Research Paper: Evaluating Biophilic Architectural Indicators in Rural Housing and Strategies for Sustainable Rural Housing (Case Study: Zabol County, Southeastern Iran)

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ABSTRACT

Purpose: In recent decades, architecture has increasingly shifted toward sustainability, driven by climate change, environmental crises, and technological advancements. Among the key approaches in this transformation is biophilic architecture, which emphasizes achieving a balance between humans, nature, and the built environment. This approach is particularly significant in the context of rural housing, where indigenous principles and close interaction with nature often shape architecture. This study examines the current state of rural housing architecture in Zabol County and assesses its alignment with the principles of biophilic architecture to propose strategies for its revitalization.

Methods: The research adopts a descriptive-analytical approach and is based on data collected through a survey. The study population consists of residents from five villages in the central district of Zabol County. Using Cochran's formula, a sample size of 347 individuals was determined. Experts confirmed the validity of the questionnaire, and its reliability was verified by administering 30 questionnaires and calculating a Cronbach's alpha coefficient greater than 0.70.

Results: The test results indicated that the principles of biophilic architecture in rural housing were statistically significant at a level below 0.05 ($p = 0.000$). The direction of significance highlights the absence and lack of adherence to biophilic architecture principles in the region's rural housing. The lowest mean score (1.580) was related to the preservation of vegetation and interaction with nature, while the highest mean (2.435) corresponded to attention to climate and geographical conditions. The overall test means of 2.103 further confirm the weak presence of biophilic architecture principles in the rural housing of the region. To revive and enhance the biophilic approach in rural housing architecture, five key strategies were proposed: (1) support and formulation of indigenous housing legislation, (2) formulation of indigenous housing architecture patterns, (3) utilizing tourism to promote indigenous housing, (4) mandating and monitoring the use of indigenous materials, and (5) using indigenous vegetation in housing spaces.

Conclusion: The findings revealed that new rural housing in the Zabol region has largely disregarded biophilic architectural principles. Considering these conditions, several measures must be implemented, including enforcing compliance within local communities through housing construction regulations and strengthening oversight mechanisms to ensure adherence.

Keywords:
Biophilic architecture, Rural housing, Sustainable development, Zabol County, Iran

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1. Introduction

In recent decades, architecture, one of the most influential fields shaping the human environment, has undergone profound transformations, driven by climate change, environmental crises, technological advancements, and sustainability imperatives (Andric et al., 2021: 339). In response to these challenges, contemporary architecture has adopted various approaches, each addressing critical issues such as energy consumption, environmental sustainability, human–nature interaction, and the mitigation of urban and rural construction impacts from different perspectives (Quy et al., 2022: 6). Among these, biophilic architecture has emerged as a key paradigm in sustainable design, emphasizing the critical integration of built structures with natural environments (Grazuleviciute-Vileniske et al., 2022: 7). Rooted in the vernacular architectural traditions of many societies, this approach incorporates natural elements, eco-friendly materials, minimal human intervention, and biological considerations to create structures that harmonize with ecosystems while reducing environmental degradation (Wolfs, 2015: 11). While many architectural schools have historically viewed nature as external or even intrusive, biophilic design seeks to dissolve the boundaries between natural and built environments, aiming to establish a sustainable balance among humans, nature, and architecture (Zhong et al., 2022: 118). This methodology not only enhances quality of life but also reduces reliance on non-renewable resources, improves energy efficiency, and strengthens climate resilience (Zare et al., 2021: 19).

The principles of biophilic architecture, particularly in rural housing, which is traditionally rooted in harmony with nature and the application of indigenous knowledge, hold exceptional significance (Mustafa Shukur, 2022: 4). Unlike urban areas dominated by industrial materials and modern technologies, rural settlements have historically evolved in response to climatic conditions, local culture, and the availability of natural materials. In rural architecture, structural design, material selection, spatial orientation, and the organization of interior and exterior spaces often reflect biophilic principles (Musthafa, 2024: 143). For instance, many traditional dwellings utilize wood, clay, adobe, and stone as primary materials, incorporate sloped roofs to channel rainwater, and feature expansive verandas that mediate between indoor and outdoor environments. These elements not only enhance thermal comfort and reduce energy consumption but also foster a connection between humans and nature, thereby contributing to regional ecological balance. However, economic shifts, the proliferation of modern lifestyles, and the influx of industrial materials have disrupted vernacular architectural practices (Tabassum & Park, 2024: 5), causing rural structures to diverge from biophilic principles (Xu et al., 2023: 9). These changes have exacerbated energy demands, diminished the quality of rural life, and jeopardized the cultural identity and heritage embedded in rural architecture (Taylor et al., 2018: 27). Against this backdrop, studying biophilic architecture in rural housing is critical for two key objectives: first, to assess the current state of rural dwellings in terms of their alignment with biophilic design; and second, to propose restorative strategies that support sustainable development and preserve the natural and cultural capital of rural communities.

Zabol County, located in the northern part of Sistan and Baluchestan Province, with its hot and dry climate, offers a suitable context for the development of biophilic architecture in rural settlements. In the traditional architecture of the region's villages, there is ample evidence of buildings aligned with biophilic design principles (Yousefi, 2017: 5). Examples include the widespread use of adobe, clay, wood, and other local materials that mitigate extreme heat. Notable features also include inward-facing courtyards to reduce direct sunlight, windcatchers and openings for natural ventilation, and wide porches that create shade and minimize heat absorption (Odisho & Davtalab, 2020: 4). These characteristics have not only optimized energy consumption but have also contributed to the unique visual and cultural identity of rural architecture in the region (Heidari et al., 2022: 7). However, in recent decades, factors such as technological advancements in construction, the widespread use of non-native materials like concrete and iron, changing rural lifestyles, and insufficient oversight have led to a decline in the application of biophilic principles. Many newly built rural homes overlook climatic and environmental conditions, leading to higher energy consumption, reduced thermal comfort, and the gradual erosion of indigenous architectural identity. Therefore, it is essential to study rural housing architecture in Zabol County through the lens of biophilic design to assess the extent to which these principles have been preserved in both past and present constructions. Additionally, appropriate measures must be identified to revive this approach and enhance the physical quality of rural housing in the region. Accordingly, this study aims to address the following key question: To what extent have the principles of biophilic architecture been incorporated into rural housing in Zabol County, and what strategies can be proposed to revive and enhance this approach?

2. Literature Review

Biophilic architecture, as a key branch of sustainable design, emphasizes the creation of harmony between the built environment and the surrounding natural world. First introduced by Frank Lloyd Wright, this approach is grounded in the use of local materials, climate-responsive design, natural light and ventilation, and the minimization of a building's environmental impact (Verderber, 2010: 46). According to theorists such as Ken Yeang and Edward O. Wilson, architecture should be sustainable not only in its physical attribute but also in its ecological function, fostering a harmonious relationship between humans and nature (Pifko et al., 2023: 231). The theory of biophilia further reinforces this perspective by emphasizing the innate human connection to natural elements. It suggests that built environments should enable both direct and indirect experiences of nature in interior and exterior spaces (Davies, 2010: 768). In line with sustainable development goals, biophilic architecture seeks to create environmentally compatible settlements by reducing energy consumption, conserving natural resources, and incorporating indigenous technologies (Hwang & Lee, 2013: 98). These principles are particularly significant in rural contexts, where traditional settlements have long embodied sustainable models of human–nature interaction. Such models serve as valuable references for contemporary architectural practices.

Rural architecture has long embodied biophilic principles, evolving in harmony with climatic and environmental conditions (Kim et al., 2021: 4). Theorists such as Amos Rapoport argue that vernacular architecture emerges from the long-term interaction between humans and their environment, shaped by indigenous knowledge and adaptations to the local climate (Permana & As'ad, 2023: 78). In Iran's traditional rural architecture, especially in Zabol county, numerous biophilic design strategies have been organically implemented, including the use of local materials such as adobe and clay; climate-responsive spatial planning; natural ventilation, and spatial flexibility. However, in recent years, the shift in construction patterns and the use of non-native materials have led to a decline in the harmony between architecture and nature. Therefore, studying and reviving biophilic architectural principles in rural housing can help preserve the cultural and local identity of villages, while also reducing energy consumption and enhancing environmental sustainability (Kurtuluş & Sahin, 2020: 54). In Iranian rural architecture, many biophilic principles have traditionally been upheld. Examples include the use of natural materials such as wood, adobe, and stone; the creation of shaded areas to control sunlight; the design of windcatchers and natural ventilation systems; the use of central courtyards; and the direct connection between indoor spaces and the external environment—all of which exemplify biophilic architecture in Iran's rural settlements (Jazayeri Farsani et al., 2019: 3).

The theoretical framework of this study is grounded in biophilic design, also known as biophilic architecture. As previously discussed, this architectural approach in rural contexts is inherently dependent on the natural environment, and rural architecture must derive its principles and indicators from this natural context. Biophilic design in rural housing offers numerous positive outcomes, many of which were highly valued by previous generations. Although various studies have been conducted on rural housing architecture, research specifically addressing biophilic approaches in this context remains relatively limited. The following section presents a selection of relevant studies as part of the research background.

Ahani (2009) highlights the significant role of nature and its elements in shaping rural housing and architecture in Gilan, emphasizing that the influence of nature is undeniable. Rezaei (2017) concluded that most newly constructed rural houses follow patterns that are occasionally urban in character, thereby disregarding the traditional fabric of rural settlements. Majidi et al. (2021) emphasize the importance of integrating natural elements into rural housing architecture, noting that this approach has declined due to technological advancements in rural areas. Similarly, Jazayeri Farsani et al. (2019) found that, despite certain transformations, the architecture of the studied village continues to incorporate natural elements and can be classified as biophilic. However, they warn that without appropriate attention, technological shifts will inevitably alter this character. Ruda (1998) also highlights the strong relationship between rural housing and the environment, noting that the climate and natural resources of each geographic region are crucial in shaping rural architectural forms. Tóth and Feriancová (2013) emphasize the pivotal role of nature in rural architecture, considering it the most significant factor in the structure of rural housing. Musso and Franco (2014) likewise highlight the influence of the environment and prevailing climate on the formation of rural housing and architectural practices. Pena Hiwaman et al. (2022) argue that the integration of natural elements is essential to rural housing design and assert that architecture divorced from nature can be detrimental. Okosun et al. (2023) similarly emphasize the critical role of natural elements and climate in shaping rural architecture, cautioning that technological advancements

should not hinder the continued use of natural elements in rural housing.

The innovation and distinction of the present research lie in two key aspects. First, studies on rural housing architecture from a biophilic perspective are relatively scarce. Second, even when studies have been conducted, they have mostly focused on the role of nature, and there has been little to no research specifically examining the biophilic architectural approach in rural areas. Previous studies have not addressed the subject of nature and its role in architecture in a systematic and integrated manner, and the present research aims to fill this gap. Another important point is that the village is a place deeply intertwined with nature, and the diminishing role of nature in its architecture—especially in housing—can have various consequences. Therefore, this study emphasizes both the theoretical and practical aspects of this approach in the context of rural settlements. Moreover, for the selected study area, the topic is also new and original.

3. Methodology

The research method is descriptive-analytical, and in terms of its purpose, it is classified as applied research. Data collection was conducted through a survey approach, utilizing questionnaires as the primary tool. Experts confirmed the validity of the questionnaire, and its reliability was assessed by administering it to individuals outside the statistical sample. For the reliability test, 30 individuals were randomly selected outside the main sample, and data analysis showed a Cronbach's alpha coefficient greater than 0.70, confirming the reliability. The statistical population of the study consists of residents of rural areas in Zabol County. Due to the large number of villages and limitations related to access and research costs, five villages were selected for the study: North Dahmardeh (with 563 people), Kalokhi (with 972 people), Heydarabad (with 740 people), Dehkol (with 382 people), and Emamieh (with 907 people). The total population of these villages is 3,564 people, and using Cochran's formula, the sample size was determined to be 347 individuals. The number of questionnaires distributed in each village was proportional to its population. The respondents were rural residents, considered the micro-level units, and a random sampling method was employed. Data analysis was performed using SPSS software.

Table 1. Research Indicators and Items

Indicator	Items	Selected References
Use of Local Materials	Use of adobe and clay in housing; use of recyclable materials in housing	Yousefi (2017); Kurtuluş & Şahin Güçhan (2020); Zhong et al. (2022)
Attention to climate and geographical conditions	Architectural compatibility with climatic conditions; building orientation relative to sunlight and prevailing winds	Rezaei (2017); Permana & As'ad (2023); Wolfs (2015); Mustafa Shukur (2022)
Harmony of building form and structure with the environment	Housing design aligned with natural landscapes; use of natural and environment-matching colors; use of nature-compatible forms in housing construction	Jazayeri Farsani et al. (2019); Permana & As'ad (2023)
Creation of Open and Semi-Open Spaces	Presence of courtyard in housing design; visual connection between indoor spaces and the external environment	Yousefi (2017); Rezaei (2017); Zhong et al. (2022)
Use of Natural Energy	Number and size of windows; use of traditional methods for heating and cooling; daylight utilization in housing design	Jazayeri Farsani et al. (2019); Pifko et al. (2023); Wolfs (2015)
Cultural and identity-based architectural harmony	Alignment of housing architecture with local culture; use of indigenous knowledge in construction; continuity of rural lifestyle in architectural design	Rezaei (2017); Kurtuluş & Şahin Güçhan (2020); Wolfs (2015); Mustafa Shukur (2022)
Preservation of Vegetation and Interaction with Nature	Use of green spaces in housing design; planting native trees for shading	Jazayeri Farsani et al. (2019); Rezaei (2017); Permana & As'ad (2023); Pifko et al. (2023)
Supportive Policies and Strategies	Government support for implementing pilot projects, providing financial facilities and low-interest loans for the construction of indigenous housing, drafting laws and regulations for the use of renewable energy in housing, establishing clear legislation for the use of indigenous design in housing facades, creating successful models that integrate traditional and modern housing in villages, offering and developing architectural patterns suited to the regional environment, drafting specific plans and layouts for the interior space of rural housing, aligning housing architecture with the lifestyle and local needs of villagers, activating the tourism sector through indigenous rural architecture, and establishing service centers—including tourism facilities—with traditional architectural styles.	Ahani (2009); Rezaei (2017); Mustafa Shukur (2022); Grazuleviciute-Vileniske (2022); Taylor et al. (2018)

4. Findings

Zabol County, covering an area of approximately 344 square kilometers, is located in the northeastern part of Sistan and Baluchestan Province. It is bordered to the north by Nimruz County, to the east by Hirmand County, to the south by Hamun and Zahak counties, and to the west by Hamun County itself. The distance from the county center to the provincial capital is 207 kilometers, and the distance from Zabol to Tehran is about 1,548 kilometers. The county is situated at an elevation of around 480 meters above sea level. Climatically, it lies within an arid region, resulting in various environmental constraints. Furthermore, the architectural style of rural areas in the region is shaped by the local climate and natural surroundings. According to the 2016 National Population and Housing Census, there were 87 inhabited villages in the county, with a total population of over 26,850 and 7,255 households. Figure 1 illustrates the location of the county and the villages studied.

Characteristics of the Statistical Sample

An examination of the statistical sample reveals that, in terms of gender, 64.8% of the participants were male, while 35.2% were female. Regarding age, the largest proportion belong to the 41–50 age group, comprising 158 individuals (45.5%), while the smallest proportion was in the 51–59 age group, accounting for 6.6%. Additionally, 14.4% of the sample fell within 23–30 age range, and 33.4% were between 31 and 40 years old. In terms of educational attainment, the majority of individuals (36%) had an education level below a diploma. Furthermore, 13.8% were illiterate, 19.3% held a high school diploma, 18.2% possessed a bachelor's degree, and 12.7% had a master's degree or higher. Regarding the variable of residency duration, more than 73.2% of participants have lived in their village for over 16 years (45.5% for 16–20 years and 27.7% for 21–30 years). The remainder of the sample has lived in the village for less than 15 years (1.4% for less than 5 years, 2.9% for 6–10 years, and 22.5% for 11–15 years). This distribution may be attributed to reverse migration, as well as demographic changes and population movements between villages. Overall, the characteristics of the sample indicate that individuals with diverse demographic backgrounds from the statistical population have been included in this study.

Assessment of the Extent to Which Rural Housing in Zabol County Incorporates Biophilic Architecture

An evaluation of the findings based on the seven principles of biophilic architecture indicates that the application of these principles in the rural housing of the region is statistically significant at the 0.05 level. The overall test means of 2.103 suggests a generally weak implementation. Further analysis reveals that among the principles, preservation of vegetation and interaction with nature reflect the poorest condition, with a mean score of 1.580. In contrast, attention to climate and geographical conditions shows the most favorable status, with a mean score of 2.422. However, a comparison of the minimum and maximum averages demonstrates that none of the principles exceed the neutral threshold of 3. Accordingly, it can be concluded that the extent to which rural housing in Zabol County integrates the principles of biophilic architecture is limited.

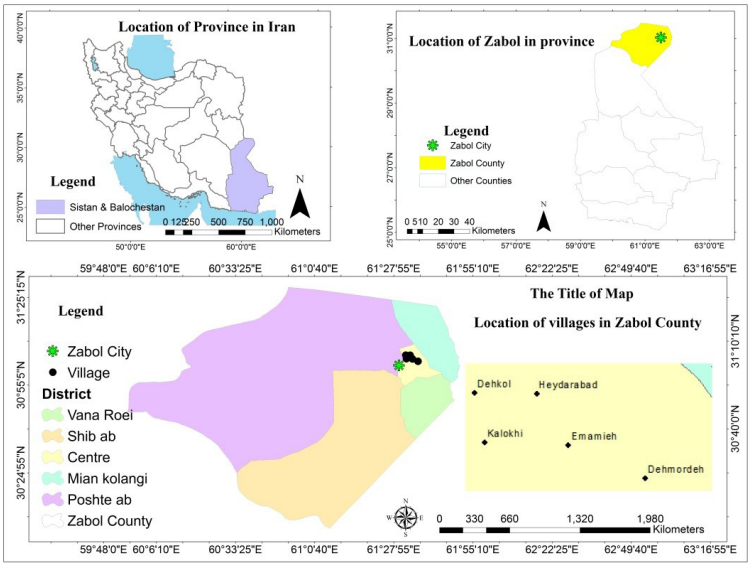

Figure 1. Geographical location of the region and distribution of the studied rural points

Table 2. Assessment of the Extent to Which Rural Housing in Zabol County Incorporates Principles of Biophilic Architecture (One-Sample t-Test)

Criterion (Principle)	t	Significance Level	Mean	Status
Use of local materials	-15.8	0.000	2.289	Low
Attention to climate and geographical conditions	-13.6	0.000	2.435	Low
Harmony of building form and structure with the environment	-13.9	0.000	2.422	Low
Creation of open and semi-open spaces	-26.4	0.000	2.086	Low
Use of natural energy sources	-31.3	0.000	2.041	Low
Cultural and identity-based architectural harmony	-25.06	0.000	1.865	Low
Preservation of vegetation and interaction with nature	-48.05	0.000	1.580	Low
Overall application of biophilic architecture principles in rural housing	-50.4	0.000	2.103	Low

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Explaining Strategies for Reviving and Enhancing the Biophilic Approach in Rural Housing Architecture

This section analyzes and categorizes strategies aimed at reviving and enhancing the biophilic approach in rural housing architecture. Thirteen relevant strategies were identified, summarized, and examined to determine the most effective methods for revitalizing and advancing this architectural perspective. In this study, to assess the suitability of data for macro-level analysis, the KMO measure of sampling adequacy was calculated as 0.530, indicating that the data were appropriate for factor analysis, as values above 0.50 are considered acceptable. Bartlett's test of sphericity yielded a value of 5446.889, which was statistically significant at the 99% confidence level ($p = 0.000$).

The eigenvalue indicates the contribution of each strategy to the total variance of the variables, with larger values reflecting greater importance and impact. As shown in Table 4, the first macro strategy accounts for the largest share of the variance (29.508%) in categorizing strategies for reviving and enhancing the biophilic approach in rural housing architecture. The second strategy explains 23.296% of the dependent variable, the third accounts for 15.561%, the fourth for 9.640%, and the fifth explains 7.914%. Collectively, these five strategies account for 85.919% of the effective approaches for reviving and enhancing the biophilic approach in rural housing architecture.

The following table presents the rotated factor matrix, based on which the strategies or solutions related to each category are identified.

Based on the conducted analysis, five strategies with eigenvalues greater than 1 were extracted, as listed below (Table 6):

Table 3. KMO Value and Bartlett's Test for Strategies to Revive and Enhance the Biophilic Approach in Rural Housing Architecture

KMO	Bartlett Test	DF	Sig
0.530	5446.889	78	0.000

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Table 4. Extracted Factors, Eigenvalues, and Percentage of Explained Variance

Strategy	Eigenvalues	Percentage of Explained Variance	Cumulative Percentage of Explained Variance
First	3.836	29.508	29.508
Second	3.028	23.296	52.804
Third	2.023	15.561	68.366
Fourth	1.253	9.640	78.005
Fifth	1.029	7.914	85.919

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Table 5. Rotated Factor Matrix Related to the Factors

Strategy	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Creating successful models integrating traditional and modern housing in villages		0.753			
Supervision and management of housing by the relevant institutions in villages				0.662	
Developing laws and regulations for the use of renewable energy in housing	0.661				
Preserving and revitalizing native vegetation in open housing areas					0.577
Activating the tourism sector through traditional rural architecture			0.567		
Providing and developing architectural models suited to the local environment		0.650			
Requiring the use of native materials in housing construction				0.625	
Aligning housing architecture with the lifestyle and needs of rural residents		0.585			
Establishing service centers, including tourism, with traditional architecture			0.559		
Government support for implementing pilot projects	0.760				
Designing specific plans for the interior space of rural housing		0.699			
Providing financial facilities and low-interest loans for traditional housing	0.821				
Developing clear laws for using traditional design in housing facades	0.779				

First Strategy: The results indicate that four factors were loaded onto the first strategy. These factors explain 29.508% of the variance in effective approaches for reviving and enhancing the biophilic approach in rural housing architecture. Overall, considering the factors included in this category, this strategy was titled "Support and Formulation of Indigenous Housing Policies and Legislation."

Second Strategy: The results show that four factors were loaded onto the second strategy. These factors explain 23.296% of the variance in effective approaches for reviving and enhancing the biophilic approach in rural housing architecture. Based on the included factors, this strategy was titled "developement of Indigenous Housing Architecture Patterns."

Third Strategy: The results reveal that two factors were loaded onto the third strategy. These factors explain 15.561% of the variance in effective approaches for reviving and enhancing the biophilic approach in rural housing architecture. This strategy was titled "Promoting Indigenous Housing Through Tourism"

Fourth Strategy: The results indicate that two factors were loaded onto the fourth strategy. These factors explain 9.640% of the variance in effective approaches for reviving and enhancing the biophilic approach in rural housing architecture. This strategy was titled "Mandating and Monitoring the Use of Indigenous Building Materials."

Fifth Strategy: The results show that one factor was loaded onto the fifth strategy. This factor explains 7.914% of the variance in effective approaches for reviving and enhancing the biophilic approach in rural housing architecture. This strategy was titled "Incorporating Indigenous Vegetation in Housing Spaces."

In terms of strategies for reviving and enhancing the biophilic approach in rural housing architecture, the results revealed that providing financial facilities and low-interest loans for the construction of indigenous housing (factor loading = 0.821), was the most important strategy. The formulation of clear regulations for incorporating indigenous design in housing facades (loading= 0.779), ranked second in importance. Government support for the implementation of pilot projects (loading= 0.760) was recognized as the third most significant strategy.

Table 6. Ranking, Naming, and Categorization of Strategies for Reviving and Enhancing the Biophilic Approach in Rural Housing Architecture

Strategy	Eigenvalue	Measure	Factor Loading
Support and Formulation of Indigenous Housing Legislation	29.508	Governmental support for the implementation of pilot projects	0.760
		Providing financial facilities and low-interest loans for indigenous housing construction	0.821
		Formulating regulations for the use of renewable energy in housing	0.661
		Establishing clear legislation for the use of indigenous design in housing facades	0.779
Formulation of Indigenous Housing Architecture Patterns	23.296	Creating successful models that integrate indigenous and modern housing in rural areas	0.753
		Developing architectural patterns suited to the regional environment	0.650
		Designing specific plans for the interior spaces of rural housing	0.699
		Aligning housing architecture with the lifestyle and local needs of rural residents	0.585
Utilizing Tourism to Preserve, Revive, and Develop Indigenous Housing	15.561	Activating the tourism sector through indigenous rural architecture	0.567
		Establishing service centers, including tourism facilities, with indigenous architectural styles	0.559
Mandating and Monitoring the Use of Indigenous Materials	9.640	Requiring residents to use indigenous materials in housing construction	0.625
		Oversight and management of housing by relevant institutions in rural areas	0.662
Using Indigenous Vegetation in Housing Spaces	7.914	Preserving and reviving native vegetation in the open spaces surrounding housing	0.577

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5. Discussion

In recent decades, architecture has faced new challenges such as climate change, environmental crises, and the development of advanced technologies. In response, various approaches have been proposed to create sustainable and environmentally aligned architecture, one of which is biophilic architecture. This approach, rooted in indigenous architectural traditions and the interplay between humans and nature, aims to mitigate the adverse effects of construction and improve the quality of life by designing buildings that blend seamlessly with the natural environment. In this context, rural housing—especially in regions like Zabol County, which possesses distinct climatic characteristics and rich natural resources—can serve as a suitable model for applying biophilic principles. However, in recent years, economic shifts and the expansion of modern construction technologies have led to a decline in the application of biophilic architectural principles in rural housing development. This article aims to identify and analyze the current state of biophilic architecture in rural housing in Zabol County, proposing practical strategies for revitalizing this approach and enhancing existing conditions.

The research findings indicate that the level of integration of biophilic architecture in Zabol's rural housing is very weak. Most variables related to this architectural approach are rated low, particularly in areas such as the use of indigenous materials, attention to climate and geographical conditions, housing design aligned with natural landscapes, and the use of natural energy sources. These results clearly show that traditional and biophilic architectural principles are rarely applied in Zabol's rural construction, and there is a noticeable shift toward non-local and industrial models. Furthermore, a comparison of these findings with previous research reveals a similar trend in other regions. Several studies, including those by Ahani (2009) and Rezaei (2017), highlight the significant role of nature in shaping rural housing architecture. However, in practice, technological developments and urbanization trends have reduced the use of these approaches in new constructions. This aligns with international studies by Tóth & Feriancová (2013) and Okosun et al. (2023), among others, which also highlight the role and impact of nature in architecture and consider it an inseparable principle of 21st-century design.

In the section analyzing strategies for reviving and improving the biophilic approach, the results show that various measures can help enhance the architectural

condition of rural housing in Zabol. Strategies such as formulating clear regulations for the use of indigenous materials and design, supporting pilot projects, and providing financial facilities for indigenous housing construction have the greatest impact. Based on the conducted analysis, these strategies demonstrate that adopting such measures can effectively contribute to the revival of biophilic architecture in rural areas. These findings are consistent with previous research, such as the study by Jazayeri Farsani et al. (2019), which pointed to the negative effects of technological changes. Studies by Musso and Franco (2014), Pena Hiwaman et al. (2022), and Okosun et al. (2023) also highlight key factors, including the use of indigenous and climate-responsive materials, supportive policies for biophilic construction projects, and the importance of legislation and oversight in this domain. Based on these results, several recommendations are proposed:

• Formulate and enforce regulations for the use of indigenous materials.

• Create financial facilities to support indigenous housing construction.

• Design rural housing in accordance with the region's climate and geographical conditions.

• Integrate traditional biophilic architecture with modern design in rural housing development.

• Utilize tourism as a strategy to preserve indigenous architecture in rural areas.

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Conflict of Interest

The authors declared no conflicts of interest.

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