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Integration of Biophilic Design Elements in Hotel Building Environment towards Enhancing Users Wellbeing in Abuja, Nigeria

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ABSTRACT

Scientific studies have demonstrated the beneficial effects of biophilic design, which integrates nature into both indoor and outdoor spaces, on people's mental and physical health. The world's natural environment has been disrupted by the construction of larger cities and buildings worldwide over the past century due to technological and construction advancements. Biophilic design greatly improves the mental and physical health of users by incorporating natural elements into the built environment. Research shown that fostering a connection with nature can improve mental health, reduce stress, and increase productivity. It is observed that a connection between the built environments, where most of our time is spent, and the natural environment is not prioritised in the planning of these buildings, which minimises the natural contact with these elements. This study aims to integrate biophilic design elements in the hotel's environments to enhance the user's wellbeing. In order to conduct this research, a purposive survey will be conducted, making use of questionnaires sent through Google Forms to get required information from the users. Findings show that the majority of the respondents are pleased having these natural elements around them, as there are inadequate biophilic elements present in the hotel environment in the study location. The paper suggests that adequate measures should be taken by the built-in professionals to ensure adequate integration of the biophilic elements in the hotel environment to ensure users comfort and adequate wellbeing.

Keywords: Biophilic Design, Environment, Hotel Architecture, Integrating, User Wellbeing.

1.0 INTRODUCTION

The prospective of incorporating biophilic design elements into hotel buildings to improve user wellbeing is becoming more widely acknowledged on a global scale. Cities can support public health, social cohesion, and environmental sustainability while cultivating a sense of connection to nature by integrating biophilic design elements into urban planning policies and practices (Peters & D'Penna, 2020). This method enhances visitors' overall satisfaction and mental health by fostering restorative experiences in addition to connecting them with nature. Fundamentally, hotels are characterised by their primary purpose

of providing visitors with short-term lodging. Because of this, the hospitality sector has become somewhat uniform, making it harder to tell one hotel from another.

In order to promote human physical, mental, and emotional well-being, biophilic design incorporates natural patterns and elements into the built environment. Drawing on the natural human attraction to nature, it aims to design areas that are both practical and healing. Throughout history, biophilic design has been employed, which is a codification of human intuition regarding what constitutes a good human environment (Mohsen *et al.*, 2022). Its foundation lies in the biophilia hypothesis, which contends that people are drawn to and connected to natural forms by nature and that spending time in nature improves people's general well-being, productivity, and health. Biophilic design includes unique patterns, which provide different design considerations that can be applied to interior and exterior spaces.

These patterns include the space's nature, complex nonlinear forms, thermal and airflow variability, the presence of water, a visual connection to nature, and a connection to natural systems (Akanke & Aduwo, 2019). In order to improve human well-being and create healing spaces, biophilic design integrates natural elements into constructed environments. This strategy seeks to promote comfort, well-being, and relaxation while addressing the urbanization-induced disconnect from nature. (Dalay, 2020; Hidalgo, 2014). Natural water features, light, colour, and vegetation are important biophilic components that can aid in stress relief and psychological healing (Weijie, 2022).

Biophilic elements in streetscapes have been shown to improve focus and concentration using eye-tracking emulation software (Milliken *et al.*, 2020). Hayles and Aranda-Mena (2018), stated that incorporating nature into urban settings, especially vertical cities, has the potential to enhance quality of life and offer both direct and indirect financial advantages, like lower healthcare costs and better job performance. Joye and De-Block (2011) posited that the biophilia hypothesis, which suggests an intrinsic human bond with nature, is the foundation of this design philosophy. The need to incorporate natural elements into the built environment has grown, leading to the development of biophilic design principles.

Regardless of the space that man occupies, these principles are a response to the widespread desire for spaces that serve purposes beyond aesthetics, spaces that also satisfy man's fundamental need to connect with nature. Based on the notion that people have a fundamental bond with nature and that this bond can improve general health and well-being, biophilic design was created. Aabouelela (2023) suggested that this design philosophy promotes the incorporation of natural elements in architectural spaces, including sunlight, fresh air, plants, water, natural materials, and other elements inspired by nature. In the hotel industry, biophilic design can be applied by providing a view of nature, large windows, water features, or plants. By introducing biophilic elements to a hotel's physical environment, a guest's need for connection with nature may be fulfilled.

This research aims at integration of biophilic design elements into the luxury characteristic of the architecture of the hospitality industry. By this, it is believed that the overall guest experience and visual comfort of the guests will be greatly enhanced. This research gap emphasises understanding the impact of biophilic elements on enhancing the wellbeing of the occupants in the hotel commercial facility. The objectives that guided the research are (i) to explore the perception of the respondent on the biophilic design element in hotel environment (ii) To examine the effects of biophilic design elements on guest perception in a hotel environment. (iii) To examine the influence of biophilic elements on the overall well-being of the users.

2.0 Literature Review

The well-being and cognitive function of commercial building occupants have been demonstrated to benefit from biophilic design elements. Studies Emechebe, (2020); Yin *et al.*, (2020) indicated that being in biophilic environments can alleviate stress and anxiety, with instantaneous physiological reactions noted within minutes of exposure. Yildirim *et al.*, (2023), suggested elements that have shown the biggest impact sizes in work environments include daylight, greenery, and window views of the outdoors. Nevzati *et al.*, (2021), indicated that water features can reduce stress and improve mood, especially in educational settings, even though their effect sizes are smaller.

According to virtual reality studies, biophilic office space interventions can result in higher creativity scores and lower physiological stress indicators than non-biophilic settings (Yin *et al.*, 2020). However, the efficacy of biophilic elements may differ based on the type of workspace and design pattern, underscoring the necessity of careful application in the design of commercial buildings (Ríos-Rodríguez, 2023). In a variety of contexts, biophilic design—which incorporates nature into constructed environments—has been demonstrated to improve user well-being and lower stress levels.

Water features can reduce stress and increase occupant satisfaction in educational buildings, especially for female users (Nevzati *et al.*, 2021). Incorporating biophilic principles into commercial spaces, such as business parks, can result in healthier workplaces that may boost productivity and enhance user experience (Atwa & Khader, 2023). According to Bolten & Barbiero (2020), the implementation of biophilic design in architecture and urban areas has been shown to foster creativity, encourage critical thinking, and hasten the healing process. Also Huntsman and Bula (2022); Emechebe and Eze (2019) stated that biophilic design promotes a connection with nature in interior spaces where people spend the majority of their time, which has a positive impact on well-being.

The significance of incorporating natural elements into built environments to improve user well-being in a variety of contexts, such as residential, commercial, and educational spaces, is highlighted by these studies taken together. Natural features are incorporated into hotel biophilic design to improve visitor experiences and wellbeing. Biophilic features have been shown to improve perceived quality and guest comfort by eliciting more positive emotional and behavioural reactions (Akinyemi *et al.*, 2024). Key components that prospective employees particularly value are indoor landscaping, outdoor green views, and natural lighting (Guzzo *et al.*, 2022).

Gillis and Gatersleben (2015) stated that the incorporation of natural elements into built environments has been associated with lower stress levels and increased productivity. Research is required on some biophilic qualities, like the use of natural materials, even though there is evidence to support others (Weijie *et al.*, 2022). In healthcare settings, biophilic design parameters differ depending on the user group: staff prioritise privacy and quiet, inpatients prioritise comfort and views, and outpatient value daylight and fresh air (Bekir *et al.*, 2022).

Biophilic elements and customer psychological reactions were found to have non-significant differences in one study (Chengli *et al.*, 2022), but other studies showed positive effects. Hotel guests' experiences vary depending on the biophilic triggers, and biophilic design elements were found to be crucial generators of spatial experience (Ariyawansa & Perera, 2022). The implementation of biophilic design principles can provide travellers with restorative advantages by encouraging calmness, vitality, and mental clarity. The longer-term anxiety and stress levels of individuals may have an impact on these effects (Suess *et al.*, 2024).

2.1 Biophilic Design Principles

In order to promote sustainability and well-being, biophilic design principles seek to create built environments that strengthen human-nature connections (Richardson and Butler, 2021). These principles place a strong emphasis on developing human-nature relationships, frequent interaction with nature, and emotional attachment to environments. With an emphasis on human-centered strategies that engage the senses, biophilic design can be applied at many scales, from architectural details to urban planning (Dalay and Aytac, 2022).

The psychological and physiological advantages of biophilic design, such as stress reduction, better mental health, and increased productivity, are supported by research (Söderlund & Newman, 2015). Although there is proof that natural elements in constructed environments have restorative effects, more comprehensive strategies that take nature connectedness into account are required (Richardson & Butler, 2021). It's interesting to note that personal efforts to apply biophilic design concepts could enhance everyday settings (Khanzadeh, 2024). Biophilic design presents a promising way to create healthier, more sustainable living spaces as urbanisation continues to distance people from nature (Dalay & Aytac, 2022). Hotel biophilic design has drawn interest due to its potential to improve visitor satisfaction and well-being. In hotel settings, research has examined its impact on patrons' psychological reactions, perceptions

of quality, and behavioural intentions (Chengli *et al.*, 2022); Akinyemi *et al.*, 2024). Various biophilic triggers have been found to influence guest experiences, demonstrating the importance of biophilic design elements in creating a spatial experience (Ariyawansa & Perera, 2022). Although the use of biophilic design in hotels has grown, particularly since the COVID-19 pandemic, there is still a significant scientific research gap when compared to other industries (Deniz & Cavka, 2024).

Few studies have been conducted on guest rooms; most have concentrated on hotel lobbies (Deniz & Cavka, 2024). According to research, integrating natural patterns and elements into hotel design fosters a bond between people and the natural world, which may reduce stress and encourage calmness among guests (Akinyemi *et al.*, 2024). Healthcare, offices, and educational institutions are just a few of the built environments where biophilic design features are essential for improving people's well-being. By fostering a relationship between residents and the natural environment, these features improve both psychological and physiological outcomes.

2.2 Biophilic Design Features

The goal of biophilic design (BD) is to improve human performance and well-being by incorporating natural elements into constructed environments. This method is becoming more widely acknowledged for its capacity to enhance mental performance, lessen stress, and promote a sense of connection with the natural world. The salient characteristics and advantages of biophilic design are delineated in the subsequent sections.

2.3 Key Features of Biophilic Design

a. Natural Elements: Indoor spaces can be greatly enhanced by adding plants, water features, and natural light, which can improve both physical and mental health (Turki *et al.*, 2023).

b. Spatial Configurations: Research in educational settings has shown that creating environments that resemble natural landscapes or offer views of the outdoors can lower stress and elevate mood (Xiaoxia., 2024).

c. Use of Natural Materials: Using materials like stone and wood improves indoor air quality and comfort in addition to aesthetic appeal (Alapieti, 2020).

Benefits of biophilic Design

a. Enhanced Productivity: It has been demonstrated that biophilic workspaces increase occupants' creativity and productivity (Elantary, 2024).

b. Improved Health Outcomes: Biophilic design has been associated with shorter recovery periods and lower medication consumption in healthcare settings (Moslehian *et al.*, 2023).

c. Positive Educational Impact: According to Determan (2019), schools that implement biophilic strategies report improved student performance and fewer behavioural issues.

d. Restorative Experiences: In line with Stress Recovery Theory (SRT), biophilic design creates spaces that encourage calmness and mental clarity (Suess *et al.*, 2024).

e. Emotional Responses: Incorporating natural materials and features into hotels improves perceived quality and behavioural intentions by eliciting more positive emotional reactions from visitors (Ahn and Kwon (2019).

f. Mental Well-Being: Research demonstrates the efficacy of biophilic design in architectural practices by showing that it significantly improves mental health (Weijie *et al.*, 2022).

2.4 Practical Applications

Design Strategies: Natural elements like greenery and natural light can be used to create calm spaces that reduce stress (Beukeboom *et al.*, 2012).

Post-Pandemic Trends: The importance of biophilic design in the hospitality industry for enhancing visitor experiences has been highlighted by the COVID-19 pandemic, which has increased interest in the concept (Başer and Ehtiyar 2021).

Although there are many benefits to biophilic design, it is important to take into account potential drawbacks, such as implementation costs and the requirement for continuous maintenance of natural

elements. To maximise the advantages of biophilic design in diverse contexts, these factors must be balanced.

3.0 RESEARCH METHODOLOGY

The study used both qualitative and quantitative research methods. Close observation and in-depth analysis of the sample population are part of this research methodology. A cross-sectional field survey was conducted with staff, visitors, and guests to gauge their perceptions. By carefully analysing the hotel spaces and how guests utilised them, the survey was conducted. The statistical data that survey respondents supply by completing questionnaires is used in the cross-sectional survey methodology. Users were given 82 questionnaires in total, 72 of which were returned for the study at various Abuja locations.

The questionnaires were distributed through the use of Google Forms to the hotels which were randomly selected with the sole aim of evaluation based on the direct experience of user's in each hotel. This study focuses on hotel building and its environment to determine the effectiveness of the biophilic elements on the users. Additionally, questionnaires were distributed to the users to ascertain on the effects of the biophilic features already in place in the hotel environment. The sample population of users consists of respondents who are users the hotel facilities which are total participants that responded to the questionnaire.

Descriptive statistics were employed to analyse questionnaire responses in order achieve the study's aim. The socio-demographic data was analysed using descriptive analysis, and the study's issues were examined using statistical analysis. Information collected from pertinent literature and published articles from journals, conferences, seminars, dissertations, and national newspapers was combined using a qualitative approach. The collected data is frequently shown in tables and charts with descriptive statistics for simpler viewing and comprehension. The images will be shown as plates, and the analysed data will be presented as tables and charts to help with comprehension of the findings.

3.1 Study Area

The study was conducted in Nigeria's capital city, Abuja, the Federal Capital Territory (FCT). Six area councils now make up the city, namely, Abaji, Abuja Municipal Area Council (AMAC), Bwari, Gwagwalada, Kuje, and Kwali. The city is located within 9.07°N and 7.6°E, occupying 1769 sq km (Figures 1 and 2). It is surrounded by Kaduna, Kogi, Nasarawa, and Niger states to the north, south, east, and west, respectively. Strategically located in the Federal Capital Territory (FCT), which is the country's geographic centre. As the seat of the Federal Government of Nigeria, it hosts key national institutions, hotel buildings, landmarks, and buildings spread out over its 50 districts. Out of the six area councils, AMAC was selected for the study area (Figure 3). The choice of AMAC is because it accommodated many exquisite hotels, whose majority lacks the biophilic features.



Figure 1: Map of Nigeria Showing FCT

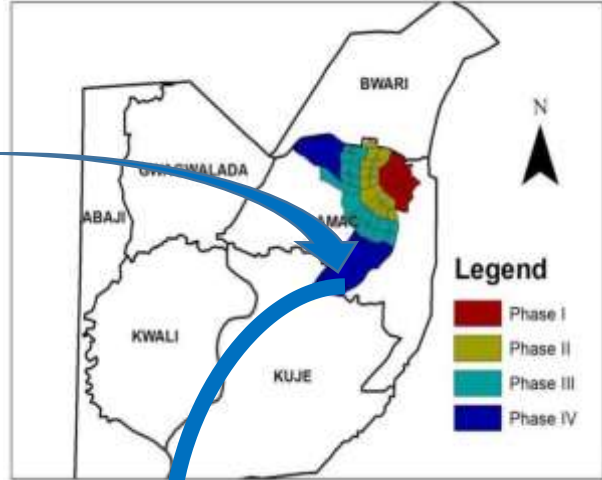


Figure 2: Map of Abuja Showing AMAC

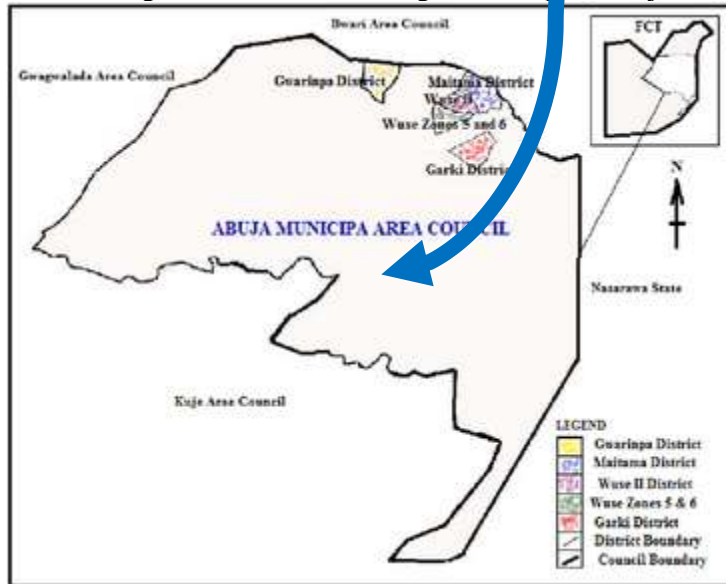


Figure 3: Map of Abuja Municipal Area Council

4.0 RESULT AND DISCUSSION

Data analysis and reliability tests were performed to ascertain the validity of the measurement scales used for analysis in this investigation. The reliability of the instruments was determined to guarantee apparent between the test scales using Cronbach's standardised alpha (Table 1).

Table 1: Reliability test

Section	Cases	Reliability	Interpretation
Section B Q5	4	0.494	Moderately reliable
Section B Q6	3	0.890	Highly reliable
Section B Q7-9	3	0.663	Moderately reliable
Section C Q13	3	0.834	Highly reliable
Section D Q15	4	0.731	Highly reliable
Section D Q16	2	0.849	Highly reliable
Section E Q17	4	0.760	Highly reliable
Section E Q18-19	2	0.930	Highly reliable
Section F Q20	3	0.510	Moderately reliable
Section F Q22	2	0.916	Highly reliable
Overall	30	0.839	Highly reliable

Variables with numerical values were identified from the data set, and all parameters have reliability coefficients that are nearly equal to 1. This suggests that the data is highly reliable. Out of the 82 questionnaires that were distributed, 72 were returned. The frequency of respondents was 54 males to 18 females, or 75% and 25% on average. As indicated in (Table 2), the majority of respondents are between the ages of 18 and 23, with 40 and older being the lowest group. The analysis shows that 55.6% of the respondents are within age 18-24 years old, 20.8% are within 25-34 years of old, 13.9% are within 35-44 years of old, 6.9% are within 45-55 years of old, and 2.8% are within 55 years and above. 55.6% of the respondents are guests and 31.9% are visitors while 12.5% are staff the luxury hotel, 44.4% of the respondents rarely stay at the hotel 27.8% had stay for 2-3 times 13.9% had stayed above 6 times and 9.7% had stayed 2-6 times while 4.2 had stayed once a year,

Table 2: Demographic Information

Variable	Frequency	Percentage
Age		
18-24	40	55.6
25-34	15	20.8
35-44	10	13.9
45-55	5	6.9
55 and above	2	2.8
Gender		
Male	54	75
Female	18	25
Category		
Staff	9	12.5
Guest	40	55.6
Visitor	23	31.9
How often do you stay at the hotel per year		
Rarely	32	44.4
Once a year	3	4.2
2-3 times	20	27.8
2-6 times	7	9.7
Above 6 times	10	13.9

Several survey questions shown on Table 3 were presented to the respondents to know their perception of the biophilic design element on the user's wellbeing. The survey questions were able to reveal the interactions of the users with elements such as natural lighting, views of nature, greenery, and sensory experiences in high-end hotel spaces

From the analysis, 50% of the respondents did have access to views natural elements from their room during their stay while 50 % do not. 69.4% of the respondents agreed that there are adequate natural lighting in their hotel room while 30.6% disagreed with a mean value of 1.306 which implies that the respondents agreed that there are adequate natural lighting in their room.

41.7% of the respondents agreed that the presence of nature-inspired artwork is positive in the hotel and 18.1% agreed that it is very positive while 13.9% agreed that the presence of nature-inspired artwork is negative, 6.9% agreed that it is very negative with a mean value of 3.5 which implies that the presence of nature-inspired artwork in the hotel is positive. 56.9% of the respondent agreed that the hotel did not feature non-visual connection with natural while 43.1% agreed that the hotel feature non-visual connections with natural.

45.8% of the respondents rarely notice natural scents in common areas or in their room, 34.7% occasionally notice natural scents while 6.3% often notice it and 11.1% very often notice the natural scent in common area with a mean value of 1.85 which implies that the respondents occasionally notice the natural scents in common areas or in their rooms. 69.4% of the respondents notice the use of biophilic materials in the design of their room and common areas while 30.6% did not notice the use of biophilic materials in the design of their room and common areas.

Table 3: Perception of the respondents on the biophilic design element

Variable	Frequency (percentage)	Mean value
Access to views of natural elements from your room during your stay? Yes No	36 (50) 36 (50)	1.5
Was there adequate natural lighting in your hotel room? Yes No	50 (69.4) 22(30.6)	1.306
Were there opportunities to interact with nature, such as outdoor seating areas or garden paths? Yes No	34 (47.2) 38(52.8)	1.528
Did you find yourself spending more time in areas with views of nature within the hotel? Yes No	36(50) 36(50)	1.5
Presence of live plants or greenery in the hotel spaces Negative Neutral Positive Very Positive	11 (15.3) 10(13.9) 34(47.2) 17(23.6)	3.79

Visual connection with nature (e.g., views of natural landscapes, outdoor seating, or balconies)		3.76
Very negative	2(2.8)	
Negative	11(15.3)	
Neutral	11(15.3)	
Positive	26(36.1)	
Very Positive	22(30.6)	
Presence of nature-inspired artwork		3.5
Very negative	5 (6.9)	
Negative	10(13.9)	
Neutral	14(19.4)	
Positive	30(41.7)	
Very Positive	13(18.1)	
Did the hotel feature non-visual connections with natural, such as natural sounds and scents		1.57
Yes	31(43.1)	
No	41(56.9)	
How often did you notice natural scents in common areas or your room?		1.85
Rarely	33 (45.8)	
Occasionally	25(34.7)	
Often	6(8.3)	
Very often	8(11.1)	
Did you notice the use of biophilic materials (e.g., wood, stone) in the design of your room and common areas		1.306
Yes	50 (69.4)	
No	22(30.6)	

52.8% of the respondent do not had the opportunities to interact with nature while 47.2% have the opportunities with a mean value of 1.528 which implies that the respondents do not have the opportunities to interact with nature. 50% of the respondents agreed that they find themselves spending more time in areas with views of nature within the hotel while 50% disagreed. The analysis shown in Table 3 is represented statically using bar chart shown on Figure 1 and 2.

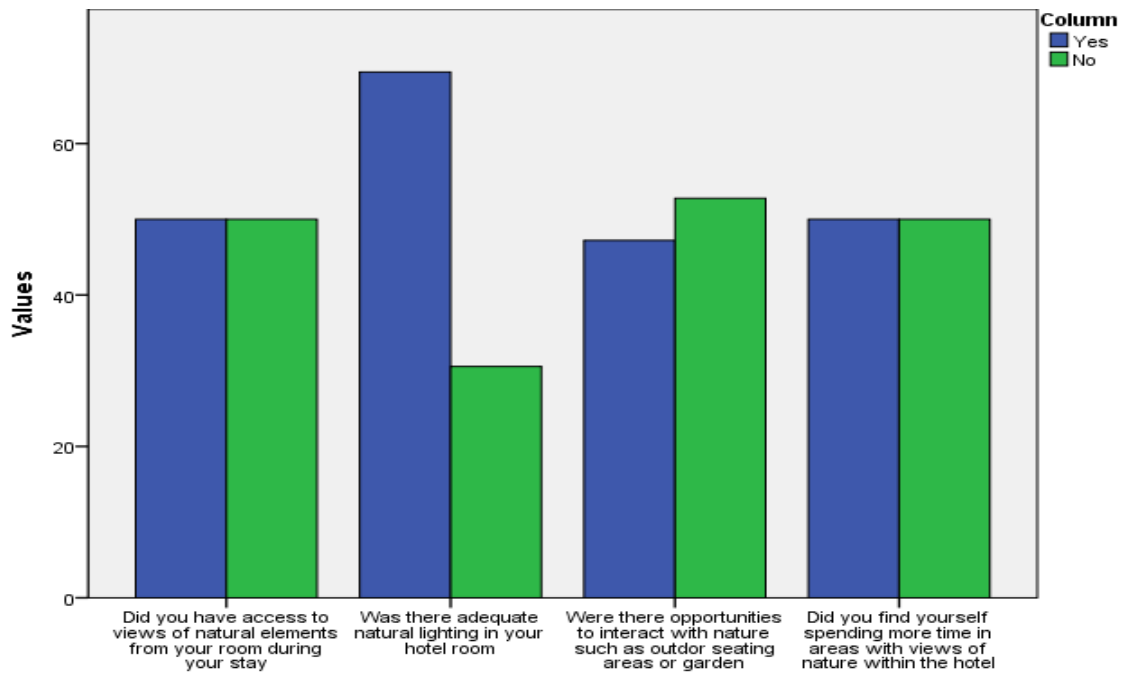


Figure 1: Perception of the respondent on the biophilic features

47.2% of the respondents agreed that the presence of live plants or greenery in the hotel spaces are positive and 23.6% agreed that it is very positive while 15.3% agreed that the presence of live plants or greenery in the hotel spaces were negative and 13.5% were neutral about it. 36.1% of the respondents agreed that the presence of visual connection with nature (view of natural landscapes, outdoor seating or balconies) were positive and 30.6% agreed that it is very positive while 15.3% agreed that the presence of visual connection is negative and 2.8% agreed that it is very negative with a mean value of 3.76 which implies that the presence of visual connection with nature is positive.

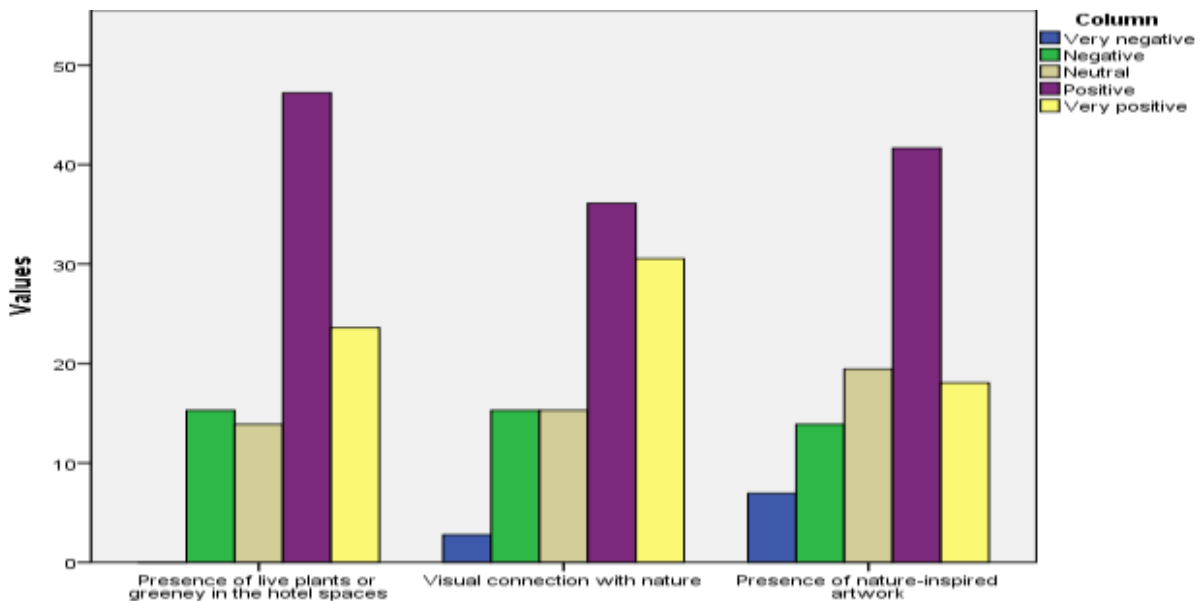


Figure 2: Perception of the respondent on the biophilic features

Table 4 shows the influence of biophilic design elements on user’s perception. From the analysis, 36.1% of the respondents agreed that it very important for them to have a view of nature from their hotel room, 43.1% agreed that it is moderately important an 11.1% agreed that it is extremely important while 8.3% agreed that it is slightly important and 1.4% agreed that it is not important with a mean value of 3.5 which implies that the respondents agreed that it is very important for them to have a view of nature from their hotel room.

33.3% of the respondents agreed that the nature lighting in their room is effective in enhancing their sense of well-being, 13.9% agreed that it is very effective, 37.5% were neutral about it, while 11.1% agreed that it is ineffective and 4.2% agreed that it is very ineffective with a mean value of 3.417 which implies that the respondent agreed that the natural lighting in their room is moderately effective in enhancing their sense of well-being.38.9% of the respondents agreed that biophilic element has a positive influence on their well-being during their stay and 4.2% agreed that the influence is very positive while 5.6% agreed that the influence is negative and 51.4% were neural about it with a mean value of 3.417 which implies that the respondents were neutral about the subject.

33.3% of the respondents agreed that the importance of non-visual connections with nature in a luxury hotel is significant, 25% agreed that it moderate and 6.9% agreed that the important is complete while 25% agreed that there is a slight important of non-visual connections with nature with the mean value 3.028. 34.7% of the respondents agreed that the important of non-visual connections with nature is significant in making the respondents feel connected to the environment, 31.9% agreed that the important is moderate and 8.3% agreed that the important is complete while 12.5% agreed that there is a slight important of non-visual connections in making the respondents feel connected to the environment with a mean value of 3.14 which implies that the important of non-visual connections with nature in making the respondent feel connected to their environment is moderate

40.3% of the respondents agreed that the visual connection with nature have a moderate influence on their choice of stay in the hotel, 29.2% agreed that the influence is very important, 12.5% agreed that the influence is extremely important while 8.3% agreed that it is slightly important and 9.7% agreed that it is not important with a mean value of 3.26 which implies that the respondents agreed that the visual connection with nature have a moderate influence on their choice of stay in the hotel

Table 4: Effects of biophilic design elements on user’s perception in hotel environment

Variable	Frequency (percentage)	Mean value
How important is it for you to have a view of nature from your hotel room?		
Not important	1 (1.4)	3.5
Slightly important	6 (8.3)	
Moderately important	31 (43.1)	
Very important	26(36.1)	
Extremely important	8(11.1)	
How effective was the natural lighting in your room in enhancing your sense of well-being?		3.417
Very ineffective	3 (4.2)	
Ineffective	8(11.1)	
Neutral	27(37.5)	
Effective	24(33.3)	
Very effective	10(13.9)	
To what extent did the visual connection with nature influence your choice of this hotel for your stay?		3.26
Not important	7 (9.7)	
Slightly important	6(8.3)	
Moderately important	29(40.3)	

Very important	21(29.2)	
Extremely important	9(12.5)	
How did these elements influence your well-being during your stay?		3.417
Extremely negative	0	
Negative	4(5.6)	
Neutral	37(51.4)	
Positive	28(38.9)	
Very Positive	3(4.2)	
How would you rate the importance of non-visual connections with nature in a luxury hotel		3.028
None	7 (9.7)	
Slight	18(25)	
Moderate	18(25)	
Significant	24(33.3)	
Complete	5(6.9)	
How important are non-visual connections with nature in making you feel connected to the environment?		3.139
None	9(12.5)	
Slight	9(12.5)	
Moderate	23(31.9)	
Significant	25(34.7)	
Complete	6(8.3)	

Table 5 shows the influence of biophilic element on overall wellbeing of the users. According to the analysis, 50% of the respondents agreed that the contribution of the nature-based material selection is positive to a sense of well-being during their stay, 27.8% were neutral about it, 8.3% agreed that the contribution is very positive while 13.9% agreed that the contribution is negative with a mean value of 3.5 which implies the respondents agreed that the nature-based material contributed positive to their sense of well-being their stay.

41.7% of the respondents agreed that the rate the impact of nature-based material selection on the hotel's overall design and atmosphere is positive, 20.8% agreed that it is very positive, 19.4% were neutral about it while 15.3% agreed that the rate of impact is negative with a mean value of 3.63 which implies the respondents agreed that the rate the impact of nature-based material selection on the hotel's overall design and atmosphere is positive.

34.7% of the respondents agreed that the use of natural shapes and forms contribute to the overall aesthetics and design of the hotel is positive, 20.8% agreed that it is very positive, 30.6% were neutral about it while 11.1% agreed that the use of natural shapes and forms is negative with a mean value of 3.597 which implies the respondents agreed that the use of natural shapes and forms contribute to the overall aesthetics and design of the hotel is positive

Table 5: Influence of biophilic element on overall well-being of the users

Variable	Frequency (percentage)	Mean value
How did the nature-based material selection contribute to a sense of well-being during your stay? Negative Neutral Positive Very positive	10 (13.9) 20(27.8) 36(50) 6(8.3)	3.53
How would you rate the impact of nature-based material selection on the hotel's overall design and atmosphere? Very Negative Negative Neutral Positive Very positive	2 (2.8) 11(15.3) 14(19.4) 30(41.7) 15(20.8)	3.63
How did the use of natural shapes and forms contribute to the overall aesthetics and design of the hotel? Extremely Negative Negative Neutral Positive Very positive	2 (2.8) 8(11.1) 22(30.6) 25(34.7) 15(20.8)	3.597
How did the presence of natural shapes and forms in the design impact your perception of the hotel's character and uniqueness? Extremely Negative Negative Neutral Positive Very positive	3 (4.2) 9(12.5) 19(26.4) 25(34.7) 16(22.2)	3.583
During your stay, did you experience a sense of relaxation and tranquillity? Yes No	60(83.3) 12(16.7)	1.167
Did you find it easier to concentrate and work (if applicable) with the presence of these natural features around you in the hotel? Yes No	62 (86.1) 10(13.9)	1.139
Did the design elements encourage you to spend more time in communal areas, such as lounges or outdoor Yes No	55 (76.4) 17(23.6)	1.236
How did the biophilic design elements affect your overall mood and happiness during your stay? Slightly decreases No noticeable change Slightly Improved Significantly improved	1 (1.4) 23(31.9) 23(31.9) 25(34.7)	4.00

The presence of indoor plants or a visual connection with nature improve your wellbeing Strongly disagree Disagree Neutral Agree Strongly agree	2 (2.8) 8(11.1) 8(11.1) 32(44.4) 22(30.6)	3.889
The presence of nature reduces stress and improves cognitive performance Strongly disagree Disagree Neutral Agree Strongly agree	2 (2.8) 8(11.1) 11(15.3) 29(40.3) 22(30.6)	3.847

34.7% of the respondents agreed that the presence of natural shapes and forms in the design is positive to their perception of the hotel's character and uniqueness, 22.2% agreed that it is very positive, 26.4% were neutral about it while 12.5% agreed that the presence of natural shapes and forms is negative with a mean value of 3.583 which implies the respondents agreed that the presence of natural shapes and forms in the design is positive to their perception of the hotel's character and uniqueness. The analysis shown in Table 5 is represented statically using bar chart shown on Figure 3, 4 and 5.

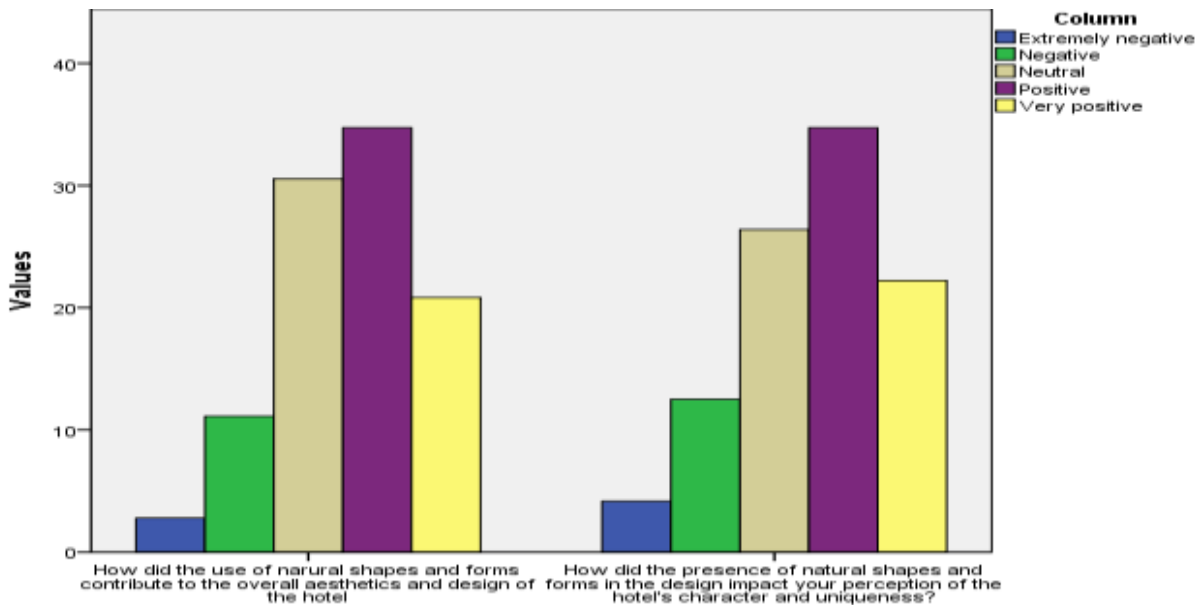


Figure 3: Respondents view on the effects of indoor plants on wellbeing

Figure 4 shows the respondents view on the effects of indoor plants on wellbeing. According to the analysis, 44.4% of the respondents agreed that the presence of indoor plants or a visual connection with nature improve their wellbeing, 30.6% strongly agreed while 11.1% were neutral and disagreed with a mean value of 3.89 which implies that the respondent agreed that the presence of indoor plants or a visual connection with nature improve their wellbeing. 40.3% of the respondents agreed that the presence of nature reduces stress and improves cognitive performance, 30.6% strongly agreed while 15.3% were neutral about it and 11.1% disagreed with a mean value of 3.847 which implies that the respondent agreed that presence of nature reduces stress and improves cognitive performance

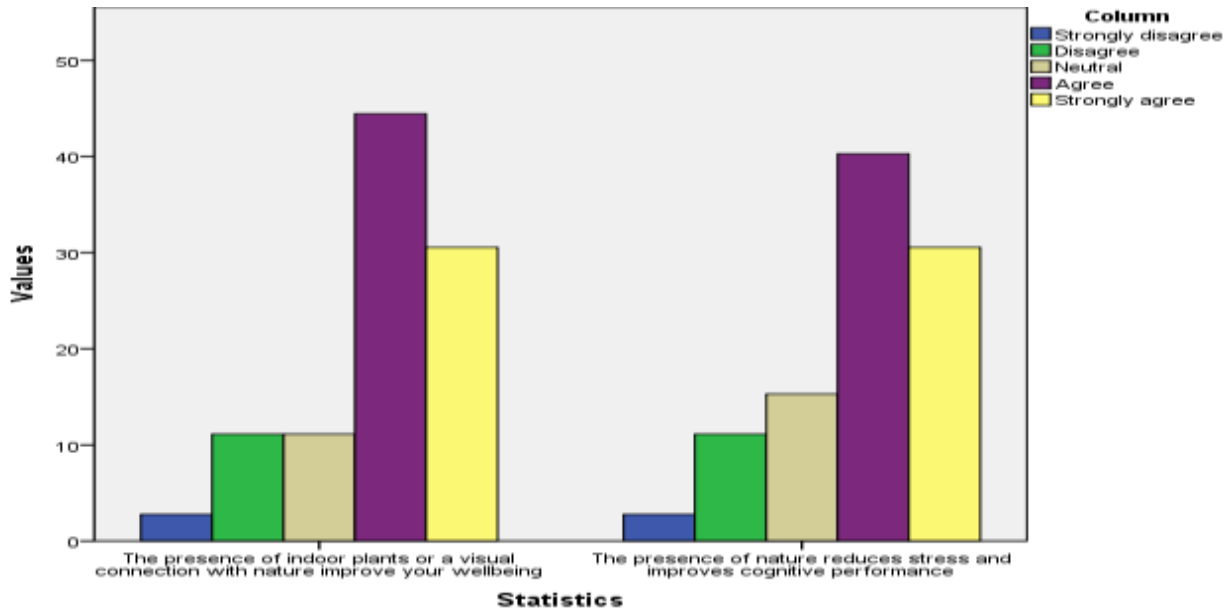


Figure 4: Respondents view on the effects of indoor plants on wellbeing

Figure 5 shows respondents view on the effects biophilic elements in the hotel environment. 83.3% of the respondents experience a sense of relaxation and tranquillity during their stay while 16.7% did not experience a sense of relaxation and tranquillity during their stay. 86.1% of the respondents find it easier to concentrate and work (if applicable) with the presence of these natural features around you in the hotel while 13.9% do not find it easier to concentrate and work (if applicable) with the presence of these natural features around you in the hotel. 76.4% of the respondents were encouraged by the design elements to spend more time in communal areas while 23.6% were not encouraged by the design elements to spend more time in communal areas.

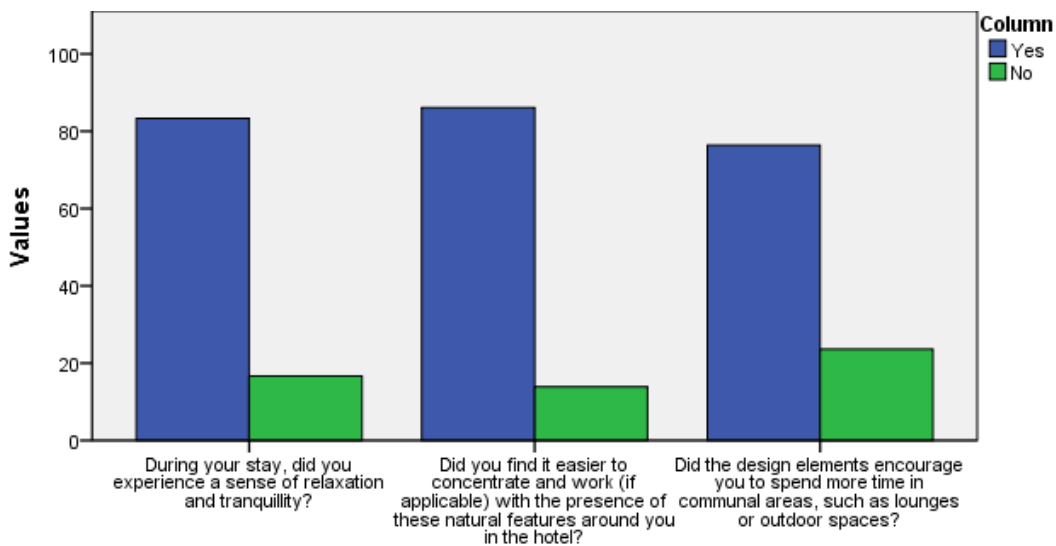


Figure 5: Respondents view on the effects biophilic elements in the environment

CONCLUSION AND RECOMMENDATION

The research explores biophilic design elements towards enhancing the user's wellbeing with a specific goal to enhance the user's adequate physical, mental, and social well-being of the occupants in hotel buildings. Based on the study, the biophilic design elements present in most of the hotel environment is

poor which promote uncomfortable environment for the users. The study also acknowledges the positive effects of the biophilic elements on the users by promoting their comfort and wellbeing. Although biophilic design has gained recognition, its widespread adoption, particularly in developing countries like Nigeria, has been hindered by a lack of technical expertise. This study highlights the potential benefits of incorporating biophilic design into various environments, emphasising its positive impact on productivity, creativity, and interaction. Therefore, it is recommended that the government, Architects and developers, take measures to embrace biophilia as a fundamental design principle for hotels, especially in areas where guests relax. To emphasise its significance, it is proposed that biophilia be incorporated into hotel policies, elevating it to a standard in the design and construction of spaces dedicated to guest comfort. This can be achieved through the enforcement of building codes, policies, and regulations that can promote adequate integration of biophilic design elements. Additionally, there is a need for increased awareness and education on the importance and benefits of biophilic elements in the hotel environment and their impact on the well-being of users.

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