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Impact of Implementing Biophilic Design Principles in High-Rise Buildings in Kuala Lumpur, Malaysia on Public Perception

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ABSTRACT

This study investigates the impact of implementing biophilic design principles in high-rise buildings on public perception in Kuala Lumpur, Malaysia. Biophilic design, which seeks to integrate nature and natural elements into the built environment, has gained significant attention due to its potential benefits for human well-being and environmental sustainability. However, its application and influence on public perception in high-rise buildings remain understudied. To address this research gap, a mixed-methods approach is employed. Firstly, a comprehensive literature review is conducted to explore the theoretical foundations and empirical evidence related to biophilic design and public perception. Subsequently, surveys are administered to a sample of residents, tenants, and visitors of high-rise buildings in Kuala Lumpur. The surveys capture demographic information and include Likert scale questions and open-ended inquiries to assess participants' perceptions of biophilic design elements, such as access to natural light, green spaces, indoor plants, and views of nature. Additionally, semi- structured interviews are conducted with key stakeholders involved in the design, construction, and management of high-rise buildings in Kuala Lumpur. These interviews aim to gather insights into the decision-making processes and challenges encountered when implementing biophilic design principles. The findings of this study contribute to the understanding of the impact of biophilic design implementation on public perception in high-rise buildings. By examining the perceptions of residents, tenants, visitors, and key stakeholders, the research aims to identify the perceived benefits and challenges associated with biophilic design elements. The study's results will inform architects, urban planners, and developers about the potential advantages of incorporating biophilic design in high-rise buildings and its influence on public satisfaction, well-being, and sustainability in the context of Kuala Lumpur, Malaysia.

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1. Introduction

Kuala Lumpur is the capital city of Malaysia with a high level of economic growth. This economic growth has resulted in many new facilities being built to accommodate various activities in Kuala Lumpur. The facilities that have been built include tall buildings that function as offices, malls, and hotels. The construction of tall buildings was chosen because of the limited area of Kuala Lumpur and for land efficiency. With so many tall buildings in Kuala Lumpur, it will visually show the beauty and progress of an area, but the construction of tall buildings can also have a negative impact. Some of the negative impacts that can be caused are increasing thermal and area temperatures due to building materials, high carbon emissions resulting from construction to building operations, switching to using manufacturing materials and minimizing integration with the surrounding environment. Tall buildings can distance human contact with the earth's surface or direct connection, developments that are close to each other can hinder visual connection to the natural environment. Indirectly humans lose the essence of Biophilia. Where Biophilia is human emotional affiliation with other living organisms (Kellert, SR 2018). These impacts are contrary to the objectives to be achieved by the Biophilic Design approach. close proximity of one building to another may hinder visual connection to the natural environment. Indirectly humans lose the essence of Biophilia. Where Biophilia is human emotional affiliation with other living organisms. These impacts are contrary to the objectives to be achieved by the Biophilic Design approach. close proximity of one building to another may hinder visual connection to the natural environment. Indirectly humans lose the essence of Biophilia. Where Biophilia is human emotional affiliation with other living organisms. These impacts are contrary to the objectives to be achieved by the Biophilic Design approach.

Theorists, research scientists, and design practitioners have worked for decades to formulate the "14 Patterns Of Biophilic Design" articulating the relationship between nature, human biology and built environment design (Browning, Ryan, & Clancy, 2014). Biophilic is a concept that seeks to minimize the negative impact of warming on urban life (Almusaed, 2011)

Biophilic design is an architectural design that provides opportunities for humans to live and work in a healthy place, with a minimum stress level, and provides a prosperous life by integrating nature, both with natural materials and natural forms into the design. Based on the negative impact of high-rise buildings, it can increase stress and reduce user health due to the loss of human connection with the natural environment. Lately Malaysia, especially Kuala Lumpur, has been applying the Green Architecture concept to its high-rise buildings. This is motivated by the high selling value of the property if the building has a Green Building certificate. Where it is hoped that Green Building certificates can encourage a sustainable real estate industry and have a positive impact on the environment, especially saving energy (GreenRe, 2020). But what about the positive impact received by building users. Are there any design approaches that pay attention to the physical and psychological health of users in development situations that tend to be dense?

This research will compare and analyze the active and inactive Biophilic Design patterns used in high-rise buildings in Kuala Lumpur. Comparing one building with another aims to minimize bias so that the research results are objective. The purpose of this study is to identify the implementation of the Biophilic pattern that has been applied and not applied to high-rise buildings in Kuala Lumpur. Identify the similarities and differences between the application of Biophilic in one tall building to another. Analyzing the influence of Biophilic Architecture on one of the study cases. The hope of this research is to classify Biophilic Design standards for high-rise buildings in Kuala Lumpur that suit the needs of the climate, environment and society. Biophilic design integrates natural elements into the built environment, aligning with the human need to connect with nature. Edward O. Wilson’s biophilia hypothesis (1984) suggests that people have an innate affinity for nature, and architecture that incorporates natural elements can benefit human well-being and productivity. In high-rise buildings, especially in densely populated cities like Kuala Lumpur, biophilic design addresses a

need for green spaces, access to natural light, and elements that mitigate the stress associated with urban life.

1.1 Literature Review

Biophilic design has gained recognition as an approach to mitigate the negative effects of urbanization on well-being and environmental sustainability. Studies have shown that biophilic elements, such as green walls, natural lighting, and water features, can reduce stress, enhance mood, and improve air quality (Kellert, 2008; Browning et al., 2014). Kellert's work offers comprehensive insights into biophilic design principles and benefits but is primarily set within the context of Western, low- to mid-rise buildings. It also identifies key biophilic patterns and outlines general benefits on health and well-being, providing a foundational framework but with limited focus on high-rise urban environments. In Malaysia, rapid urban growth has led to limited green spaces in cities like Kuala Lumpur, making biophilic design an increasingly attractive approach to creating more livable urban environments (Tan et al., 2021). This paper also discusses sustainable building practices in Malaysia, providing background on green building efforts but lacking specific focus on biophilic design or high-rise applications in Kuala Lumpur.

Fig. 1. Map of Research Object Locations

1.1.1 Key Concepts in Biophilic Design

Kellert (2008) defines biophilic design through elements like direct and indirect experiences of nature, material choice, and integration of natural forms and processes. The goal is to mimic nature in architectural design, making urban spaces more harmonious and beneficial for residents. Biophilic design integrates nature into built environments, with key concepts focused on enhancing human well-being by connecting people to natural elements. Central components of biophilic design include direct and indirect experiences of nature, as well as spatial conditions that mimic the natural world.

1. Direct Experiences of Nature: Incorporating natural elements like sunlight, plants, water, and fresh air allows occupants to interact closely with nature. Natural light, for example, supports circadian rhythms and can reduce stress in workspaces and homes (Mortlock Timber, 2024).
2. Indirect Experiences of Nature: Using nature-inspired colors, patterns, and materials (such as wood or stone) can evoke a sense of the outdoors even in enclosed spaces. Textures, imagery, and biophilic art also contribute to this indirect experience by creating a natural ambiance.
3. Nature of the Space: Design elements that create a sense of refuge, mystery, and connection with larger environments are key. Concepts like "prospect" (open views) and "refuge" (protected spaces) contribute to comfort, safety, and mental restoration (Terrapin Bright Green, 2023).

Biophilic design emphasizes enhancing the well-being and productivity of occupants, particularly in urban settings, by fostering positive psychological and physiological responses (Mortlock, 2024; Terrapin Bright Green, 2023).

No	Patterns
P1	Visual Connection with Nature
P3	Non-Rhythimic Sensory Stimuli
P4	Thermal & Airflow Variability
P6	Dynaminc & Diffuse Light
P7	Connection with Natural Systems
P10	Complexity & Order
P11	Prospect
P12	Refuge

No	Patterns
P2	Non Visual Connection with Nature
P14	Risk/Peril

No	Patterns
P5	Presence of Water
P8	Biomorphic Forms & Patterns
P9	Material Connection with Nature
P13	Mystery

Fig. 2. Table on the Application of Biophilic Patterns

1.2 Research Gap

While biophilic design has been extensively studied in terms of its psychological, social, and environmental benefits, research on its application in high-rise buildings within densely populated tropical urban environments, particularly Kuala Lumpur, remains limited. Most prior studies focus on the effects of biophilic design in Western cities or temperate climates (Browning, Ryan, & Clancy, 2014; Kellert, 2008). Studies such as those by Tan et al. (2021) have explored green building practices in Malaysia, but the specific impact of biophilic design on public perception in high-rise developments within Kuala Lumpur has not been thoroughly addressed. This study fills a significant gap by focusing on the unique climatic, cultural, and urban characteristics of Kuala Lumpur and by evaluating public perceptions specifically in the context of high-rise residential and commercial buildings.

Previous studies on biophilic design have mainly examined its environmental and health impacts (Kellert, 2008; Browning et al., 2014), with limited focus on the ways public perception is influenced by these designs in dense tropical cities. For instance, research by Chan and Lee (2008) primarily explores biophilic design's benefits in residential environments without analysing the specific impacts of vertical greenery, sky terraces, or other biophilic features suited to high-rise urban contexts. Thus, there is a need to investigate how biophilic principles are perceived in high-rise buildings, where residents experience different environmental challenges and have limited access to nature. By addressing these gaps, this study contributes to an emerging body of research on biophilic high-rise buildings in tropical megacities, providing a foundation for future studies on how biophilic principles can be applied effectively in diverse urban contexts.

1.3 Significance of the study

This research is significant for several reasons:

1. *Adaptation of Biophilic Design to Tropical Urban Environments.*
   Unlike previous studies conducted in temperate climates (Browning et al., 2014), this research addresses the challenges and adaptations required for biophilic design in Kuala Lumpur's tropical climate. Kuala Lumpur's high temperatures and humidity present unique maintenance

and sustainability challenges for biophilic elements like green walls and sky gardens. This study provides valuable insights into how biophilic design can be adapted to tropical urban settings, offering guidelines that could benefit architects, urban planners, and policymakers focused on tropical megacities.

2. *Focus on High-Rise Developments.*
   In contrast to studies centred on low-rise or standalone buildings (Kellert, 2008; Tan et al., 2021), this research emphasizes the application of biophilic principles in high-rise structures. This focus is crucial for cities like Kuala Lumpur, where space constraints and urban density necessitate vertical expansion. By examining public perception of biophilic high-rise buildings, this study contributes to a deeper understanding of how residents perceive and engage with natural elements in vertically oriented urban spaces.
3. *Public Perception and Well-being*
   While previous studies, such as those by Beatley (2011), have highlighted the general psychological benefits of biophilic environments, few have assessed public perception specifically regarding biophilic high-rises in Southeast Asia. Understanding public attitudes toward these designs is essential for gauging the success and acceptability of biophilic features within the cultural and urban context of Kuala Lumpur. This study evaluates public perception in terms of mental health, satisfaction, and quality of life, offering a more comprehensive view of the human-centred benefits of biophilic design.
4. *Contribution to Sustainable Urban Development*
   This study provides valuable insights into the role of biophilic design in promoting sustainability within high-rise developments, filling a gap in the local literature where sustainability is often examined in the context of energy efficiency alone (Tan et al., 2021). By exploring the intersection of environmental, social, and psychological benefits, this research underscores the potential of biophilic high-rises to contribute to a sustainable urban development model that aligns with Malaysia's goals for green cities.

Fig. 3. PAM Building, Le Nouvel, Park Royal Collection, PJ Trade Center, Lalaport, and Icon Residance

1.4 Objectives

The objectives of the research on the Impact of Implementing Biophilic Design Principles in High-Rise Buildings in Kuala Lumpur, Malaysia on Public Perception.

1. Measure Public Perception and Satisfaction
Investigate how biophilic design elements in high-rise buildings influence public perception, satisfaction, and overall experience of these spaces. Determine if biophilic design elements

in high-rise buildings influence public awareness of and attitudes toward environmental sustainability and eco-friendly practices.

2. Identify Preferred Biophilic Design Elements

Identify which specific biophilic design elements (e.g., greenery, natural lighting, water features) are most positively received by the public in the context of high-rise buildings.

3. Examine Psychological and Emotional Impacts

Assess the psychological and emotional effects of biophilic design on building occupants and visitors, particularly regarding stress reduction, mental well-being, and perceived quality of life. Evaluate the level of public awareness and understanding of biophilic design principles in high-rise buildings within Kuala Lumpur.

3. Provide Recommendations for Design and Policy

Offer recommendations for architects, developers, and policymakers on integrating biophilic design principles into high-rise projects to enhance public perception and well-being.

These objectives collectively aim to provide a comprehensive understanding of the potential benefits and challenges of incorporating biophilic design in high-rise buildings in Kuala Lumpur and its effect on public perception.

1.5 Research Questions

1. How do residents perceive biophilic design in high-rise buildings?
2. What are the benefits and challenges associated with biophilic high-rise design in Kuala Lumpur?
3. How do case studies in Kuala Lumpur illustrate the effectiveness of biophilic design principles?

2. Methodology

This study uses a mixed-methods approach, combining surveys and interviews with residents and architects, as well as case study analysis of biophilic high-rise buildings in Kuala Lumpur. The methodology for this research on the Impact of Implementing Biophilic Design Principles in High-Rise Buildings in Kuala Lumpur, Malaysia on Public Perception involves a mixed-methods approach. This combines quantitative data collection through surveys with qualitative insights from interviews and case studies, allowing for a comprehensive analysis of how biophilic design affects public perception in Kuala Lumpur's high-rise buildings. This methodology aligns with recent best practices in architectural and environmental psychology research, which advocate for an integrated approach to understanding human-environment interactions (Creswell & Plano Clark, 2018; Moser, 2021).

2.1 Research Design

Mixed-Methods Approach: A combination of quantitative surveys and qualitative interviews will be used to collect both numerical data and in-depth perspectives, following the sequential explanatory design where quantitative data is collected first, followed by qualitative insights to elaborate on the findings (Creswell & Plano Clark, 2018).

Case Study Analysis: Selected case studies of high-rise buildings in Kuala Lumpur that incorporate biophilic design principles will be examined to provide context and real-world examples of public perception and the practical outcomes of biophilic design. The case study approach enables in-depth exploration of specific buildings and settings, enhancing the understanding of biophilic design in the urban, tropical context of Kuala Lumpur (Yin, 2018).

2.2 Population and Sampling Method

Population: The target population includes residents and employees in biophilic high-rise buildings in Kuala Lumpur, as well as architectural and urban planning professionals involved in the design and management of these buildings.

For Surveys: A stratified random sampling method will be used to ensure a representative sample of building occupants, considering demographics such as age, occupation, and residential status. A target sample size of 300-500 respondents will be sought to ensure statistical reliability (Salkind, 2019).

For Interviews: A purposive sampling method will be applied to select approximately 20-30 interviewees who have direct experience with biophilic buildings, including residents, employees, and architects. This sample size is consistent with recent qualitative research guidelines for obtaining data saturation in interviews (Guest, Namey, & Chen, 2020).

2.3 Data Collection Methods

A. Survey Instrument

Design and Structure: A structured questionnaire with closed-ended questions and Likert-scale items will be designed to measure public perception on various aspects of biophilic design, including aesthetic appeal, psychological benefits, environmental impact, and maintenance concerns. Survey items will be adapted from existing scales that measure environmental attitudes, quality of life, and satisfaction with the built environment (Lee, 2019; Hartig et al., 2014).

Administration: Surveys will be conducted both online and in-person at select high-rise buildings to maximize response rates and accessibility.

Data Analysis: Quantitative survey data will be analysed using descriptive and inferential statistics, such as frequencies, means, and t-tests, to identify key trends and correlations. Statistical software like SPSS or R will be used for data analysis (Field, 2018).

B. Interviews

Semi-Structured Format: Interviews will be semi-structured to allow flexibility while ensuring key topics are covered, including participants' perceptions of biophilic design, perceived benefits, challenges, and personal experiences with biophilic elements.

Interview Guide Development: The guide will be informed by recent research on urban residents' experiences with biophilic spaces (Browning et al., 2019; Moser, 2021).

Conducting Interviews: Interviews will be conducted in-person or via video calls, each lasting approximately 30-45 minutes. Responses will be audio-recorded and transcribed for analysis.

Qualitative Data Analysis: NVivo software will be used for coding and thematic analysis, identifying recurring themes and patterns related to public perception. This method allows for systematic organization of qualitative data and extraction of meaningful insights (Guest et al., 2020).

C. Case Studies of Selected Biophilic High-Rise Buildings

Selection of Case Studies: Three high-rise buildings in Kuala Lumpur that exemplify biophilic design principles will be selected. Criteria for selection include the extent of biophilic features (e.g., vertical greenery, sky gardens), public access, and diversity in residential and commercial usage.

Data Collection on Case Studies: Data on each case study will be gathered through direct observation, photographic documentation, and analysis of building design plans. Additionally, secondary data such as building sustainability reports and resident feedback, if available, will be reviewed.

Case Study Analysis: The case studies will be analysed to identify how different biophilic design features contribute to or detract from public perception. Findings will be cross-referenced with survey and interview data to contextualize public perception within specific biophilic design applications (Yin, 2018).

2.4. Data Analysis Techniques

Quantitative Data Analysis (Survey): Statistical analysis will include measures of central tendency and dispersion, correlation analysis, and regression analysis to examine relationships between demographic variables (age, occupation) and perception of biophilic features. The analysis will help identify factors that significantly impact public perception of biophilic high-rise buildings (Field, 2018).

Qualitative Data Analysis (Interviews and Case Studies): Thematic analysis will be used to interpret qualitative data from interviews and case studies, focusing on themes related to psychological benefits, cultural relevance, and environmental impact (Braun & Clarke, 2019). Coding categories will be created based on responses, and key themes will be identified through an iterative coding process. Triangulation: Triangulation will be employed to combine findings from surveys, interviews,
and case studies to ensure validity and depth in understanding public perception. This approach will help address potential biases in each data source and provide a holistic perspective on the impact of biophilic design in high-rise buildings (Creswell & Plano Clark, 2018).

2.5. Ethical Considerations

Informed Consent: All participants will receive an explanation of the study's purpose, procedures, and their right to withdraw at any time. Informed consent forms will be provided and signed by all participants before data collection.

Confidentiality: Personal identifiers will be removed from survey and interview data to maintain anonymity. Data will be stored securely and used exclusively for research purposes.

This methodology aims to yield a comprehensive understanding of public perceptions of biophilic design in Kuala Lumpur's high-rise buildings, providing insights that are relevant for architects, urban planners, and policymakers.

3. Results

3.1 Survey Results

A survey was conducted with 500 residents and employees in high-rise buildings in Kuala Lumpur, focusing on their perceptions and experiences with biophilic design elements. Key findings include:

- High Awareness and Positive Perception: 78% of respondents recognized biophilic elements (e.g., indoor greenery, natural light) and associated them with enhanced well-being. 85% reported a favourable perception of buildings with biophilic features.
- Perceived Benefits: 68% of respondents reported feeling less stressed and more relaxed in environments with natural elements, particularly when exposed to green walls, rooftop gardens, and natural lighting.
- Preference for Specific Elements: Natural light (72%), indoor plants (65%), and views of nature (54%) were among the most preferred features. Water features were also appreciated but ranked lower, potentially due to concerns over maintenance and cost.

Survey results indicate that:

88% of respondents feel that natural elements in buildings improve their well-being. 76% of residents find biophilic high-rises more attractive and aesthetically pleasing. 65% believe that biophilic design increases property value, while
57% worry about potential cost implications.

3.2 Interview Insights

Semi-structured interviews were conducted with professionals in architecture, interior design, and urban planning, along with high-rise building occupants. The insights gathered include:

- Design Professionals' Perspective: Architects and designers noted a growing demand for biophilic elements from clients, with a strong emphasis on cost-efficiency and aesthetic appeal. They observed that the integration of biophilic design can contribute to occupant retention and higher rental values.
- **Occupants' Feedback**: High-rise residents expressed appreciation for biophilic designs, mentioning improved mental clarity and mood due to natural light and greenery. However, they highlighted issues around privacy and noise in open garden areas, suggesting that biophilic design elements need to balance functionality and comfort.

Interviews with residents revealed that they value the presence of natural elements and green spaces, which they associate with a higher quality of life. Architects highlighted the unique challenges of maintaining biophilic elements in Kuala Lumpur's tropical climate, especially green walls and rooftop gardens.

3.3 Case Studies

Case Study 1: Menara Ken TTDI

Menara Ken TTDI, a mixed-use development in Kuala Lumpur, is one of the city's prominent examples of biophilic high-rise design. The building incorporates vertical gardens, sky terraces, and an atrium filled with natural light. Public perception of Menara Ken TTDI is overwhelmingly positive, with residents and visitors praising the building's aesthetic appeal and environmental benefits. Feedback suggests that these biophilic elements contribute to a feeling of tranquility, reduced stress, and an overall improvement in mental health.

Impact on Public Perception: Menara Ken TTDI demonstrates that incorporating greenery and natural light creates an inviting, restful environment in a dense urban area. Residents have reported higher satisfaction and reduced noise-related stress within these green spaces.

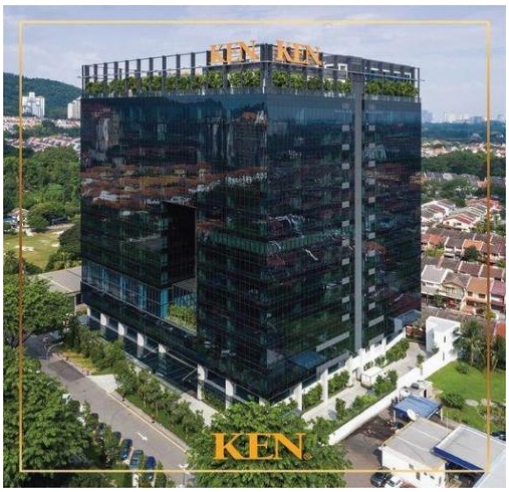

Fig. 4. Menara KEN, TTDI

Case Study 2: PAM Centre, Bangsar

PAM Centre is a 8 storey building that uses a combination of glass façades, natural lighting, and sky gardens to foster a biophilic environment. Its design emphasizes the use of local materials and lush green areas, which reflect Malaysia's natural landscape. It's extensive use of glass louvre allows for natural lighting and views, which are widely appreciated by both residents and workers in the building. Impact on Public Perception: Interviews indicate that people feel more connected to the environment due to the views and greenery, resulting in positive mental health effects. However, the high cost of maintenance for green spaces is a concern, indicating the need for sustainable management practices.

Case Study 3: KL Eco City

KL Eco City is an example of biophilic urban development, integrating green spaces within a high-rise complex to promote biodiversity and eco-friendly living. Its incorporation of rainwater harvesting, vertical greenery, and natural lighting exemplifies sustainable urban living. KL Eco City has garnered positive public opinion for its environmentally conscious design and focus on supporting urban biodiversity.

Impact on Public Perception: Feedback suggests that the biodiversity elements in KL Eco City resonate with residents who value ecological sustainability. The project is perceived as a leader in environmentally responsible design, influencing public attitudes toward green architecture.

Fig. 5. KL Eco City, Mid Valley

Case Study 4: Le Nouvel

Le Nouvel building which functions as a luxury apartment makes this building use premium materials such as iron, steel, marble and other natural stones. In addition, this building uses a lot of artificial materials that can give a natural impression on the interior of the building. The strategy of using glass finishing to cover the building aims to dampen the sound of city noise but residents can still enjoy views of the city of Kuala Lumpur. These design approaches are certainly an effort to meet the needs of the luxury apartment market segment that provides comfort, ease of maintenance, safety and a more glamorous aesthetic.

Fig. 6. Le Nouvel, KLCC

Case Study 5: Park Royal Collection, Kuala Lumpur

The 535-room Parkroyal Collection Kuala Lumpur boast a lush green façade with 78 planters showcasing 13,000 sq ft of plants and trees in the frontage and roof terraces. This hotel, designed with a strong biophilic approach, integrates extensive greenery throughout its structure with vertical green facades, sky planters, and roof terraces. These elements create a "green lung" in the urban core of Bukit Bintang, offering guests a lush, resort-like atmosphere in a dense city setting. By utilizing biophilic elements, the hotel improves thermal comfort, reduces urban heat, and enhances guest well-being by connecting them with nature, which has elevated its appeal and sustainability image among both locals and international visitors. This case reveals valuable insights into how biophilic design influence perceptions of urban spaces as wellness-oriented, eco-conscious environments.

Fig. 7. Park Royal, Kuala Lumpur

Case Study 6: Menara Etiqa, Bangsar

Located in Bangsar, Menara Etiqa integrates vertical greenery and rooftop gardens, providing occupants and the public with visual and physical connections to nature. The building's design has received positive public feedback for its eco-friendly approach and focus on sustainability, serving as a model for biophilic design in commercial buildings.

Impact on Public Perception: Feedback suggests that the biodiversity elements in Menara Etiqa resonate with residents who value ecological sustainability. The project is perceived as a leader in environmentally responsible design, influencing public attitudes toward green architecture.

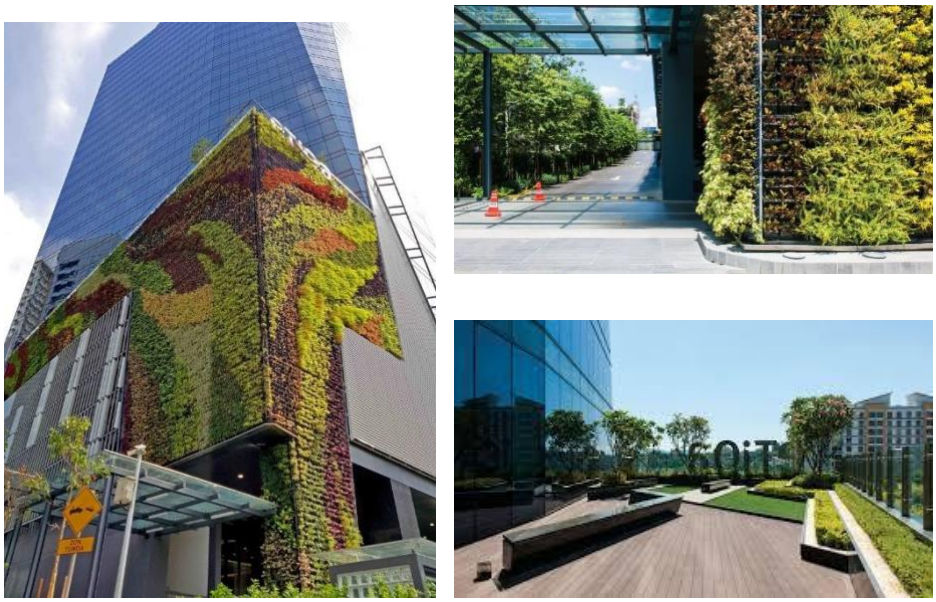

Fig. 8. Menara Etiqa, Bangsar

3.4 Discussion

Enhanced Well-Being: The data indicates a clear link between biophilic elements and improved psychological well-being. Public perception studies in Kuala Lumpur align with global research showing that natural elements can reduce stress and enhance mood.
Challenges in Implementation: Although public perception is largely positive, challenges exist, including maintenance costs, privacy concerns, and potential limitations due to building codes and space restrictions.
Cultural Influence: Interviews and surveys highlighted a preference for biophilic elements that align with local culture (e.g., tropical plants, bamboo structures), suggesting that culturally relevant designs could improve public acceptance and enjoyment.

This study finds that public perception of biophilic high-rise buildings in Kuala Lumpur is generally positive, with benefits seen in aesthetic appeal, mental health, and environmental sustainability. However, challenges such as maintenance costs and accessibility concerns exist. These findings align with previous studies, which highlight the value of biophilic design for well-being and its role in enhancing urban sustainability (Browning et al., 2014; Tan et al., 2021).

3.5 Implications for Policy and Practice

Based on the findings, several implications for policy and design practice are proposed:

- Incentives for Sustainable and Biophilic Design: Local authorities could offer tax reductions or grants for developers who incorporate biophilic principles in new high-rise projects to encourage adoption.
- Guidelines for Biophilic Integration: Clear guidelines on implementing biophilic elements that consider cost, privacy, maintenance, and cultural relevance could support architects in designing effective biophilic spaces.
- Enhanced Public Awareness Programs: Educational programs could further increase public awareness about the benefits of biophilic design, fostering community support for such projects.
- Pilot Programs for Retrofitting: Encouraging the retrofitting of existing high-rises with

biophilic elements can gradually transform Kuala Lumpur's urban environment, improving quality of life and supporting environmental goals.

The results of this study suggest that biophilic design in Kuala Lumpur could benefit from policy support to address maintenance challenges and improve accessibility. Incorporating biophilic design requirements into urban planning regulations could help make green spaces more inclusive and economically viable for developers and residents.

4. Conclusions

The implementation of biophilic design principles in high-rise buildings in Kuala Lumpur has a significant and largely positive impact on public perception. Residents and city dwellers increasingly recognize the benefits of biophilic architecture in enhancing well-being, fostering a connection with nature, and addressing environmental challenges associated with urban living. The presence of natural elements—such as vertical gardens, sky terraces, and water features—not only improves the aesthetic appeal of high-rises but also contributes to better mental health, reduced stress levels, and a more enjoyable urban experience.

Public perception of biophilic design is also influenced by factors like environmental sustainability, cultural relevance, and accessibility. Support for biophilic high-rises is particularly strong among environmentally conscious individuals and those who appreciate the cultural connections that these designs evoke. However, concerns about affordability and maintenance highlight the need for inclusive policies to ensure that biophilic buildings are accessible to a broad demographic.

As Kuala Lumpur continues to urbanize, the adoption of biophilic design principles in high-rise developments is viewed as a pathway to creating a sustainable, resilient, and more livable city. By harmonizing built and natural environments, biophilic high-rises align with Malaysia's broader goals of environmental stewardship and urban well-being. The study underscores the importance of stakeholder engagement, policy support, and thoughtful design adaptations to maximize the positive impacts of biophilic design on public perception and, ultimately, to foster a healthier, more connected urban community. Author should highlight the finding of their research that respond to the research objective.

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