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Evaluating Biophilic Design Strategies for Enhancing Guest Well-Being in Resort Hotels: A Study of Almat Farms Resort in Abuja, Nigeria

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Abstract

Biophilic design has gained vital recognition for enhancing well-being through the integration of nature-based elements into the built environment. The incorporation of natural elements in resort hotels has been associated with improved guest satisfaction and overall experience quality. However, the application of biophilic design strategies in resort environments within Abuja remains underexplored. Therefore, this study examines the extent of biophilic design integration at Almat Farms Resort in Abuja and its implications for guest well-being. A quantitative research approach was adopted, employing field observations and the Biophilic Design Performance Index (BDPI) as the primary evaluation tool. Data were obtained through systematic observation of biophilic elements and analyzed using descriptive statistics and mean scores. The results revealed a moderate to strong integration of biophilic design principles, with an overall BDPI score of 63.75%. Direct experience with nature emerged as the leading feature, while environmental and sensory integration elements recorded the lowest performance, alongside moderate outcomes for ecological and place-based design attributes. Notably, guest well-being was not directly measured through perception surveys but was inferred from the BDPI, based on established literature. The findings suggest that the identified biophilic features are likely to improve environmental quality and promote guest well-being with respect to relaxation, comfort, and connection to nature, based on their quantified performance within the index framework. Therefore, the study highlights the importance of integrating biophilic strategies in designing restorative resort environments.

Keywords: Biophilic Design, Resort Hotels, Guest Well-Being, Environmental Comfort, Natural Materials, Landscape Integration

Introduction

Hospitality architecture has evolved from a primary focus on functionality and service provision to a more holistic, user-centred design approach that prioritizes experiential quality and well-being (Nanu et al., 2024). This change is largely influenced by the rising recognition of environment–behaviour relationships, through frameworks such as evidence-based design (EBD), which establish measurable links between the built environment and human outcomes (Harris et al., 2024). Within present hospitality design, the built environment is no longer perceived merely as a setting for accommodation but as an active contributor to guest satisfaction, psychological restoration, and overall experiential value (Suess et al., 2024). As a result, architectural interventions in resort hotels are increasingly expected to integrate environmental, sensory, and socio-cultural dimensions that enhance user well-being.

Biophilic design has developed as a key concept that harmonizes the built environment with natural elements (Tekin et al., 2025). The concept of biophilic design is rooted in the principle that human beings possess an inherent attraction to natural systems. It integrates strategies that seek to incorporate natural features such as vegetation, exposure to natural lighting, water bodies, and organic materials into architectural spaces (Asojo & Hazazi, 2025). Such features are relevant in the design of resort hotels, where the key drive is to provide comfort, relaxation, and restorative experiences. Unlike conventional hotels, resort hotels provide a unique setting for effective engagement with nature, making their built environment suitable for the application of biophilic design strategies.

The spatial and sensory qualities of resort hotels play an important role in shaping guest perceptions and experiences within such environments (Li et al., 2023). Architectural design strategies such as landscape integration, materiality, and visual and physical connections to nature, as well as environmental comfort, influence how individuals relate to their built surroundings. Numerous studies show that built environments enhanced with appropriate natural features contribute significantly to reduced stress levels, improved mood, and enhanced cognitive restoration (Fu et al., 2025; Jimenez et al., 2021). Recent studies further indicate that exposure to natural daylight and vegetation improves indoor environmental quality while reducing reliance on artificial lighting and mechanical ventilation systems, thereby enhancing both occupant well-being and overall building performance (Asojo & Hazazi, 2025; Rhee et al., 2023). Conversely, environments that depend heavily on artificial elements without ecological consideration often fail to achieve the benefits associated with restorative features, thereby limiting their contribution to guest well-being (Wang et al., 2025).

In the Nigerian hospitality sector, particularly within the hot tropical climate of Abuja, the absence or inadequate integration of biophilic design strategies has direct environmental and economic consequences. Buildings that lack passive design features such as natural ventilation, solar shading through vegetation, and optimized daylighting tend to rely heavily on air-conditioning systems, resulting in increased energy demand, higher operational costs, and greater carbon footprints (Asim et al., 2022; Xi et al., 2025). In addition, recent studies suggest that limited access to nature-based experiences can reduce perceived service quality, weaken place identity, and negatively influence guest satisfaction, length of stay, and repeat visitation behaviour (Jimenez et al., 2021; Nguyen & Walters, 2024). These outcomes demonstrate that the absence of nature is not only an environmental design limitation but also a critical factor affecting the economic performance and competitiveness of resort facilities.

Despite these studies that highlight the significance of biophilic design, its application within resort developments in Nigeria, particularly in Abuja, remains understudied (Odeh et al., 2025). Most resorts incorporate fragmented natural elements, such as decorative landscaping or artificial water features, without adequate consideration of ecological and sensory systems. This gap is further intensified by challenges such as limited awareness, economic constraints, and the absence of a structured biophilic design framework for the city. As Abuja continues to witness rapid urban growth and increasing demand for hospitality infrastructure, the need for sustainable and user-centered design approaches becomes increasingly critical. Almat Farms Resort serves as a suitable case for evaluating the application of biophilic design within an urban context. The resort integrates green landscapes, natural materials, and outdoor activities, providing significant opportunities for direct guest interaction with nature. However, there is a need for a systematic evaluation of the extent to which the natural features within the resort align with biophilic design principles and how they impact guest well-being. Therefore, this study aims to evaluate biophilic design strategies in Almat Farms Resort and assess their effectiveness in enhancing the potential for guest well-being. To achieve this aim, the study seeks to: (i) examine the level of integration of key biophilic design elements within the resort; (ii) assess indicators related to comfort, relaxation, and connection to nature; and (iii) provide insights to inform the design of biophilic resort environments in Abuja and beyond.

LITERATURE REVIEW

Hospitality architecture has increasingly incorporated user-centred and evidence-based design approaches, reflecting the rising recognition that spatial configuration, environmental quality, and material selection significantly influence user experience and well-being (Elgani et al., 2025; Suess et al., 2024). Evidence-based design (EBD) establishes a link between architectural interventions and measurable outcomes that include comfort, satisfaction, and psychological restoration (Elf et al., 2020). For resorts, the built environment is deliberately designed not only for accommodation but also for relaxation, escape, and immersive engagement with nature. Recent studies indicate that guests in resort hotels are highly sensitive to environmental factors such as landscape quality, lighting conditions, materiality, and spatial

organization (Acampora et al., 2022; Chang & Lin, 2024). These factors influence perception, emotional responses, and overall experience quality. Therefore, biophilic design has emerged as a vital framework that integrates natural systems into the built environment, enhancing both environmental quality and human well-being.

Biophilic Design in Hospitality Architecture

Biophilic design has emerged as a major framework that integrates natural elements into built environments in order to improve human well-being (Tekin et al., 2025). The concept is rooted in the philosophy that humans possess an inherent affinity for nature. Biophilic design seeks to reconnect people with natural systems through architectural strategies (Zhong et al., 2022). In resort hotels, this approach is particularly relevant due to its emphasis on relaxation and experiential quality. Biophilic design in hospitality environments is characterized by three key dimensions: direct interaction with nature, indirect representation of natural elements, and spatial conditions that promote sensory engagement (Zhong et al., 2022).

Direct Experience with Nature

Direct experience with nature represents the physical and direct interaction between individuals and natural elements within the built environment. Such features include natural ventilation and lighting, vegetation, water features, and the presence of animals.

Earlier studies reveal that exposure to natural light plays an essential role in regulating circadian rhythms and improving visual comfort, while natural ventilation helps to improve indoor air quality and thermal comfort (Wang & Di, 2022). Natural features such as vegetation and water bodies are also closely linked to improved mood, reduced stress levels, and better cognitive restoration in individuals within resort environments (Olszewska-Guizzo et al., 2022). Such elements can contribute to relaxation and psychological restoration, which are the key expectations of guests within such settings. The inclusion of natural colours may also enhance the relationship between individuals and nature, strengthening sense of place.

Indirect Experience of Nature

Indirect experience of nature involves the representation or abstraction of natural elements within the built environment. This includes the use of natural materials (wood, stone), natural shapes and forms, and biomorphic patterns that mimic nature.

According to Zhong et al. (2022), indirect biophilic elements evoke similar psychological responses to direct nature exposure by creating familiar and comforting environments. Natural materials provide tactile and visual warmth, while organic forms and patterns enhance aesthetic quality and reduce cognitive stress. In hospitality design, these elements are essential where direct access to nature may be limited. Their integration ensures continuity of the natural experience within indoor spaces, thereby contributing to comfort, satisfaction, and emotional well-being (Fu et al., 2025; Jimenez et al., 2021).

Ecological and Place-Based Design

Ecological and place-based design highlights the importance having natural and cultural dimensions in built environment. The principle promotes the use of native materials and plants to reflect local identity, while designing in harmony with the environment.

Kumar et al. (2023) revealed that the use of landscape features such as indoor gardens, water bodies, and green open spaces helps to improve environmental conditions and strengthen user connection. Similarly, the use of culturally responsive design helps to promote environmental sustainability. Such strategies are vital in resort environments, where guests pursue unique and context-driven experiences. A strong ecological and cultural connection enhances place identity, improves environmental performance, and promotes a better sense of belonging and engagement.

Environmental and Sensory Integration

Environmental and sensory integration focuses on the active engagement of the human mind through spatial and environmental design. The principle utilizes concepts such as prospect and refuge, order and complexity, curiosity, and sensory variability to improve guest experiences and well-being. Prospect and refuge allow users to experience openness while maintaining a sense of safety (Dosen & Ostwald, 2016). Spatial complexity and organized patterns inspire curiosity and engagement without misperception. Sensory design integrates visual, acoustic, and tactile elements for immersive experiences. Natural sounds, varying light conditions, and textural materials also contribute to a multi-sensory environment adequate for relaxation and well-being (Omogbai et al., 2025). In resort environments, these elements are essential for creating immersive and memorable experiences due to their influence on user perception and space interaction.

Research Gap and Theoretical Basis

Despite the numerous global studies on biophilic design and user well-being, there remains a notable gap in empirical research in Nigeria, particularly in Abuja. Existing studies often generalize sustainability concepts without providing detailed evaluations of key biophilic design strategies within resort environments. This study addresses this gap by evaluating four key biophilic design principles, which include direct experience with nature, indirect experience of nature, ecological and place-based design, and environmental and sensory integration within Almat Farms Resort, Abuja.

The research relies on biophilic design theory, environmental psychology, and hospitality architecture, linking theoretical concepts with measurable design variables. By aligning these principles with empirical evaluation using the BDPI framework, the study provides an understanding of how built environments may influence well-being in resort environments.

RESEARCH METHODOLOGY

This study adopted a quantitative research approach aided by systematic field observational techniques to evaluate the biophilic design strategies implemented in Almat Farms Resort.

This approach enables the objective assessment of measurable physical attributes and their performance within the built environment. It is most suitable for architectural research where environmental quality and spatial effectiveness are evaluated using quantifiable indicators (Kong et al., 2018; Östlund et al., 2020).

Research Design and Approach

The study was structured as a case study analysis focusing on Almat Farms Resort located in Kuje, Abuja. The case study approach is widely used in built environment research due to its ability to provide an in-depth assessment of context-specific design features influenced by multiple environmental and spatial factors (Annamalah, 2024). The selection of a single case facilitated a detailed assessment of the extent of biophilic integration within the resort. An assessment checklist was developed to identify, document, and evaluate specific design elements based on four key biophilic design principles.

Data Collection Methods

Data were collected through field observations. The field observations assessed the presence, quality, and effectiveness of biophilic design elements in relation to the four identified biophilic design principles: (i) direct experience with nature, (ii) indirect experience of nature, (iii) ecological and place-based design, and (iv) environmental and sensory integration. A structured observational checklist was developed to enhance consistency and reliability in data recording. The study's checklist captured key biophilic strategies under each principle to systematically document observations and minimize subjectivity during the evaluation process.

Analytical Framework: Biophilic Design Performance Index (BDPI)

The Biophilic Design Performance Index (BDPI) was used as the study's main analytical tool for quantifying the level of biophilic design integration within the case study. The BDPI framework was structured using the four biophilic design principles.

Each element under these principles was assigned a score on a five-point scale ranging from 1 (poor) to 5 (excellent), reflecting the observed degree of integration on-site. Subtotals were calculated for each principle, and the overall BDPI score was derived using a weighted scoring approach, where all elements contributed to the final score.

The BDPI was computed using the following formula:

$$BDPI = \frac{\text{Total Score}}{\text{Maximum Possible Score}} \times 100$$

To enhance the analytical rigor, a weighted evaluation approach was incorporated within the BDPI framework. The weighting scheme was developed by the authors based on an extensive review of literature and established frameworks, such as Kellert's biophilic design principles. The weighting criteria relied on three considerations: (i) the extent of documented influence on psychological and physiological well-being in the literature; (ii) the degree of user interaction and sensory engagement; and (iii) the contribution of each principle to overall

environmental performance. The analytical approach enabled the systematic transformation of qualitative observations into quantitative values, facilitating objective evaluation. The resulting BDPI scores were interpreted using performance categories ranging from weak to strong levels of biophilic integration.

Variables of the Study

The study evaluated four variables corresponding to key biophilic design principles: (i) direct experience with nature, (ii) indirect experience of nature, (iii) ecological and place-based design, and (iv) environmental and sensory integration. Each variable was assessed using a five-point scale scoring system. This ensures that the assessment is aligned with established theoretical concepts, allowing for quantitative evaluation of the study's variables.

Data Analysis Techniques

The data collected were analyzed using descriptive statistical methods such as mean scores, Likert scale ranking, and percentage scores. Mean scores were used to assess the relative performance of variables, while ranking identified the most influential elements contributing to potential guest well-being. Since the study utilized a 5-point Likert scale, the mean scores were interpreted using the ranges presented in Table 1.

Table 1: Mean Score Interpretation.

Mean Score Range	Interpretation / Level of Performance
4.5 – 5.0	Excellent / Very Strong
3.5 – 4.49	Very Good / Strong
2.5 – 3.49	Good / Moderate
1.5 – 2.49	Fair / Weak
1.0 – 1.49	Poor / Very Weak

In addition, the overall BDPI score was analyzed to determine the level of biophilic design integration within the resort. This facilitated a more detailed interpretation of how each of the biophilic principle contribute to environmental performance and potential well-being outcomes within the resort setting.

RESULTS

The results of the assessment of the four (4) key biophilic design principles within the case study area, i.e., Almat Farms Resort, suggest a moderate-to-strong level of biophilic integration, with certain areas requiring targeted improvement to enhance the potential for guest well-being, as inferred from established biophilic design principles.

Evaluation of Key Biophilic Design Variables

The results shown in Table 2 reveal the performance of the four biophilic design principles in Almat Farms Resort. Direct experience with nature recorded the highest mean score of 4.2, reflecting strong integration of immersive and interactive natural elements (Mygind et al.,

2019). Environmental and sensory integration recorded the lowest mean score of 3.0, suggesting moderate multi-sensory engagement (Piller et al., 2025). Ecological and place-based design recorded a mean score of 3.5, indicating moderate integration and suggesting that, while the resort incorporates contextual and landscape-responsive elements, cultural and ecological connections could be further strengthened. Similarly, indirect experience of nature recorded a mean score of 3.3, also reflecting a moderate level of integration.

Table 2: Assessment of Biophilic Design Variables at Almat Farms Resort.

Biophilic Design Principle		Key Elements Evaluated	Likert Scale Interpretation	Mean Score	Rank
1.	Direct Experience with Nature	Natural light, natural ventilation, plants availability, presence of animals, use of natural colours	Very Good	4.2	1st
2.	Indirect Experience of Nature	Use of natural shapes and forms, natural materials, natural patterns and processes	Moderate	3.3	3rd
3.	Ecological and Place-Based Design	Cultural connection to a place, use of native materials, defining building form through landscape	Moderate	3.5	2nd
4.	Environmental and Sensory Integration	Prospect and refuge, order and complexity, curiosity and enticement, change and metamorphosis, security and protection	Moderate	3.0	4th

The high performance of Direct Experience with Nature highlights the resort's extensive use of open landscapes, vegetation, and water features that facilitate direct interaction with the natural environment. Ecological and place-based design shows moderate integration, suggesting that while there is some cultural connection, the use of native materials, and landscape-defined building form, there is room for improvement. Indirect Experience with Nature also demonstrates moderate integration, indicating effective but improvable use of natural forms, materials, and patterns. The relatively lower performance of Environmental and Sensory Integration underscores the need to further enhance multi-sensory engagement through textures, spatial configuration, and soundscapes.

Biophilic Design Performance Index (BDPI)

To quantitatively assess biophilic integration, the Biophilic Design Performance Index (BDPI) was applied. The BDPI aggregates the observed scores of the four (4) key biophilic principles into a standardized percentage, providing a clear measure of design effectiveness.

Table 3: Biophilic Design Performance Index (BDPI) – Almat Farms Resort.

Biophilic Design Principles		Elements	Score (1–5)	Percentage (%)	Remark
1.	Direct Experience with Nature	Natural light, natural ventilation, plants availability, presence of animals, use of natural colours	18/25	72%	Strong Integration
2.	Indirect Experience of Nature	Natural shapes and forms, materials, patterns and processes	9/15	60%	Moderate Integration
3.	Ecological and Place-Based Design	Cultural connection, native materials, building-landscape harmony	10/15	67%	Moderate Integration
4.	Environmental and Sensory Integration	Prospect and refuge, order and complexity, curiosity and enticement, change and metamorphosis, security and protection	14/25	56%	Moderate Integration
	Overall Score	–	51/80	63.75%	Moderate–Strong Integration

The BDPI results show that the resort achieved the strongest integration with the biophilic principles connected to Direct Experience with Nature, while ecological and place-based design and other principles remain moderate. This reinforces the observation that the resort provides good interaction with natural elements but could further strengthen cultural and contextual identity.

Comparative Performance of Variables

Figure 1 shows the performance of the four (4) biophilic design principles examined at Almat Farms Resort. Direct experience with nature achieved the highest mean score of 4.2, indicating strong interaction with biophilic features such as natural lighting and ventilation, plant availability, and the presence of animals. Ecological and place-based design ranked second with a mean score of 3.5, followed by indirect experience of nature with a mean score of 3.3, indicating moderate integration. Environmental and sensory integration also had moderate integration, with the lowest mean of 3.0. The comparative trend suggests a strong engagement with nature while showing notable gaps and opportunities to improve cultural, contextual, and sensory integration.

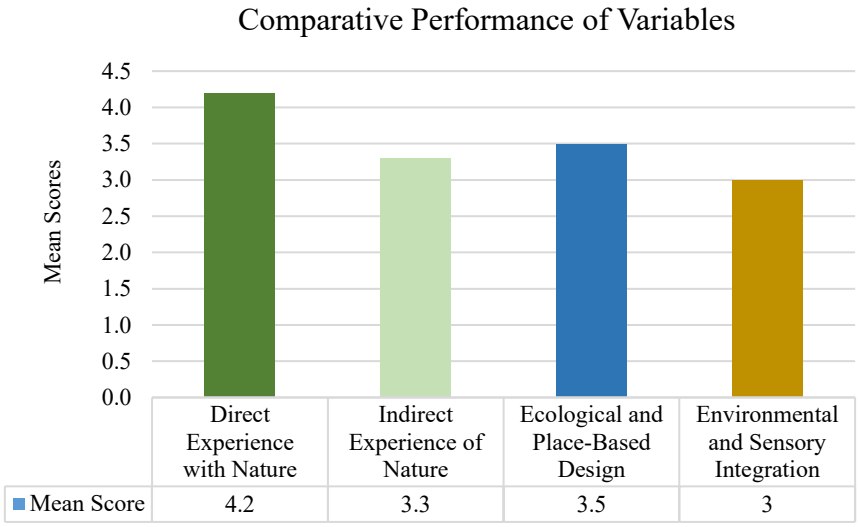


Figure 1. Comparative Performance of Biophilic Design Variables.

DISCUSSION

Direct Experience with Nature

Direct experience with nature emerged as the most dominant principle, with the highest BDPI score of 72%, including biophilic elements such as natural light, vegetation, water features, and open landscapes. This result suggests that the landscaped green areas and water features provide opportunities for guests to engage directly within the resort environment, which, according to existing literature, is associated with promoting relaxation, reducing stress, and restoring emotional balance. Earlier studies by Fu et al. (2025) and Jimenez et al. (2021) have also revealed that experiencing nature regulates mood, reduces anxiety, and contributes to improved well-being.

Indirect Experience of Nature

Indirect experience of nature indicated moderate integration with a BDPI score of 60%. The result indicates that although the use of natural shapes, materials, and patterns is present, this principle could be further improved within the resort. The mild integration of biomorphic signs and material aesthetics contributes to cognitive comfort and environmental coherence. Strengthening this principle through enriched natural textures and forms within transitional spaces could improve continuity between indoor and outdoor environments and further amplify the resort's immersive quality.

Ecological and Place-Based Design

Ecological and place-based design recorded a BDPI score of 67%, signifying moderate integration. The result reflects an effective but improvable use of native materials, culturally inspired motifs, and landscape-informed building forms, as shown in the findings on sense of place and local identity. Therefore, improving this principle through various ecological and

place-based design strategies could help enhance environmental sustainability and deepen guests' appreciation of local culture and heritage.

Environmental and Sensory Integration

Environmental and sensory integration had the lowest BDPI score of 56%, reflecting moderate integration. According to Suess et al. (2024), biophilic hotel design should support prospect and refuge spaces, spatial complexity, and multi-sensory engagement, allowing guests to experience a combination of visual, auditory, and tactile stimuli. The integration of these strategies helps to foster holistic engagement, cognitive restoration, and satisfaction, which are theoretically linked to improved well-being outcomes.

Relationship Between Biophilic Design and Guest Well-Being

The findings suggest a positive relationship between biophilic design integration and the potential for enhanced guest well-being within Almat Farms Resort. However, it is important to note that guest well-being was not directly measured through user surveys or physiological assessments in this study. Rather, well-being outcomes are inferred from the BDPI scores based on established biophilic design theory and empirical literature. Principles such as Direct Experience with Nature and Ecological and Place-Based Design, which recorded relatively higher scores, are widely associated in the literature with improved comfort, relaxation, and human–nature connection. Therefore, while the present results indicate that the resort environment is conducive to restorative experiences, these findings should be interpreted as theoretically grounded inferences rather than direct empirical validation of guest well-being. Future research incorporating user-based evaluation using guest perception surveys is therefore necessary to validate this study's inferred relationships.

CONCLUSION

The study investigated the utilization of biophilic design strategies in Almat Farms Resort, Abuja, with a focus on their role in enhancing the potential for guest well-being. The findings revealed a moderate to strong integration of natural elements, with direct experience with nature, such as natural light, ventilation, vegetation, and interaction with animals, emerging as the most dominant strategy. Ecological and place-based design showed moderate integration, while indirect experience of nature and environmental and sensory integration recorded comparatively lower performance, indicating areas requiring improvement to achieve a more immersive biophilic environment. These findings highlight that biophilic design extends beyond visual aesthetics to include sensory, cognitive, and emotional dimensions that are theoretically associated with improved guest experience. Effective implementation therefore requires a deliberate integration of natural elements, spatial configuration, and guest-centred amenities to enhance potential restorative and wellness outcomes. The study underscores the importance of incorporating multi-sensory engagement, ecological responsiveness, and cultural relevance in resort design, particularly within emerging hospitality contexts. However, it is important to note that guest well-being in this study was inferred from BDPI

scores and established biophilic design theory, rather than being directly measured through user-based assessments. Future research should adopt a mixed-methods approach that combines quantitative environmental evaluation with qualitative and psychological assessment of guests using perception surveys, behavioural observations, and physiological or psychological testing. This would enable empirical validation of the relationship between biophilic design and guest well-being, thereby strengthening evidence-based, user-centred resort design.

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