iranian – Islamic Housing with Qualitative Evaluation of Traditional Houses / M. Asefi, E. Imani // Chronology of Islamic Architectural Research. — 2018. — №11. — P. 56-73.