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# The Dark Side of Biophilic Retail Design on Pest, Hygiene, and Maintenance Challenges within the Malaysian Context

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**Abstract**

Biophilic design has been increasingly relevant in the context of current retail interior architecture in Malaysia as it is widely advocated for its capability to improve customer experience, brand image and environmental sustainability. Yet the conversation that appears most frequently in print gives priority to its subjective psychological or aesthetic effects, while little academic discussion has emerged concerning its unintentional operative and environmental repercussions. This research seeks to explore the latent downside of biophilic design retention in Malaysian retail space, particularly under a tropical climate condition of high humidity and biodiversity. With the attention to pest insects and rodents' infiltration; bird intrusion and droppings in semi-open retail space; plant decay, mold formation, hygiene issues, elevated maintenance needs, and costs; this research investigates how nature-related strategies might inadvertently detract from retail performance or public health benchmarks. Taking a qualitative multiple-case approach, the study is based on rigorous semi-structured interviews of retail store owners and design professionals with enhanced triangulation of experiential data through visitor feedback analysis. The results indicate that there is a real conflict between aesthetics-naturalness and functional practicality. Though green walls, indoor planting systems, natural ventilation and water features can have a positive impact on spatial ambience, underdeveloped technical detailing, maintenance planning and risk assessment often leads to biosecurity issues and reputational risk. This problem is compounded by high humidity and rapid organic growth in the warm and humid climate of Malaysia. The research adds to the discussion on sustainable retail design by putting forward a risk-informed framework, which combines biophilic aspirations with health and safety control, hygiene operation and long-term commercial sustainability. It recommends nuanced application of biophilic principles in order to provide balanced, resilient and commercially viable retail store interiors.

**Keywords**: Islamic Ornamentation, Cultural Identity, Retail Interior Design, Cultural Sustainability, Malaysian Context

## Introduction

Biophilic design has become a prevalent paradigm in modern interior architecture, notably in the retail sector, to offer experiential distinction (Kuponiyi & Akomolafe, 2024). In Malaysia, many shopping malls, lifestyle boutiques, coffee shops and flagship stores have incorporated indoor plants, living walls, water features and semi-open ventilation systems to become in-trend (Esan-Ojuri & You, 2021). More often than not these approaches are presented as value-adds that enrich customer experience, bolster brand narrative and play nice on the sustainability field (Cortázar & Vela, 2023). In tropical settings, biophilic design is recognized as culturally and climatically suitable, taking into account Malaysia's diverse flora and fauna and its environmental character (Syafinaz & Sidik, 2025).

Nevertheless, for all its increased application there remains a largely supportive literature and professional discussion of biophilic retail design focusing, as it does, on psychological well-being, restorative environments and dwell-time. Its unintended operational, sanitary and environmental impacts, especially in tropical regions marked by high humidity, rainfall and biodiversity have not been adequately investigated.

Although biophilic features enhance the quality of space, their application in commercial interiors presents issues in controlling an environment. In the hot and humid Malaysian weather, the addition of living plants and water features or natural ventilation openings can lead to unintentional infestation from insects, rodents, birds. Semi-open retail formats are also more exposed to bird droppings, pests and air borne contaminations. In addition, mold development is promoted by high levels of humidity, as well plant degradation and material damage. The present study aims to fill this void, providing a critical reflection of the neglected costs associated with biophilic retail design.

## Literature Review

### *Biophilic Design in Interior Architecture*

An overview of the historical theories relating to biophilia and its interior spatial application in terms of immediate experience; plants, water, mediated experience; natural materials, patterns and other spatial strategies prospect-refuge, organic forms (Syafinaz & Sidik, 2025). These elements are being leveraged to a greater extent in retail contexts as part of an experiential brand strategy (Esan-Ojuri & You, 2021).

### *Biophilic Retail Design and Consumer Experience*

Customer ethnic biofiliatrical shop promotes longer customer-dwell time, emotional connectedness, and brand perception (Esan-Ojuri & You, 2021). Research shows reduced stress, better mood and even increased space comfort. However, a benefits-based approach is taken in the majority of such research and there is relatively little operational criticism (Cortázar & Vela, 2023).

### *Environmental Challenges in Tropical Interior Architecture*

Tropical conditions present specific environmental factors such as high humidity (70–90%), heavy rainfall, and high biodiversity (Amaripadath et al., 2023). These conditions also result

in the proliferation of molds, activity of termites, and rapid degradation of organic matter. Semi-open retail models add additional challenges in managing environments (Wu et al., 2025).

*Pest, Hygiene, and Biosecurity in Commercial Interiors*

A few studies focus on healthy biophilic interiors and how pests could be thwarted and hygiene can be sustained (Lei et al., 2022). The retail space is governed by public health codes and the potential for pollutants such as bird droppings and insects can jeopardize an enterprises brand image and if severe enough, their ability to be operational (Esan-Ojuri & You, 2021).

*Maintenance and Lifecycle Cost Implications*

Biophilic installations also require the provision of watering systems, drainage details and replacement plant cycles as well as ongoing environmental monitoring (Haidamous, 2022). Lack of planning results in higher operational costs-over the long-term-and lower sustainability (French, 2021).

**Methodology**

The research utilizes qualitative multiple-case study to investigate the context of operating challenges of biophilic retail interiors in Malaysia. A qualitative methodology was chosen to enable insight into multifaceted experiences and also attitudes, and to provide thin descriptions factors of those experiences that are not readily reducible. The strategy of multiple-cases enables a comparison between the different retail environments which have implemented biophilic elements, such as living walls, indoor planting systems and vegetation interiors, semi-open up plan design and water features. The study, through multiple-case analysis, gains more depth of analysis which allows for the discovery of themes and possible deviation within Malaysia tropical retail environments.

Triangulation and contextual richness were given priority through both systematic semi-structured interviews, as well as visitor feedback analysis. Semi-standardized interviews took place with three retail store owners who were in charge of making decisions related to daily running of stores and maintenance together with three interior designers participating in the conceptualization and realization of biophilic retail solutions. The interview questions targeted maintenance, pest complaints and control, mold management, hygiene problems, environmental control measures that were implemented by the business as well as cost effects and brand image. As a supplement to the professional point of view, interviews were conducted with 20 retail customers to gain an insight into their general impressions about comfort, cleanliness, environmental quality and the overall shopping experience. This multi-stakeholder perspective permitted analysis of actual operations and public perception, leading to increased rigour in the findings.

Thematic analysis was chosen to explore recurring patterns within interview transcripts in a systematic way. Data was coded through an ongoing process of categorization to establish broader themes such as pest incursion, perception of hygiene, management of moisture, burden of maintenance and influence on brand reputation. Comparisons were made across the cases to assess similarities and contextual variations. Visitor comments were subjected to simple descriptive analysis with a view to identifying trends in frequency according to

comfort, cleanliness and environment. The combination of thematic and profile analysis helped to unpack interview responses by means of relating these back to perceptual trends, which in turn increased the validity and interpretive depth of interviews.

**Results**

*Pest Attraction in Biophilic Retail Interiors: Store Owners' Operational Perspectives*

Interviews results with three retail store operators suggest that pest attraction is highly problematic in biophilic environmental operations.

Although all participants recognized the aesthetic and branding gains of indoor foliage and water features, two-thirds of shop owners (66.7%) stated they had persistent pest problems. These are the ants, flies and sometimes mosquitoes colonies that are observed in planter systems and irrigation points during periods of high humidity. One respondent (33.3%) reported little interference of pest because of rigorous maintenance contracts and systematic irrigation system. Bird invasion in semi-open commercial constructions was encountered by one store owner (33.3%). All respondents expressed positive attitudes towards the integration of biophilic design, although most identified pest control as a required operational consideration.

Table 1, shows the pest-related operational challenges reported by store owners in biophilic retail interiors.

Table 1
*Summary of Store Owners' Responses on Pest Attraction in Biophilic Retail Interiors*

| No. | Respondent | Aspect Identified | Description of Issue | Representative Statement | % of Respondents |
|---|---|---|---|---|---|
| 1. | Store Owner A | Insect attraction (ants, flies). | Insects observed near planter boxes and irrigation systems during humid periods. | Noticed ants and small flies around the plants, especially after watering. | 66.7% (2) |
| 2. | Store Owner B | Bird intrusion. | Birds entering semi-open entrance zones, occasional droppings. | Birds sometimes enter through the open façade, and we need extra cleaning. | 33.3% (1) |
| 3. | Store Owner C | Controlled pest situation. | Minimal issues due to regular pest control and drainage management. | With proper pest control contracts, the issue is manageable. | 33.3% (1) |
| 4. | Store Owners A & B | Increased cleaning requirement. | Additional cleaning frequency due to insects and droppings. | Cleaning costs increased slightly after installing the green wall. | 66.7% (2) |

*Moisture Management and Mold Risks in Biophilic Retail Installations: Designers' Technical Perspectives*

Three interviews' results with interior designers confirmed that the technical concern of humidity control is an important consideration for biophilic retail spaces.

Despite all respondents indicating positive attitudes toward the aesthetic and experiential benefits of living walls and planter systems, two thirds of designers (66.7%) reported to have experienced mold problems in at least one project. These issues were mostly related to high indoor humidity, lack of waterproofing layers and improperly set up irrigation. One designer (33.3%) stated that there were no mold problems and they achieved a successful result via careful detailing of waterproof membrane requirements and integrated drainage systems. In general, while there was positive momentum toward biophilic integration, most participants acknowledged moisture management as a technical challenge that need to be addressed with careful detailing and monitoring in the context of Malaysia's tropical climate.

Table 2, shows the interior designers' responses on mold and moisture challenges in biophilic retail interiors.

Table 2
*Summary of Moisture and Mold Management Challenges Reported by Interior Designers in Biophilic Retail Interiors*

| No. | Respondent | Aspect Identified | Description of Issue | Representative Statement | % of Respondents |
|---|---|---|---|---|---|
| 1. | Designer A | Mold formation behind living walls. | Mold growth due to trapped moisture and inadequate ventilation. | Observed mold developing behind the panel where airflow was restricted. | 66.7% (2) |
| 2. | Designer B | Irrigation system control. | Excess watering caused seepage and surface staining. | Improper irrigation calibration led to water marks on adjacent finishes. | 66.7% (2) |
| 3. | Designer C | Successful moisture management. | No mold issues due to waterproof membranes and proper drainage detailing. | With proper waterproofing and drainage planning, we managed to prevent mold. | 33.3% (1) |
| 4. | Designers A & B | Odor and material deterioration. | Accumulated moisture resulted in mild odor and finish degradation. | Persistent humidity affected nearby materials over time. | 66.7% (2) |

*Lifecycle Cost Implications and Maintenance Burden in Biophilic Retail Interiors: Store Owners' Financial Perspectives*

Interviews results with three retail store owners suggest that although biophilic installations contributed to brand perception and customer relationship-building, they also resulted in concrete elevations of maintenance-related costs.

Two-thirds (66.7%) of shop owners felt that overheads had increased since living wall and planter systems were installed, mainly because they now had to operate plant replacement cycles, manage pests through contracts and maintain irrigation systems. One expert (33.3%) mentioned the effects of moderate and manageable cost escalation through a planned maintenance of infrastructure at an early stage of design. Despite the generally positive attitudes of all respondents towards biophilic aesthetics, most agreed that long-term operation was not fully anticipated when similar sustainability aspirations were established for Malaysia's humid tropical climate.

Table 3, shows the maintenance cost implications reported by store owners in biophilic retail interiors.

Table 3
*Summary of Lifecycle Maintenance and Cost Challenges Reported by Store Owners in Biophilic Retail Interiors*

| No. | Respondent | Aspect Identified | Description of Issue | Representative Statement | % of Respondents |
|---|---|---|---|---|---|
| 1. | Store Owner A | Plant replacement costs. | Regular plant replacement due to decay and humidity stress. | Some plants did not survive long in indoor conditions, requiring periodic replacement. | 66.7% (2) |
| 2. | Store Owner B | Pest control contracts. | Additional pest management services required after installation. | Had to engage monthly pest control after introducing the green wall. | 66.7% (2) |
| 3. | Store Owner C | Controlled maintenance budget. | Costs remained manageable due to planned maintenance strategy. | Allocated maintenance budget early, so cost escalation was predictable. | 33.3% (1) |
| 4. | Store Owners A & B | Irrigation & cleaning expenses. | Repairs to irrigation systems and increased cleaning frequency. | Water leakage and cleaning requirements added to monthly expenses. | 66.7% (2) |

*Visitor Perceptions of Cleanliness and Environmental Quality in Biophilic Retail Interiors*

The results impressions of biophilic retail interiors are largely positive by the 20 retail visitors subjects with respect to the atmosphere, comfort, and visual aesthetics.

80% of those who answered (16) appreciated the calming effect felt when indoor greenery and natural elements brought the environment to life, which was “refreshing,” “relaxing,” and “inviting.” However, 6 participants (30%) indicated intermittent perceived problems with visible plant distress, low levels of arthropods, or musty smells. Of significance, 18 of respondents (90%) indicated that cleanliness played a role in their overall satisfaction with retail. Aesthetic assessment was good and it was found that comfort and willingness to revisit are influenced by the perceived hygiene of shop establishment. These results indicate that users’ acceptance towards biophilic design will depend on the intensive maintenance and the evident environmental control.

Table 4, shows the visitor perceptions of environmental comfort and hygiene in biophilic retail interiors.

Table 4
*Summary of Visitor Perceptions of Biophilic Retail Interiors and Hygiene Conditions*

| No. | Respondent | Description of Feedback | Representative Statement | Percentage (%) |
|---|---|---|---|---|
| 1. | Positive ambiance & aesthetic appeal | Appreciated greenery, calming atmosphere, natural feeling. | The plants make the store feel fresh and relaxing. | 80% (16) |
| 2. | Enhanced comfort | Felt comfortable spending more time in the store. | It feels less stressful compared to typical retail spaces. | 75% (15) |
| 3. | Concern about visible plant deterioration | Noticed dry leaves, discoloration, or poorly maintained plants. | Some plants looked unhealthy, which reduced the appeal. | 30% (6) |
| 4. | Insect presence | Observed small insects near planter areas. | Small ants near the plant area. | 20% (4) |
| 5. | Cleanliness as key satisfaction factor | Hygiene condition strongly influenced overall perception. | As long as it’s clean, I enjoy the natural concept. | 90% (18) |

## Discussion and Conclusion

*Aesthetic Intentions versus Operational Demands*

The findings indicate a significant gap between the aesthetic aspirations of biophilic retail design and its practice. While adding greenery and natural elements can add some atmosphere or branding to the space, they also bring with them various environmental issues in Malaysia's hot and humid tropical environment. High humidity and a good biodiversity

make the morgues prone to pests, moulds and damage to materials, which must be constantly technically monitored.

*Sustainability Beyond Symbolic Greenery*

The research questions findings the premise that biophilic design is by definition sustainable. It's important that sustainability is more than 'greenwashing' and goes further than simply having visual greenery, but also considers lifecycle return on investment, minimal maintenance requirements, as well as operational savings. Repeated plants replacement, watering requirements and pest control visits can contradict sustainability aims if not properly considered.

*Climate-Responsive Technical Detailing*

For tropical climates, the findings detailing needs to respond to climate with waterproofing membranes, suitable drains, managed irrigation and ventilation. Design elements from overseas, such as in temperate climate countries need to be made suitable or otherwise the wrong design can result in mould and termite problems.

*Integrated Hygiene and Pest Management*

The findings on pest and sanitary control needs to be integrated into the strategy design phase, rather than an afterthought of some direct post management cleansing. The perception of cleanliness significantly shapes customer satisfaction; thus, environmental control is a prerequisite for brand authenticity.

*Toward Performance-Driven Biophilic Retail Design*

The research findings recommend moving from aesthetic use to performance use. Risk evaluation, life-cycle costing analysis and environmental monitoring are required to ensure that biophilic retail interiors are commercially viable as well as environmentally sound.

**Conclusion**

The state of biophilic retail design in Malaysia is a duality of the enriching experience and an endangered operation. The key climatic characteristics of the tropics include high humidity, rain and biodiversity that further attract pests and mold growth as well as complicate maintenance. Nature-inspired retail environments are unlikely to deliver upon commercial performance and brand reputation if not adequately planned technically, looking back over their lifecycle. The present study highlights the importance of reconciliation between ecosystem ambitions and regulation. A sensitive and responsive way of managing is essential to achieve a resilient, commercially viable approach to biophilic retail. Figure 1, a conceptual visualization of bird intrusion and hygiene risks in green wall–integrated retail environments. Figure 2, a conceptual visualization of pest attraction risks in biophilic retail environments with green wall integration.

Figure 1: Conceptual visualization of avian intrusion and hygiene implications in green wall–integrated retail interiors.
Source: Author

Figure 2: Conceptual visualization of pest attraction and biosecurity risks in green wall–integrated retail interiors.
Source: Author

**Research Contribution**

This research adds to the literature by adding a new dimension to the conversation about biophilic design beyond benefits and costs. It contributes empirical evidence of the negative operational aspects when transferring biophilic retail practices, especially in a tropical Southeast Asian setting which is under-researched upon in existing literature. In addition, the research provides a risk-aware conceptual framework that joins sustainability aspirations with commercial feasibility and environmental performance objective.

**Practical Contributions**

Practically, this study also has implications for retail designers to become more aware of methods such as technical detailing and moisture control mechanisms, by selecting the appropriate plant species that are suitable in interior humid climate conditions. Designers

should be encouraged to consider environmental control devices as integral components that are part of the early conceptual design rather than accessories. From a retailers' perspective, the results indicate that retail owners should consider lifecycle costs before implementing biophilic strategies. Knowledge of long-term maintenance considerations, pest control needs and day-to-day operating expenses can help you make better investment decisions. Implications for policy and practice the study indicates the requirement of updated cleaning specifications for nature-integrated commercial interiors, specifically in semi-open retail settings prone to biodiversity hazards, may be vital for policymakers and regulatory authorities. Lastly, for design educators the study proposes to integrate a critical and context sensitive way of approaching biophilic design into interior architecture curricula. It will be necessary to educate future practitioners not only to recognize the aesthetic and psychological advantages but also tolerances concerning operational hazards, limits with respect to environmental constraints, and aspects related to long-term performance.

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