

# Natural Environment Accessibility through Green Architecture in Malaysian Low-Cost Housing Development from Islamic Principles

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## ABSTRACT

Rapid urbanisation has led to an urgent need to enhance the quality of life in urban environments. The development of low-cost housing, often without sustainable design, has disconnected urban residents from nature, affecting the low-income population. This disconnection has increased over the past few decades, restricting natural human tendencies and reducing rights to a healthy living environment. To reconnect residents with nature and improve urban living conditions, low-cost housing developments should consider incorporating sustainable design and green architecture strengthened by respect to Islamic values as the significant element of Malaysian identity. The purpose of this paper is to emphasise the importance of accessibility to nature by highlighting a more comprehensive understanding of the significance of natural environment accessibility from the Islamic principles, particularly in low-cost housing development areas that have been planned with poorly built environments. The concept of biophilia which postulated that people have innate tendencies towards the natural environment poses an important foundation for green architecture approaches which later can be developed into a series of green building

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regulations and rating tools. In this study, these green rating tools are utilised to evaluate the significance of natural environment accessibility for developing low-cost housing through comparative analysis. From the literature review, comparative analysis and case study, it is found that the accessibility to the natural environment needs to be improved significantly in the low-cost housing project through involvement of various parties in built environment practices. By considering the Islamic viewpoint, which advocates for human roles in the preservation and conservation of natural environments, the purpose of this paper is to bring attention to the significance of aligning the translation of biophilic theory in green architecture through natural environment accessibility in low-cost housing in respect to Islamic values, upholding Malaysian identity as Islamic country.

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## INTRODUCTION

### Background

The term "natural environment" refers to the physical world and all its naturally occurring elements, including plants, animals, mountains, oceans, rivers, and stars, which exist independently of human creation (Ali & Kamraju, 2023). Exposure to nature has proven to be important for mental health, backed by a study involving 94,879 United Kingdom (UK) adults which indicated a consistent positive effect of green environment on depression risk that was more pronounced among women, participants younger than 60 years, and participants residing in areas with low neighbourhood socioeconomic status or high urbanicity (Sarkar, 2018). Recent urban development focusing on the economic aspect resulted in the neglect of social and environmental needs, ignoring our basic psychological needs thus making it difficult to thrive in the city (Cardoso et al., 2022). It is now more important than ever to find the connection on how to tie the city back to nature to make it closer to its users' hearts while sustaining through the rapid urbanisation adversity and its restriction by increasing nature accessibility in the neighbourhood (Pineo, 2022). On the other hand, the term green architecture, or green design, is an approach to building or development that minimises the harmful effects of construction projects on human health and the environment.

There is an immediate and pressing requirement to enhance the quality of life due to rapid urbanisation. Urban residents are increasingly disconnected from nature due to the widespread development of low-cost housing, which often lacks sustainable design (Stanley & Galbraith, 2024). This disconnect has grown in recent years, making affordable housing search harder. This is because the developments rarely include green spaces and environmentally friendly practices. Over the last few decades, low-cost urban planning has increasingly excluded natural elements, restricted residents' natural human tendencies and reduced their accessibility to a healthy living environment (Xiang et al., 2020). The trend emphasises the need to incorporate environmentally friendly architecture into low-cost housing to improve urban liveability and sustainability.

### Problem Statement

The United Nation (UN) predicted that 68% of the world's population will live in cities by 2050 (Gu et al., 2021). Rapid urbanisation due to higher economic opportunities in city centres has made cities like Kuala Lumpur denser (Yasin et al., 2022). There are still marginalised low-income earners in city centres despite the promise of high-paid jobs (Padawangi, 2023). To serve these groups, low-cost housing has been introduced. Kuala Lumpur Structure Plan 2040 calls for a City-For-All, but the cities are planned and built

for economic opportunities, neglecting the environment and social needs. The poor are excluded, the environment is ravaged, and economic gaps widen. Despite their contributions to the city, low-income residents, especially in low-cost housing, are denied a better life (Yaacob & Hassan, 2024). Low-cost housing accessibility to nature is decreasing because nature is considered a wealth for the rich (Tedong & Zyed, 2022) and deemed to be high on maintenance costs. With limited availability of public park, people were disconnected from nature, and they had little to no space for morning walks, exercise, socialising with neighbours, or learning from nature (Ip, 2023). The built environment quality for future generations has been less considered as more natural public spaces are consumed for city development (Wen et al., 2020). Thus, the significance of green architecture and natural environment accessibility must be highlighted, especially for the benefit of low-income communities in low-cost housing areas.

## Research Objectives

This paper aims to highlight the importance of green architecture principles, grounded in an Islamic principle to enhance natural environment accessibility in Malaysian low-cost housing developments, using literature reviews, comparative analysis, green building rating tools, and case studies. Supporting the research aim are the following research objectives:

- (i) To conduct a comprehensive literature review on the principles of green architecture from Islamic principles with relation to biophilic theory and their application in enhancing natural environment accessibility in low-cost housing.
- (ii) To perform a comparative analysis based on case studies of selected Malaysian urban low-cost housing projects, assessing their implementation of green architecture principles and natural environment accessibility using Malaysian green building rating tools.

## LITERATURE REVIEW

### Importance of Natural Environment

The importance of the natural environment is well known, but urban development, especially in developing countries, rarely considers preservation and inclusion of green area within built environment (Monteiro et al., 2020). Science shows that spending time outdoors improves mood, reduces rumination, and boosts attention, focus, and concentration. Some psycho-evolutionary theories hold that humans are still innately linked to the natural environment as its ecosystem and not fully adapted to urban life. Stress in built environments is caused by lack of accessibility to nature (Calogiuri et al., 2021).

According to Luo et al. (2021), urban workers visit the urban green park to escape the city's physical shape and daily stress. Accessibility to parks reduce stress level, and provide peace and tranquillity (Chiesura, 2004; Puhakka, 2021). Many empirical studies have tested the hypothesis that natural environments are restorative (Cooley et al., 2020; Hady, 2021). For example, hospital patients who could see trees and nature from their windows recovered faster than those who could only see buildings (Ulrich et al., 2019). Preferable environments encourage social interaction (Zhou & Rana, 2012; Riva et al., 2021). Frequent use of outdoor green spaces can also foster a sense of community (Kearney, 2006; as cited by Zhou & Rana, 2012; Kruize et al., 2019). On top of that, healthy environment of green buildings with integration of natural environment improves well-being, evoking positive emotions which promote creativity and cognitive flow, helping to boost productivity (Parida, 2021) in working environment or habitable spaces.

## Biophilic Theory

In the 1980s, Harvard University biologist Edward Wilson proposed biophilia theory, the idea that humans are naturally drawn to nature. Human-nature relationships are organised into three (3) broad experience categories: nature in space, natural analogues, or nature of space (Ryan et al., 2014). Biophilic theory emphasises the integration of natural elements into the built environment to enhance human well-being and foster a deeper connection to nature.

The Nature in Space principles emphasise direct nature experiences in built environments. This includes providing visual connections to natural elements, such as plants, water, or landscapes, and engaging other senses through sounds, smells, or tactile experiences like the rustling of leaves or the scent of flowers (Ryan & Browning, 2020). It also involves mimicking natural environmental conditions by varying temperature and airflow, introducing water features to create calming atmospheres, and using dynamic lighting that reflects natural patterns throughout the day (Rietveld, 2024). Theoretically, it can be deduced that application of Nature in Space in designing spaces that reflect natural processes, like seasonal changes or plant growth, fosters a stronger connection with nature.

Natural Analogues refer to the use of design elements that mimic natural forms and patterns (Ryan & Browning, 2020). This includes using shapes and motifs inspired by nature, such as leaves, shells, or waves, and choosing materials that resemble natural textures and colours to create a sense of closeness to nature (Browning & Ryan, 2020). Additionally, achieving a balance between complexity and order by integrating diverse yet harmonious patterns found in nature can enhance the aesthetic and sensory experience of the built environment.

The Nature of Space principles focus on how spatial design can evoke the psychological benefits of being in nature (Richardson & Butler, 2022). According to Tabb (2020), this principle includes providing unobstructed views (prospect) to create a sense of openness and safety, while also offering sheltered areas (refuge) that provide privacy and protection. Spaces that encourage exploration and curiosity, through features like winding paths or partially obscured views (mystery), add an element of intrigue and engagement (Browning & Ryan, 2020).

Overall, biophilic principles aim to create environments that reduce stress, improve cognitive function, and promote overall well-being by bringing elements of nature into daily life. Each of the principles of biophilic theory represents how humans are naturally drawn to nature either by experience; Nature in Space, by mimic and resemblance; Natural Analogues and by function; Nature of Space. The wholeness of Biophilic theory poses possible linkage between the importance of natural environment with values of Islamic principles, which covers the holistic aspect of human quality of life.

## Islamic Perspective on the Natural Environment

In Islam, the true owner of the world is God. As a Muslim, everything is bound to God's command, including human behaviour toward the natural environment, based upon Islam's set of beliefs. In Islam, humans were sent to the Earth as the caliph, the ruler of the Earth. Hence in Islam, the preservation and conservation of the natural environment is a must because the Earth and all of it were entrusted by God to humans to be taken care of. Thus, in Islam, any irresponsible action worldwide is rejected because humans are responsible for taking care of God's creation. As the Quran says:

*Behold, thy Lord said to the angels: "I will create a vicegerent on earth." They said: "Wilt thou place therein one who will make mischief therein and shed blood? - whilst we do celebrate Thy praises and glorify Thy holy (name)?" He said: "I know what ye know not" (Qur'an, 2: 30).*

This verse establishes humans as vicegerents on Earth, entrusted with the responsibility to manage sustainably and justly. In the context of natural environment, this principle translates into the mandate to human as a caliph to administer responsible development that protects natural resources and preserves the environment for future generations. Even though humans have power over other creations, this power is bound and accompanied by the act of worship towards God, that is, to follow His command and behave toward His creation justly (Ahmad, 2020). In the Islamic perspective regarding the natural environment, humans are restricted from overexploiting and destroying natural resources (Ridho & Wibowo, 2023) as the Quran says:

*When he turns his back, His aim everywhere is to spread mischief through the earth and destroy crops and progeny. Nevertheless, Allah does not love mischief-making (Qur'an, 2: 205).*

According to Islam, the Universe has been created by Allah with a purpose and meaning; thus, humans should ensure that the interests and rights of every other living being are well managed and preserved. It is mentioned in the Quran:

*“(and) who remember God when they stand, and when they sit, and when they lie down to sleep, and (thus) reflect on the creation of the heavens and the earth: “O our Sustainer! Thou hast not created (aught of) this without meaning and purpose...” (3:191)*

Muslims were also called *Ummatan Wasatan*; the *Ummah* (community) does not leave the golden middle path, avoids excesses, and practices moderation (Mohamed, 2018). According to Islam, nature is the creation of Allah that bears a clear manifestation of the *Ayah* or signs of Allah (Hossain, 2018). Thus, the importance of natural environment preservation is crucial for human beings to ponder upon His creation.

Furthermore, in Islam, humans were also forbidden to conduct animal cruelty and were encouraged with the idea of land restoration and revitalisation through agriculture, cultivation, and construction (Ogunbado & Darussalam, 2020). Thus, overdevelopment without consideration for the animal and natural environment do not reflect the actual Islamic practices and ethics (Sayem, 2021)

Islamic teachings provide a robust framework for sustainable living and comprehensive environmental stewardship code of conduct. It also binds greed, which exploits natural resources without limit to make money without considering its impact on others and itself. Instead of relying on human-centric laws to control human greed to exploit the natural environment, Islam uses spirituality and knowledge to teach the importance and rewards of preserving the environment. Alignment with Islamic principles allow a creation of built environment that is sustainable and affordable, socially equitable, promotes resources conservation and the well-being of all inhabitants, thereby fulfilling the divine mandate of stewardship over the Earth.

### **Green Architecture Concepts in Islamic Principles**

Green architecture focuses on the health and well-being of residents and the community (D'alessandro et al., 2020). Islamic principle of *maslaha* (مصلحة) means "public interest," which translates into creating safe, healthy, and human-friendly environments (Nouman et al., 2021). *Maslaha* promotes public welfare for society through actions and policies. El-Hussieny (2023) states that green Islamic architecture uses non-toxic, natural building materials and designs that improve natural light and air quality for a healthier living environment. This follows Islam's emphasis on life and health.

Islamic green architecture also promotes community and inclusivity for social sustainability (Jaffar et al., 2020). By design, communal spaces like courtyards and gardens encourage social interaction, reflection, and recreation (Wan Ali et al., 2020). These areas improve society and provide relaxation and spiritual

rejuvenation (Nursanty & Wulandari, 2023). They promote community dignity and well-being in the spirit of *ihsan* (إحسان).

According to Islamic *iqtisad* (الاقتصاد), one should not waste resources, and conservation is also important (Al Farisi & Ibadurrahman, 2023). *Iqtisad* emphasises moderation, frugality, and resource conservation to avoid excess and maintain balance (Setia, 2016). Green architecture includes the practice of rainwater harvesting and greywater recycling (Wanjiru & Xia, 2018). *Iqtisad* and energy efficiency are closely related in Islamic green architecture, which promotes renewable energy sources like solar power to reduce fossil fuel use and environmental impact. These systems ensure responsible and environmentally friendly use of this valuable resource.

Islamic environmental ethics are rooted in the understanding that humans are stewards of the Earth, tasked with maintaining a balanced relationship with all of creation. The concept of *mizan* (ميزان), or balance, emphasises the importance of harmony between human activity and the natural environment (Muhamad et al., 2020). In the context of low-cost housing development, this principle can inform a balanced approach to urban planning that integrates green spaces, natural light, ventilation, and materials that minimise environmental impact (Wells & Vermeer, 2020). For example, incorporating biophilic design elements such as communal gardens, natural landscaping, and water features can help restore the ecological balance disrupted by rapid urbanisation, ensuring that housing projects are in harmony with their natural surroundings contributing to a healthier and more sustainable living environment (Hakala, 2021) that aligns with the Islamic imperative of maintaining balance.

Similarly, the concept of *amanah* (الأمانة), or trust, emphasises the responsibility humans to protect and preserve the Earth for future generations. This trust extends to ensuring that all community members, regardless of socioeconomic status, have access to the benefits of a healthy and sustainable environment (Muhamad et al., 2020). In relation to the design and development of low-cost housing, *amanah* calls for inclusive policies that provide equitable access to natural resources, green spaces, and sustainable infrastructure ((Dariah et al., 2019). This can be achieved through planning strategies that prioritise the use of local, renewable materials, energy-efficient technologies, and water conservation systems, ensuring that low-cost housing is not only affordable but also environmentally responsible.

Green architecture, based on the Islamic principles of humanity and *ihsan*, aims to harmonise with nature, respect cultural heritage, and improve the quality of life for all. This holistic approach will address environmental, ethical, and spiritual issues, creating a sustainable and just society.

### **Influence of Islam as Religion of Federation in Malaysian Architectural Identity**

Around the 15th century, Gujarati merchants and missionaries first brought Islam to Malaysia through the Malacca Sultanate, a bustling trade and cultural centre (Andaya, 2021). Over several centuries, Islam influenced Malaysian society, including architecture (Nursanty & Wulandari, 2023). Green architecture and Islamic principles of living in harmony with nature, conserving resources, and protecting the environment are closely related.

Modern Malaysian architecture incorporates Islamic elements like courtyards, water features, and natural ventilation (Mohamed, 2020). These architectural elements are sustainable by nature. These components enhance space aesthetics, energy efficiency, and environmental harmony. Islamic principles are applied to green architecture by encouraging local materials, passive solar design, and energy-efficient buildings (ElSayed, 2023). This promotes environmental harmony and ethical and cultural sustainability.

Malaysia's Islamic architectural heritage, which blends Malay and Islamic styles, inspires modern designs that balance modernity and ecology (Alsheikh Mahmoud et al., 2024). Mosques, palaces, and public

buildings are part of this rich heritage. Most of these structures are intricate and eco-friendly (Dariyadi et al., 2022). Islamic architecture influences the character of traditional Malay house, which have elevated floors for ventilation. Bamboo and timber are used in their construction.

This combination of Islamic principles and environmentally friendly architecture strengthens the nation's architectural and cultural identity and emphasises the importance of sustainable practices in environmental well-being. Malaysia combines historical Islamic influences with modern green design principles to formulate architectural solutions that respect cultural and environmental contexts. This ensures environmentally sustainable and culturally relevant local development.

### **Emergence of Green Architecture**

Green architecture reduces the environmental impact of buildings. This philosophy uses the environment to create low-impact, adaptable, and healthy spaces (Ebrahiem et al., 2021). The 1960s youth movement in the United States (US) gave environmental advocacy its first serious social momentum (Silvern, 2021). The first wave of green architecture was inspired by early Native American lifestyles and their low environmental impact (Saiyed & Irwin, 2017).

By the mid-1980 and through the 1990s witnesses the rise of environmental advocacy societies, and in 1996, Leadership in Energy and Environmental Design (LEED) was established with a few basic qualifications:

- (i) When possible, reuse existing buildings and preserve the environment for sustainable site development. Earth shelters, roof gardens, and extensive planting around buildings are encouraged.
- (ii) Cleaning and recycling grey water and installing rainwater catchments in each building to promote water conservation.
- (iii) Orienting buildings to take advantage of seasonal sun changes and using diversified and regionally appropriate energy sources like solar, wind, geothermal, biomass, water, or natural gas can increase energy efficiency.
- (iv) Recycling and renewable materials with low energy use are best. They should be local and chemical-free. The use of non-polluting raw materials must be of durable and recyclable.
- (v) Indoor environmental quality includes personal space control, ventilation, temperature control, and non-toxic materials.

In 2009, Malaysian professionals like Pertubuhan Arkitek Malaysia (PAM) founded the Green Building Index (GBI) to promote green architecture. Malaysian building environmental design and performance are evaluated by GBI using six (6) independent criteria: Energy Efficiency, Indoor Environmental Quality, Sustainable Site Planning and Management, Materials and Resources, Water Efficiency, and Innovation. The 2012 CIDB Green Performance Assessment System (GreenPASS) quantifies embodied and operational carbon, site, energy, indoor environmental quality, water, and waste. Skim Penilaian Penarafan Hijau Jabatan Kerja Raya (PHJKR) was created in 2012 as a green rating tool based on building sustainability and government requirements. The Real Estate and Housing Developers' Association (REHDA) founded Green Real Estate (GreenRE) in 2013. Kementerian Kerja Raya (KKR), JKR, and Construction Industry Development Board (CIDB) created Malaysia Carbon Reduction & Environmental Sustainability Tool (MyCREST). Green rating tools like Low Carbon Cities Framework (LCCF) (2011), Melaka Green Seal (2014), Malaysian Green Highway Index (MyGHI) (2014), and

Comprehensive Assessment System for Built Environment Efficiency (CASBEE) Iskandar (2016) show the advancement of Malaysian green architecture.

### Green Building Index (GBI)

GBI serves as the prominent national green rating tool in Malaysian architecture. The GBI, launched in 2009, assesses building environmental design and performance to promote sustainable construction. Energy efficiency, indoor environmental quality, sustainable site planning, materials and resources, water efficiency, and innovation are GBI criteria (Solla et al., 2020). Malaysian building design and construction have been influenced by its implementation, encouraging green technologies and practices (Lam et al., 2024). By standardising sustainability, the GBI helps architects, developers, and policymakers build environmentally friendly and energy-efficient buildings, contributing to Malaysia's carbon emission reduction and sustainable urban development goals (Lam et al., 2024).

Table 1. Green Building Index (GBI) Summary of Final Score for Detail Assessment Criteria

Detail Assessment Criteria Summary of Final Score			
Part	Item	Maximum Point	Score
1	Energy Efficiency	38	
2	Indoor Environmental Quality	21	
3	Sustainable Site Planning & Management	10	
4	Material & Resources	9	
5	Water Efficiency	12	
6	Innovation	10	
	Total Score	100	

Source: Greenbuildingindex.org (2009)

### GreenRE by REHDA

GreenRE was launched by the REHDA in 2013, to drive Malaysia's real estate industry towards a more sustainable and liveable built environment. The rating tool is developed as an instrument to evaluate the building's performance, in terms of energy efficiency, water efficiency, environmental protection, indoor environmental quality, and carbon emissions of the development, commencing from the conceptualisation and design stage, construction and up to post completion. The tool currently caters for mega projects, high-rise residential buildings and landed houses, classified by the size of the development. The wide classification criteria of the assessment are divided into two (2) main groups, namely Energy Related Requirements and Other Green Requirements. The Energy Related Requirements consist of Energy Efficiency where credits are allocated for the various energy-efficient designs, practices and building features. Other Green Requirements consist of Water Efficiency, Environmental Quality, Other Green Features and Carbon Emission of Development. Design Reference Guide in GreenRE helps designers to craft their architectural design with the intention towards green and sustainable development. Assessments for residential are categorised under GreenRE Residential Building and Landed Home. As of January 2024, the Green Residential category has been updated to version 3.3, after the fourth revision for implementation since version 2.0 was developed in June 2014 and the pilot issue in June 2013. There are six (6) sections in GreenRE Residential Building Rating System:

- (i) Part 1 – Energy Efficiency
- (ii) Part 2 – Water Efficiency
- (iii) Part 3 – Environmental Protection

- (iv) Part 4 – Indoor Environmental Quality
- (v) Part 5 – Other Green Features
- (vi) Part 6- Carbon Emission of Development

<b>Credit Allocation:</b>				
<b>Category</b>		<b>Credits Allocations</b>		
<b>(I) Energy Related Requirements</b>		<b>High- Rise</b>	<b>Landed</b>	
Minimum 30 credits	<b>Part 1: Energy Efficiency</b>			
	RES 1-1 Thermal Performance of Building Envelope -RETV	15	22	
	RES 1-2 Naturally Ventilated Design and Energy Efficient Cooling	22	22	
	RES 1-3 Daylighting	6	6	
	RES 1-4 Artificial Lighting	8	4	
	RES 1-5 Ventilation in Carparks	6	2	
	RES 1-6 Domestic Hot Water System	3	3	
	RES 1-7 Lifts	1	1	
	RES 1-8 Cool Hardscaped Areas	2	2	
	RES 1-9 Energy Efficient Features	7	7	
	RES 1-10 Renewable Energy	15	15	
<b>Category Score for Part 1 – Energy Efficiency</b>		<b>85 (Max)</b>	<b>84 (Max)</b>	
<b>(II) Other Green Requirements</b>				
Minimum 20 credits	<b>Part 2: Water Efficiency</b>			
	RES 2-1 Water Efficient Fittings	8	8	
	RES 2-2 Water Usage Monitoring	1	1	
	RES 2-3 Irrigation System and Landscaping	3	3	
	<b>Category Score for Part 2 – Water Efficiency</b>		<b>12</b>	<b>12</b>
	<b>Part 3: Environmental Protection</b>			
	RES 3-1 Sustainable Construction	10	10	
	RES 3-2 Sustainable Products	8	8	
	RES 3-3 Greenery Provision	8	8	
	RES 3-4 Environmental Management Practice	10	10	
	RES 3-5 Green Transport	5	5	
	RES 3-6 Stormwater Management	3	3	
	RES 3-7 Internet Connectivity	1	1	
	RES 3-8 Community Connectivity	1	1	
	<b>Category Score for Part 3 – Environmental Protection</b>		<b>46</b>	<b>46</b>
	<b>Part 4: Indoor Environmental Quality</b>			
	RES 4-1 Noise Level	1	1	
	RES 4-2 Indoor Air Pollutants	2	2	
	RES 4-3 Waste Disposal	1	1	
	RES 4-4 Indoor Air Quality in Wet Areas	2	2	
<b>Category Score for Part 4 – Environmental Quality</b>		<b>6</b>	<b>6</b>	
<b>Part 5: Other Green Features</b>				
RES 5-1 Green Features & Innovations	7	7		
<b>Category Score for Part 5 – Other Green Features</b>		<b>7</b>	<b>7</b>	
<b>Part 6: Carbon Emission of Development</b>				
RES 6-1 Carbon Emission of Development	3	3		
<b>Category Score for Part 6 – Carbon Emission of Development</b>		<b>3</b>	<b>3</b>	
<b>GreenRE Score:</b>		<b>159 (Max)</b>	<b>158 (Max)</b>	

*\*Total score will be rounded to the nearest whole number*

Fig. 1. Credit Allocation in GreenRE Assessment

Source: GreenRE.org (2024)

## Skim Penilaian Penarafan Hijau JKR or PHJKR

Table 2. Evaluation Criteria for PHJKR Green Rating Tool

No	Kriteria Pemarkahan		Kategori Bangunan							
			A		B		C		D	
			MM	MV	MM	MV	MM	MV	MM	MV
1	TL	Perancangan dan Pengurusan Tapak Lestari	26	24	29	27	29	27	29	27
2	KT	Pengurusan Kecekapan Tenaga	24	26	36	38	52	54	55	57
3	SB	Pengurusan Sumber dan Bahan	20	20	20	20	20	20	20	20
4	PA	Pengurusan Kecekapan Penggunaan Air	14	14	22	22	22	22	22	22
5	PD	Pengurusan Kualiti Persekitaran Dalaman	11	13	13	15	25	27	29	31
6	FL	Pengurusan Fasiliti Lestari	0	0	5	10	5	10	5	10
7	IN	Inovasi dalam Reka Bentuk	6	6	6	6	6	6	6	6
		Jumlah	101	103	131	138	159	166	166	173

Source: eph.jkr.gov.my (2015)

The Skim Penilaian Penarafan Hijau JKR, also known as PHJKR, is a green rating tool that assesses the sustainability performance of existing buildings, taking into account the latest government requirements. The Public Works Department of Malaysia has begun implementing green initiatives in projects since the 8<sup>th</sup> Malaysian Plan. PHJKR is introduced and implemented by JKR to evaluate the level of sustainability in their construction projects. PHJKR primarily emphasises the design phase, and the evaluation is conducted using a predefined set of criteria. The scope of coverage includes four (4) categories of buildings: landed residential (A), strata residential (B), non-residential without air conditioners (C), and non-residential with air conditioners (D) with allocation of marks specified as MM (maximum marks) and MV (verification marks).

## METHODOLOGY

In this study, the importance of the natural environment was analysed through a comprehensive literature review, which encompassed three (3) distinct perspectives: the current understanding of the physical natural environment, biophilic theory and the Islamic spiritual view of the natural environment. The research methodology involved a comparative analysis table that incorporated the studied parameters, including the biophilic theory principles, Islamic principles, natural environment accessibility, elements of green architecture and green rating tools in GBI, GreenRE by REHDA, and the Skim Penarafan Hijau PH JKR (PHJKR). Each of the Islamic principles extracted from literature reviews were mapped with the aforementioned green rating tools to highlight the correlation of biophilic theory and Islamic principles with the corresponding criteria of the green rating tools. Additionally, the study included a comparative analysis of three (3) Projek Perumahan Rakyat (PPR) low-cost housing projects in Kuala Lumpur: Kenanga Flat Sri Selangor, PPR Beringin, and PPR Desa Tun Razak to assess their natural environment, green accessibility and sustainability. These multi-aspects approach allowed for an overview examination of how these low-cost urban housing projects integrate principles of green architecture and sustainability from both contemporary and Islamic perspectives, providing a holistic understanding of their compliance with the natural environment and resident well-being, responding to the research objectives and ultimately achieving the aim of the research to highlight the importance of green architecture principles in relation to Islamic principles.

## RESULTS & FINDINGS

### Natural Environment Accessibility

Natural Environment Accessibility through Green Architecture refers to the design and construction of buildings and spaces in a way that enhances the connection between occupants and the natural environment, while also prioritising sustainability and environmental responsibility. This concept encompasses several key aspects:

Table 3. Natural Environment Accessibility Translation into Green Architectural Elements

Biophilic Theory	Natural Environment Accessibility	Green Architecture
Nature in Space	Integration of Natural Elements:	Incorporating natural features such as gardens, green roofs, courtyards, water bodies, and natural ventilation systems into architectural designs to create a seamless interaction between the built and natural environments.
	Community and Social Benefits	Developing spaces that encourage community interaction and engagement with the natural environment. This can include communal gardens, green public spaces, and outdoor recreational areas that foster social cohesion and community well-being.
Natural Analogue	Sustainable Design Practices:	Utilising eco-friendly materials, energy-efficient systems, and renewable energy sources to minimise the environmental impact of buildings. This includes passive solar design, rainwater harvesting, and the use of recycled or locally sourced materials.
Nature of Space	Enhanced Well-being and Health:	Designing spaces that improve the physical and mental well-being of occupants by providing access to natural light, fresh air, and views of nature. Studies have shown that such access can reduce stress, enhance mood, and promote overall health.
	Environmental Responsibility	Creating buildings that not only reduce negative environmental impacts but also positively contribute to the surrounding ecosystem. This involves careful planning to preserve natural habitats, promote biodiversity, and ensure resource efficiency.

Source: Authors (2024)

In essence, natural environment accessibility through green architecture aims to create sustainable living environments that harmoniously blend with the natural world, enhancing the quality of life while promoting ecological stewardship.

## Relationship of Islamic Principles and Natural Environment Accessibility

The aspects of Natural Environment Accessibility through Green Architecture can be classified and matched with biophilic theory consists of and Islamic principles such as *maslaha* (public interest), *ihsan* (excellence and benevolence), *mizan* (balance), *amanah* (trust) and *iqtisad* (moderation).

By matching these aspects with Islamic principles, it becomes clear that natural environment accessibility through green architecture is not only about sustainability but also deeply intertwined with ethical and moral values that enhance the quality of life.

Table 4. Classification of Islamic Principles with Corresponding Natural Environment Accessibility and Green Architecture

Biophilic Theory	Islamic Principle	Natural Environment Accessibility	Green Architecture
Nature of Space	<i>Maslaha</i> (Public Interest)	Enhanced Well-being and Health:	Designing spaces that improve the physical and mental well-being of occupants aligns with <i>maslaha</i> , which focuses on actions and policies that promote public welfare and benefit society. Enhancing health and well-being serves the greater good.
	<i>Amanah</i> (Trust)	Environmental Responsibility:	Creating buildings that positively contribute to the surrounding ecosystem and promote ecological stewardship also aligns with <i>maslaha</i> . Protecting and preserving the environment is in the public interest and benefits the community.
Nature in Space	<i>Ihsan</i> (Excellence and Benevolence)	Integration of Natural Elements for Community and Social Benefits:	Integrating natural elements into architectural designs reflects the principle of <i>ihsan</i> , which emphasises doing things with excellence and benevolence. Creating spaces that provide beauty and enhance the well-being of occupants aligns with the spirit of <i>ihsan</i> . Developing spaces that encourage community interaction and engagement with the natural environment aligns with <i>ihsan</i> . Holistic approach that promotes social cohesion and community well-being through thoughtful design reflects the principle of <i>mizan</i> .
	<i>Mizan</i> (Balance)		
Natural Analogue	<i>Iqtisad</i> (Moderation)	Sustainable Practices:	Design Utilising eco-friendly materials and energy-efficient systems

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reflects the principle of *iqtisad*, which advocates for moderation and the prudent use of resources. This aligns with avoiding wastefulness and maintaining a balance in consumption.

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Source: Authors (2024)

### Kenanga Flat Sri Selangor Case Study

Kenanga Flat Sri Selangor is a low-cost housing development situated on Jalan Gelugor in Kuala Lumpur. Each of these flats comprised 8 units per floor and had a height of 17 storeys. As a low-cost housing initiative, the flat was designed with less regard for the user's basic entitlements, such as the right to adequately ventilated indoor areas. As shown in Fig. 2, the indoor courtyard is a flat, concrete floor without any natural elements, suffered from insufficient ventilation and natural light, resulting in persistent dampness and unpleasant odours throughout the day.

The absence of a natural setting in the flat surroundings and the design of the housing project itself alienates the user from communal spaces, thereby exacerbating social isolation and detachment from the natural environment. These disruptions in the connection to the natural environment will also lead to a greater separation of future generations from the natural environment causing most of the time will be spent indoor. The design consideration, in this case, the site planning restricting the access to natural environment were inappropriate and does not align with Islamic principles, which promotes the preservation of nature and encourages humans to reflect on the signs of God.



Fig. 2. Flat Internal Courtyard

Source: Authors (2024)



Fig. 3. Flat External Courtyard Lacks Natural Environment Element.

Source: Authors (2024)

Based on the design and construction of the Kenanga Flat Sri Selangor, it is evident that less attention is given to the preservation of the natural environment and the sustainable practices. The courtyard suffered from the absence of the natural environment and a lack of amenities in the outdoor community space, which discouraged the public from accessing the natural environment and consequently disconnected them from nature.

### **Program Perumahan Rakyat (PPR) Beringin, Kuala Lumpur Case Study**



Fig. 4. Satellite View PPR Beringin

Source: Google Earth (2023-a)

The availability of open and green spaces in this PPR community area is severely restricted and compacted due to the intricate layout of the units and the high population density. The inadequate allocation of green spaces in this locality restricts the residents' capacity to fully appreciate and engage with their current natural environment. Fig. 4 displays a satellite view of PPR Beringin, showing the layout of the buildings, the adjacent green area, and the surrounding environment.

The red demarcation delineates the boundary of the PPR Beringin, while the green colour denotes the position of the open areas within the housing complex. This residential development is situated near the Sungai Batu. Nevertheless, due to private land ownership, the riverfront has been enclosed by a gate, effectively preventing the general public from accessing and utilising the riverfront. Fig. 5 depicts the inadequate upkeep and limited expansion of open space. The tree's shade is limited only to the pedestrian walkway.



Fig. 5. Open Space at PPR Beringin

Source: Authors (2024)



Fig. 6. Green space at PPR Beringin

Source: Authors (2024)

Fig. 6 shows another open green area located within PPR Beringin. This area provides ample space for the community and is embellished with a handful of sizable trees that offer shade. The park employs natural turf, allowing individuals to directly access the ground. This supports the assertion made by Hady (2021) and Cooley et al. (2020) that incorporating restorative architectural designs can effectively address and alleviate negative health conditions by ensuring easy access to green spaces within urban environments.

Fig. 7 shows the restricted entry to the water body at Sungai Batu. The large community of PPR Beringin could not enjoy the accessibility to the riverbank which, if accessible, could pose immense benefits as relief and restorative natural elements amongst the cramped neighbourhood. Due to the existence of private property ownership, there is a potential for future development in the mentioned region, which could hinder the ability to interact with the existing water body.



Fig. 7. Gated at Sungai Batu

Source: Authors (2024)

In conclusion, the PPR Beringin community in Kuala Lumpur encounters constraints in accessing and preserving the natural environment and green spaces due to limitations in land size and boundaries. However, the government's establishment of the "Program Perumahan Rakyat" partially fulfils the fundamental criteria for providing open spaces, enabling residents to partake in regular activities within the vicinity, despite restricted access to the adjacent water body. Improving residents' ability to reach nearby green areas may pose the potential to decrease community conflicts and encourage the adoption of restorative architectural intervention, resulting in a more favourable environment for well-being.

### **Program Perumahan Rakyat (PPR) Desa Tun Razak, Kuala Lumpur Case Study**

On another low-cost residential, the utilisation of the central courtyard has diminished the available open area, significantly limiting opportunities for communal engagement. To address this issue, Kuala Lumpur City Council, Dewan Bandaraya Kuala Lumpur (DBKL) has decided to construct a podium parking facility in the central courtyard, surrounded by all the residential units. Consequently, the remaining space is predominantly occupied by only a small playground for children. As shown in Fig. 9, the satellite view of the PPR Desa Tun Razak, showing the arrangement of the buildings and the surrounding area.



Fig. 9. Satellite View PPR Desa Tun Razak

Source: Google Earth (2023-b)



Fig. 10. Before construction of podium parking

Source: Google Earth (2021)

Fig. 10 illustrates the initial open area at PPR Desa Tun Razak, showcasing outdoor activity courts, a playground, and green turf. At first, the neighbourhood had a larger open space that offered unobstructed views of the surroundings, fostering a sense of community and creating a pleasant environment. Nevertheless, this verdant space has been transformed into a podium parking complex in order to address concerns regarding the scarcity of parking spaces. The primary objective of this project is to enhance traffic flow and mitigate parking problems.



Fig. 11. After construction of podium parking

Source: Google Earth (2023-c)



Fig. 12. The effect of podium parking on existing green space

Source: Authors (2024)

Consequently, the community's capacity to participate in outdoor activities is currently limited due to lack of easy access to green areas, which could potentially pose detrimental effect on the residents' well-being due to the absence of open recreational space. Research indicates that access to green spaces is crucial for promoting both mental and physical well-being, as it fosters social interaction and facilitates outdoor activities (Dadvand & Nieuwenhujisen, 2021). Insufficient availability of green spaces tends to result in increased indoor time for residents, thereby contribute to exacerbating stress.

The PPR Desa Tun Razak community in Kuala Lumpur is facing a scarcity of open areas because of an overwhelming number of vehicles from the community. As a result, the local authority has decided to build a podium parking facility. The community bears the responsibility of maintaining green space, as it is a vital element of the environment. According to the biophilic design theory, the existence of open space can have a beneficial effect on mental well-being by facilitating the intake of fresh oxygen and fostering a feeling of tranquillity.

## DISCUSSION

Adopting a hybridisation of biophilic theory and Islamic principles in urban planning and housing development presents significant policy implications for national housing strategies, particularly in promoting sustainable and nature-inclusive urban environments. Islamic principles, such as stewardship (*khalifah*), moderation (*iqtisad*), and public welfare (*maslaha*), advocate for a balanced approach (*mizan*) that respects both human needs and environmental preservation as mandated (*amanah*) in Quran. National housing policies influenced by these principles can prioritise the integration of green architecture in low-cost housing, ensuring that development aligns with both social equity and environmental sustainability (Hakala, 2021). Table 5 below shows the overall comparative analysis of the Islamic principles and green architecture elements to provide an overview comparison across the biophilic elements, Islamic principles, different rating tools, and the findings from case studies in response to the natural environment accessibility.

Currently, low-cost housing in Malaysia, as exemplified by the case studies of Kenanga Flat Sri Selangor, PPR Beringin, and PPR Desa Tun Razak, lacks sufficient access to natural environment. For instance, Kenanga Flat Sri Selangor offers limited natural accessibility by design; PPR Beringin, despite being adjacent to a water body, denies direct access; and PPR Desa Tun Razak has reduced green areas to accommodate parking. These cases highlight a critical gap in ensuring equitable access to green spaces and natural elements for all residents, a necessity for physical and mental well-being, and social cohesion.

The current typology and built environment of low-cost housing projects were not suitable for living due to a lack of accessibility to the natural environment. The only attempt to reconnect the residents with natural elements was through the balcony already being used as a laundry area; thus, the residents were trapped in the concrete walls separated from the outer natural environment, inducing stress and social isolation. Although there are a few attempts to provide green spaces in the community courtyard, it is inadequate and does not cater to diverse users and interests. A new set of active green community spaces must be designed and provided in housing developments to reconnect the residence with the natural environment. Following Islamic principles, preserving the natural environment is obligatory, even in the face of economic development where humans were to ensure the rights and interests of every other living being are well managed and preserved. Thus, even though Flat Sri Selangor, PPR Beringin and PPR Desa Tun Razak are low-cost housing projects, everyone should be treated equally, by having policies that ensure that low-cost housing projects provide adequate green spaces, all its amenities to be maintained regularly and have the pedestrian-friendly built environment that connects the public realm and the natural environment. New construction of housing projects in the City of Kuala Lumpur needs to be designed with green architecture principles, including these dated housing projects need to be rejuvenated with active green spaces. This can help mitigate issues such as stress, social isolation, and the deteriorating quality of life often experienced in urban settings. Moreover, adopting green community spaces within housing developments can foster social cohesion by providing areas for interaction, recreation, and community activities, aligning with the Islamic principles.

Table 5. Overall Comparative Analysis of Biophilic Elements, Islamic Principles and Green Building Rating Tools

Biophilic Elements	Islamic Principles and Elements of Green	Green Building Index (GBI)	Green Real Estate (GreenRE) Residential Building & Landed Home (RES)	Penarafan Hijau Jabatan Kerja Raya (PHJKR) Building Sector	Kenanga Flat Sri Selangor	PPR Beringin, Kuala Lumpur	PPR Desa Tun Razak, Kuala Lumpur
<i>Nature of Space</i>	<p><i>Maslaha</i> (Public Interest)</p> <p>Enhanced Well-being and Health:</p> <ul style="list-style-type: none"> <li>Designing spaces that improve the physical and mental well-being of occupants</li> <li>Access to natural light</li> <li>fresh air</li> <li>Views of nature</li> </ul> <p><i>Amanah</i> (Trust)</p> <p>Environmental Responsibility:</p> <ul style="list-style-type: none"> <li>Careful planning to preserve natural habitats</li> </ul> <p>Promote biodiversity</p>	<p>Innovation (IN)</p> <ul style="list-style-type: none"> <li>IN1 Innovation &amp; Environmental Initiatives</li> <li>IN2 Green Building Index Facilitator</li> </ul> <p>Sustainable Site Planning &amp; Management (SM)</p> <ul style="list-style-type: none"> <li>SM3 Integrated Pest Management, Erosion Control &amp; Landscape Management</li> <li>SM6 Greenery &amp; Roof</li> </ul>	<p>Part 5: Other Green Features</p> <ul style="list-style-type: none"> <li>RES 5-1 Green Features &amp; Innovations</li> </ul> <p>RES 3-3 Greenery Provision</p> <p>RES 3-4 Environmental Management Practice</p> <p>RES 3-6 Stormwater Management</p>	<p>IN: <i>Inovasi Dalam Reka Bentuk</i></p> <p>TL: <i>Perancangan dan Pengurusan Tapak Lestari</i></p> <p>PD: <i>Pengurusan Kualiti Persekitaran Dalam</i></p> <p>FL: <i>Pengurusan Fasilitas Lestari</i></p>	<p>There are no outstanding innovations or special building features evident in this building complex, but the building orientation and massing block arrangement of the massing block allows the residents to enjoy the limited views of nature. Though conventional, the use of framed louvred windows and open balcony responds well to the tropical climate which allow access to natural light and exchange of fresh air.</p> <p>There are no dedicated green spaces or garden except an open green area surrounded by residential blocks with futsal court serves as outdoor recreational area and playground at a side. The area becomes the only shared facility for the residents to enjoy recreational activities.</p> <p>Greenery provision within this residential compound is in the form of curb planting of shade trees and an open green area where the futsal court is located. However, there are no access to water bodies within and near the residential compound, given with its location and no consideration for man-made water bodies.</p> <p>There are no dedicated community centre provided except ground floor occupancy is repurposed into kindergarten.</p> <p>Only existing surface parking facility is provided, with less priority given to improve accessibility of public transport.</p>	<p>There are no outstanding innovations or special building features evident in this building complex, but the building orientation and massing block arrangement of the massing block allows the residents to enjoy the limited views of nature. Though conventional, the use of framed louvred windows responds well to the tropical climate which allows access to natural light and exchange of fresh air.</p> <p>There are no dedicated green spaces or garden except an open green area surrounded by residential blocks with multipurpose court serves as outdoor recreational area and playground at a side with gazebo. The placement of the open area surrounded by the building blocks creates an inward looking,</p> <p>mimicking the placement of courtyard.</p> <p>Greenery provision within this residential compound is in the form of curb planting of shade trees and open green area where the multipurpose court is located. However, access to water bodies is restricted and limits the potential to promote biodiversity.</p> <p>The Community Centre is provided with upgraded indoor facilities, such as 3 badminton courts and a basketball court.</p> <p>Only existing surface parking facility is provided, with less priority given to improve accessibility of public transport with nearest MRT station Sri Delima located 21 minutes of walking distance.</p>	<p>There are no outstanding innovations or special building features evident in this building complex. The residents are not able to enjoy views towards nature, except those staying at the units facing outward view, only by limited parameter planting of shade trees. Though conventional, the use of framed louvred windows responds well to the tropical climate which allows access to natural light and exchange of fresh air.</p> <p>There are no dedicated green spaces or garden except podium car park complex with multipurpose court serves as outdoor recreational area at the top which contribute towards social benefit, but not environmental. The building podium is surrounded by the building blocks giving a perception of cramp and limited, blocked view towards nature.</p> <p>There are few premises dedicated for communal use and facilities, such as clinic, kindergarten and public library provided.</p> <p>Increased parking facility is provided by podium parking, with less priority given to improve accessibility of public transport where both nearest terminal hub and commuter are not accessible via walking route.</p>
<i>Nature in Space</i>	<p><i>Ihsan</i> (Excellence and Benevolence)</p> <p><i>Mizan</i> (Balance)</p> <p>Integration of Natural Elements for Community and Social Benefits:</p> <ul style="list-style-type: none"> <li>Incorporating natural features</li> <li>Communal Gardens</li> <li>Green public spaces</li> <li>Outdoor recreational areas</li> <li>Green roofs</li> <li>Courtyards</li> <li>Water bodies</li> <li>Natural ventilation systems</li> </ul>	<p>Facility Management</p> <ul style="list-style-type: none"> <li>SM1 GBI Rated Design &amp; Construction 1</li> <li>SM2 Building Exterior Management</li> <li>SM4 Green Vehicle Priority - Low Emitting &amp; Fuel Efficient Vehicles</li> <li>SM5 Parking Capacity Reduce Heat Island Effect</li> </ul>	<p>Part 3: Environmental Protection</p> <ul style="list-style-type: none"> <li>RES 3-1 Sustainable Construction</li> <li>RES 3-2 Sustainable Products</li> <li>RES 3-5 Green Transport</li> <li>RES 3-7 Internet Connectivity</li> <li>RES 3-8 Community Connectivity</li> </ul>				

Natural Analogue	Iqtisad (Moderation & Efficiency) Sustainable Design Practices:	<p>Energy Efficiency (EE)</p> <p>EE Energy Efficiency Design &amp; Performance</p> <ul style="list-style-type: none"> <li>• EE1 Minimum Performance</li> <li>• EE2 Lighting Zoning</li> <li>• EE3 Electrical Sub-metering</li> <li>• EE4 Renewable Energy</li> </ul> <p>Water Efficiency (WE)</p> <p>Water Harvesting &amp; Recycling</p> <ul style="list-style-type: none"> <li>• WE1 Rainwater Harvesting</li> <li>• WE2 Water Recycling</li> </ul> <p>Increased Efficiency</p> <ul style="list-style-type: none"> <li>• WE3 Water Efficient - Irrigation/Landscaping</li> <li>• WE4 Water Efficient Fittings 3</li> <li>• WE5 Metering &amp; Leak Detection System</li> </ul> <p>Material and Resources (MR)</p> <p>MR Materials &amp; Resources</p> <p>Reused &amp; Recycled Materials</p> <ul style="list-style-type: none"> <li>• MR1 Materials Reuse and Selection</li> <li>• MR2 Recycled Content Materials</li> </ul> <p>Sustainable Materials &amp; Resources and Policy</p> <ul style="list-style-type: none"> <li>• MR3 Sustainable Timber</li> <li>• MR4 Sustainable Purchasing Policy</li> </ul> <p>Waste Management</p> <ul style="list-style-type: none"> <li>• MR5 Storage, Collection &amp; Disposal of Recyclables</li> </ul>	<p>Part 1: Energy Efficiency</p> <ul style="list-style-type: none"> <li>• RES 1-1 Thermal Performance of Building Envelope -RETV</li> <li>• RES 1-2 Naturally Ventilated Design and Energy Efficient Cooling</li> <li>• RES 1-3 Daylighting</li> <li>• RES 1-4 Artificial Lighting</li> <li>• RES 1-5 Ventilation in Carparks</li> <li>• RES 1-6 Domestic Hot Water System</li> <li>• RES 1-7 Lifts</li> <li>• RES 1-8 Cool Hardscaped Areas</li> <li>• RES 1-9 Energy Efficient Features</li> <li>• RES 1-10 Renewable Energy</li> </ul> <p>Part 2: Water Efficiency</p> <ul style="list-style-type: none"> <li>• RES 2-1 Water Efficient Fittings</li> <li>• RES 2-2 Water Usage Monitoring</li> <li>• RES 2-3 Irrigation System and Landscaping</li> </ul>	<p>KT: <i>Pengurusan Kecekapan Tenaga</i></p> <p>SB: <i>Pengurusan Sumber dan Bahan</i></p> <p>PA: <i>Pengurusan Kecekapan Penggunaan Air</i></p>	<p>No evidence on energy efficiency efforts such as rainwater harvesting, solar energy, water and electrical consumption monitoring. The building uses conventional building services to operate all the residential blocks.</p>	<p>No evidence on energy efficiency efforts such as rainwater harvesting, solar energy, water and electrical consumption monitoring. The building uses conventional building services to operate all the residential blocks.</p>	<p>No evidence on energy efficiency efforts such as rainwater harvesting, solar energy, water and electrical consumption monitoring. The building uses conventional building services to operate all the residential blocks.</p>
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Source: Authors (2024)

Applying the principles of green architecture from Islamic principles to low-cost housing in Malaysia can significantly improve the living conditions of less fortunate communities, reflecting both environmental stewardship and social responsibility (Nouman et al., 2021). In Malaysia, where a substantial portion of the population resides in low-cost housing, integrating sustainable practices can address pressing issues such as inadequate living conditions, high utility costs, and limited access to natural resources.

Firstly, the use of local and renewable building materials can reduce construction costs while promoting environmental sustainability. Materials such as concrete and recycled wood not only lessen the ecological footprint but also make housing more affordable for low-income families. This approach aligns with the Islamic principle of using resources wisely and ensuring that all people, regardless of economic status, can benefit from housing with decent accessibility to natural environment, as mentioned by Muhamad et al., (2020).

Energy-efficient designs are particularly beneficial in low-cost housing, where electricity bills can be a significant burden. Implementing passive design strategies, such as optimal building orientation, natural ventilation, and the use of shading devices, can drastically reduce energy consumption and costs. These passive design strategies not only make housing more affordable but also enhances the comfort and health of residents, aligning with the Islamic principles of *maslaha* (public interest) and *ihsan* (excellence and benevolence) by living in balanced moderation, frugality, and resource conservation to minimise wastage (Setia, 2016).

Water conservation is another critical aspect, where low-cost housing can incorporate rainwater harvesting systems and greywater recycling to ensure a sustainable and cost-effective water supply. Such practices resonate with *iqtisad*, raised by Al Farisi & Ibadurrahman (2023) elaborating on the Islamic ethic of avoiding waste and ensuring that resources are used judiciously. These systems not only reduce water bills but also promote a culture of sustainability among residents, echoing the element of energy efficiency in green architecture.

Community-oriented designs can foster social cohesion and support networks among low-income families. Incorporating communal gardens, playgrounds, and open spaces within housing projects can provide residents with areas for social interaction, recreation (Wan Ali et al., 2020), and even urban farming. These communal spaces balance the enhancement of the quality of life, encourage a sense of community, and provide opportunities for residents to engage in sustainable practices (Jaffar et al., 2020), such as growing their food. This reflects the Islamic value of *mizan*, fostering community and mutual support which complements each other's differences to create a balanced, strong unity.

Moreover, educational initiatives about sustainable living can empower residents to adopt eco-friendly practices in their daily lives. For example, policies inspired by Islamic teachings could mandate the incorporation of workshops and community programs can teach skills such as recycling, composting, and energy-saving techniques, fostering environmental consciousness among the community in line with the principle of *amanah* in taking care the natural environment (Dariah et al., 2019). This not only improves the sustainability of the housing projects but also instils a sense of pride and responsibility in residents, reflecting the Islamic principles of knowledge (*ilm*) and stewardship (*khalifah*).

In summary, integrating green architecture principles in low-cost housing in Malaysia can greatly benefit less fortunate communities by providing affordable, sustainable, and healthy living environments. This approach, if implemented in national housing policy, would addresses economic and environmental challenges, upholding the Islamic values of social equity, community well-being, and environmental stewardship, and ultimately contributing to a more just and elevated quality of life within compassionate society.

## **CONCLUSION**

From the above discussion, this study concludes that incorporating green architecture principles rooted in Islamic principles are crucial for enhancing natural environment accessibility in Malaysian low-cost housing developments, with significant potential to positively impact community and culture. Answering to the research objectives, findings from the literature review, comparative analysis, and case studies presented the scenario where current low-cost housing projects in Malaysia is deficient in providing adequate access to natural environments, demanding the need for a stronger integration of Islamic principles, while the elements of green rating tools are found to be aligned both with biophilic theory and Islamic principles, suggesting a balanced integration of sustainable design and the aspiration of shaping the Malaysian identity with influence of Islamic principles are already in place. By embedding values such as stewardship (caliphate), moderation, and compassion for all living beings, this approach not only enhances the quality of life and well-being for residents but also fosters a deep respect for nature and strengthens social cohesion. Implementing green architectural principles in alignment with Islamic teachings can help build inclusive, supportive communities where shared green spaces encourage interaction, solidarity, and mutual respect among diverse groups, thereby preserving and reinforcing Malaysian cultural identity. Although the financial benefits may not be immediate, such an approach promises substantial long-term gains by promoting a healthier, more sustainable environment for future generations. This research, therefore, advocates for the creation of specific green and sustainable guidelines tailored to Malaysian low-cost housing, challenging the notion that sustainability is reserved for higher-income groups and encouraging innovative, affordable strategies that uphold both environmental and Islamic values in Malaysian architecture.

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## **CONFLICT OF INTEREST STATEMENT**

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

## **AUTHORS' CONTRIBUTIONS**

Ariff developed the theoretical formalism with the addition of recent literature and helped refine the first draft of manuscript by Ismi with consultation and assistance from Hasnan who strengthened the direction and focus of the research parameters. Wan Mahadi enriched the data from case studies, Azmy provided insights on the housing context, Ramli standardised the manuscript formatting and Alias contributed her expertise by enriching the content from an Islamic perspective. All authors contributed to the preparation of the final manuscript.

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