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FRAMING THE 'SOFT PART' IN LIVEABLE NEIGHBOURHOOD: A PERSPECTIVE FROM MALAYSIA

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Abstract

A socially cohesive society is widely recognised as a vital component of the "soft part" of liveability in neighbourhoods, fostering a sense of belonging through active engagement, mutual respect, and strong community interactions. This intangible dimension significantly influences residents' community experience and participation within their living environments. This study aims to identify the social dimension aspect and attributes that contribute to the development of liveable neighbourhoods within Malaysia's housing sector. Employing a mixed-methods approach, the research integrates qualitative insights obtained through the Fuzzy Delphi technique, which was used to achieve expert consensus among 14 selected professionals and quantitative data derived from community perceptions in 10 neighborhoods identified by local authorities as high in liveability. The experts were selected based on criteria including academic publications in urban planning and housing, professional experience in town planning and development, and recognition for cities with high liveability ratings in Malaysia. Community perceptions were gathered from residents in neighborhoods with the highest liveability indices. The findings validate key social aspects such as density, demographic structure, lifestyle, social, local preferences, and cultural identity as critical features of liveable neighborhoods. This research provides valuable insights to inform future planning, development, and policy initiatives aimed at enhancing the social dimension of liveability in Malaysian urban environments.

Keywords: Social Dimension, Liveable, Neighbourhood

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INTRODUCTION

Since the 1990s, liveability has been a topic of discussion and is becoming more significant as cities need to change their growth patterns from the declining urban centres to the rapidly growing suburban areas. However, there is no clear definition of liveable as it depends on what the local population desires in their neighbourhood. To create a liveable environment, the social dimension is essential. Community's quality of life is greatly enhanced by opportunities for engagement, inclusive social dimension, and a strong feeling of community. As a result, encouraging social dimension is crucial to making sure that a location is both practical and liveable for all.

LITERATURE REVIEW

The Characteristic of Neighbourhood

A neighbourhood is a physical area with houses where people can reside and manage their own lives (Power, 2004). According to Hosseini (2016), a neighbourhood is an integrated city unit that includes social, physical, and environmental elements. A desirable neighbourhood, as defined by Hashim (2005), comprises a place where people may live, work, and engage in social and commercial activities. While Ghani (2012) stated neighbourhood is a cluster of houses in connection to other land uses and amenities. In the other hand, a neighbourhood is larger than a residential area, which is made up of houses. A liveable lifestyle and development are achieved in large part through neighbourhood involvement (Hathaway, 2013). Quality of life is one of the finest measures of the social dimension of a neighbourhood (Karuppannan and Sivam, 2011). According to PLANMalaysia's housing criteria, the neighbourhood in this study is classified to as a 'neighbourhood unit' which within 50 acres, has 400 units, and has 2000 residents. Additionally, the neighbourhood has the necessities like a school, a community centre, a prayer hall, a kindergarten, and a playground. As everyone lives close to one another and the community in this instance typically engages in social interactions and it can lead to the liveability.

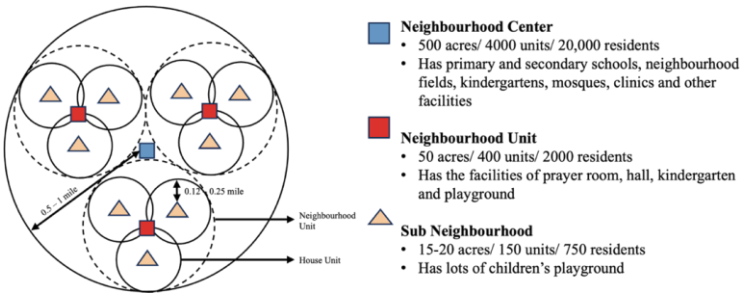


Figure 1: Characteristic of neighbourhood in perspective of Malaysia
(Department of Town and Country Planning (PLANMalaysia), 2016)

Liveable Neighbourhood Through Community

A study by Vergunst (2003), liveability is a subset of sustainability outcomes that have a direct impact on community members, including social equity, public health, economic growth, and pollution exposure. Castillo et al. (2016) highlight the social components of communities, such as who residents live with, how they live, and how they share space. According to Khorsani and Zarghamfard (2018), liveability is not merely determined by a city's purely objective measurements, but it is also a complex social structure composed of the relationships that its residents have built and governed by possibility and unpredictability. A 'spirit of belonging together', trust in a stable power structure, an understanding that collaboration results in trade and mutual benefit, and a spirit generated from shared experiences that are commemorated in art are all more specific definitions of a sense of community. The social construct known as sense of community has been connected, for example, to neighbourhood trust (Perkin and Long, 2002). Communities' satisfaction and quality of life may be enhanced by a stronger feeling of community (Elvas and Moniz, 2012).

Social Dimension of Sustainable Neighbourhood

The social dimension is a crucial aspect of developing liveable neighbourhoods, emphasising how residents interact, build relationships, and foster a sense of community. Bacon et al. (2014) emphasise that the social dimension involves designing physical environments that encourage social use and community engagement, with a recent focus on sustainability efforts (Ghahramanpouri et al., 2015). Additionally, social interactions, formal and informal engagement, and diversity are vital for creating vibrant, culturally rich communities that foster collaboration and social cohesion (Dempsey et al., 2011; Neamtu, 2012; Woodcraft et al., 2012). However, participation remains a challenge for many residents despite the clear benefits of social activity.

Furthermore, fostering a sense of belonging and community pride is central to the social dimension of sustainability. These elements contribute to creating lively, inclusive neighbourhoods by encouraging interactions across diverse backgrounds and values, ultimately strengthening community bonds (Woodcraft et al., 2012). Nonetheless, barriers such as a lack of participation opportunities still hinder full engagement, underscoring the importance of deliberate planning to enhance the social fabric of neighbourhoods.

However, Mary et al. (2019) believed in seven domains as shown in Figure 2. The model outlines the key domains necessary to comprehend community well-being. These interconnected domains are crucial for shaping a liveable neighbourhood, as they collectively enhance residents' quality of life, sense of belonging, and equitable access to opportunities and resources.

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Figure 2: Conceptual model for communities and neighbourhood research
(Mary et al., 2019)

Reaching a high standard of quality of life is challenging, particularly in developing countries like Malaysia (Alias et al., 2025). Considering these factors directly affect residents' well-being and liveability, the literature review emphasises the significance of addressing the 'soft part' of liveable communities, which includes density, demographic structure, lifestyle, social, and local preferences. These components emphasise community involvement, inclusion, safety, and access to opportunities and services rather than just physical infrastructure. As illustrated in Figure 3, the conceptual framework of 'soft part' components synthesises into a cohesive structure that guides both researchers and practitioners to comprehend and improve liveability from a more comprehensive and people-centred perspective. These components will serve as the basis for the research instrument used in the in-depth interviews.

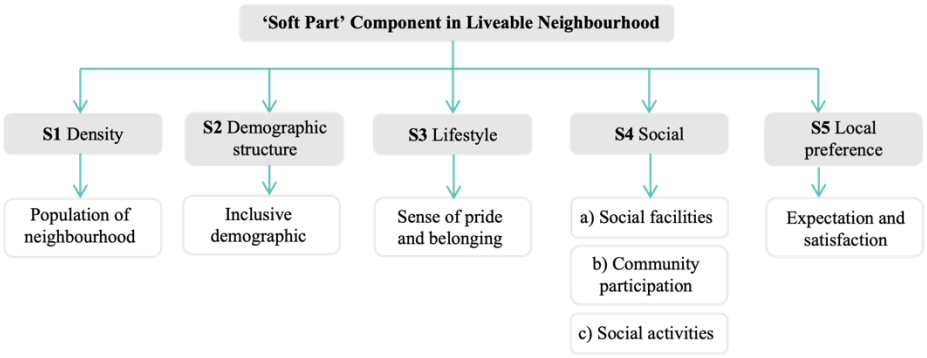


Figure 3: Conceptual framework of 'soft part' components liveable neighbourhood

RESEARCH METHODOLOGY

Figure 4 shows the data gathering procedure, which includes choosing sampling frames and case study criteria. In stage 1, information and in-depth knowledge are gathered for the research through the literature review method. This literary reading was compiled from a variety of sources, including books, journals and scholarly articles. The results of the review will indicate the 'soft part' aspects and attributes to examine liveability, as considered and adapted by the experts.

Next, in Stage 2, this study employs a qualitative methodological technique using a Fuzzy Delphi approach to collect agreement from a group of experts, ensuring that all their viewpoints are included. The Delphi questionnaire was developed using the aspect and attribute constructs from the literature review. Moreover, this study conducted with sample size of field experts with consideration; (1) academia has extensive experience and publish material in urban planning, housing development or liveable; (2) town planner officers with 5 years 'experience or managing project and government initiatives regarding liveable and housing projects; (3) town planner from private firm or developer with 5 years 'experience; and (4) community leader in neighbourhood awarded highest liveable award in Malaysia. Based on these considerations, 14 experts were selected for this study using a purposive and snowball sampling technique.

Table 1: Sample size

No.	Local Authority	Sampled Neighbourhood	Number of Residents	Number of Households	Size (1%)
1	Perbadanan Putrajaya	Kompleks Kejiranan Presint 9	23,249	5,961	60
2	Majlis Bandaraya Iskandar Puteri (MBIP)	Taman Bukit Indah 1	42,814	10,978	110
3	Majlis Bandaraya Melaka Bersejarah (MBMB)	One Krubong	7,238	1856	19
4	Majlis Bandaraya Petaling Jaya (MBPJ)	Bayu Damansara	1,447	371	3
5	Majlis Bandaraya Subang Jaya (MBSJ)	USJ 9	4,902	1,257	13
6	Majlis Perbandaran Hang Tuah Jaya (MPHTJ)	Taman Anjung Gapam	8,814	2,260	23
7	Majlis Perbandaran Kajang (MPK)	Setia Ecohill 2	39,893	10,229	102
8	Majlis Daerah Kerian (MDK)	Taman Serai Perdana	3,994	1,024	10

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No.	Local Authority	Sampled Neighbourhood	Number of Residents	Number of Households	Size (1%)
9	Majlis Daerah Kampar (MDK)	Taman Bandar Baru Kampar	7,933	2,034	20
10	Majlis Daerah Rembau (MDR)	Taman Rembau Utama	1,669	428	4
		Total	**137,959**	**36,398**	**364**

While stage 3 conducts a survey through local communities based on the residents of the city, which is awarded as the highest liveable city index by PLANMalaysia and is identified by local authorities. According to Neuman's (1994) three-stage sampling technique, larger populations require lower sampling ratios to ensure accuracy. For populations over 100,000, even a 1% ratio or 1,000 samples can yield reliable results. Therefore, this study applies a 1% sampling ratio. Table 1 shows that the sample size needed is 364. The fuzzy scores acquired can be used to appropriately rank the influential aspect and attribute identified for the 'soft part' in the liveable neighbourhood framework. Other than that, thematic analysis is employed to categorise and generate themes that correspond to the in-depth interview. The research aim will be achieved with the support of the analysis techniques to construct the 'soft part 'components in a liveable neighbourhood for the Malaysian housing scheme.

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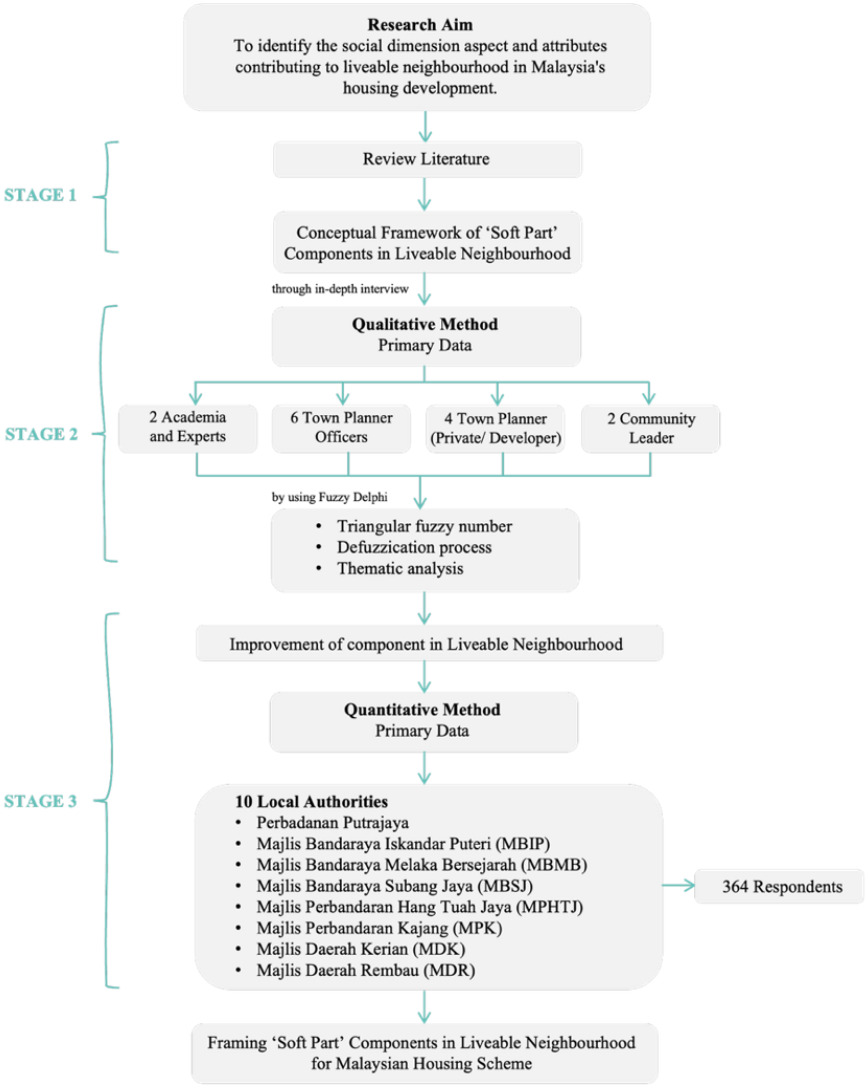


Figure 4: Research flowchart

ANALYSIS AND DISCUSSION

The 'soft part' of liveable neighbourhood includes influential aspects and attributes that are essential for neighbourhood adaptation. Five aspects and seven attributes constitute the soft part element. According to Table 2, the expert consensus percentage is greater than 75% and the threshold value *(d)* is less than 0.2. The influential attributes S4a (social facilities) and S5a (expectation and

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satisfaction) get 100% consensus, meaning the attributes are most influential in creating a liveable neighbourhood.

Table 2: First condition of item acceptance for 'soft part' liveable neighbourhood: Triangular fuzzy numbers

Item Code	Influential Aspects	Influential Attributes	Threshold value *(d)*	Percentage of Expert Consensus (%)	Fulfilment of Condition
S1	Density	Population of neighbourhood	0.141	87	Fulfilled
S2	Demographic structure	Inclusive demographic	0.071	87	Fulfilled
S3	Lifestyle	Sense of pride and belonging	0.071	87	Fulfilled
S4	Social	a) Social facilities	0.000	100	Fulfilled
		b) Social activities	0.071	87	Fulfilled
		c) Community participation	0.038	93	Fulfilled
S5	Local preference	Expectation and satisfaction	0.000	100	Fulfilled

Table 3 displays the fuzzy value for the second condition of the item acceptance during the defuzzification process. Experts agreed that all seven items met the conditions of having fuzzy scores greater than or equal to the α-cut value of 0.5. The ranking of the items for the 'soft part 'in a liveable neighbourhood is displayed in Table 4, with reference to the fuzzy score. The greatest fuzzy score of 0.7, most experts agreed with items on social facilities, expectation and satisfaction.

Table 3: Second condition of item acceptance for 'soft part' liveable neighbourhood: Defuzzification process

Item Code	Influential Aspects	Influential Attributes	m1	m2	m3	Fuzzy Score (A)	Condition of Fuzzy Score ^{3}a - cut value of 0.5
S1	Density	Population of neighbourhood	0.847	0.647	0.447	0.647	Fulfilled
S2	Demographic structure	Inclusive demographic	0.873	0.673	0.473	0.673	Fulfilled
S3	Lifestyle	Sense of pride and belonging	0.873	0.673	0.473	0.673	Fulfilled
S4	Social	a) Social facilities	0.900	0.700	0.500	0.700	Fulfilled
		b) Social activities	0.873	0.673	0.473	0.673	Fulfilled
		c) Community participation	0.887	0.687	0.487	0.687	Fulfilled
S5	Local preference	Expectation and satisfaction	0.900	0.700	0.500	0.700	Fulfilled

Table 4: Ranking influential attributes of 'soft part' in liveable neighbourhood

Ranking No.	Influential Attributes	Fuzzy Score (A)
1	Social facilities	0.700
2	Expectation and satisfaction	0.700
3	Community participation	0.687
4	Inclusive Demographic	0.673
5	Sense of pride and belonging	0.673
6	Social activities	0.673
7	Population of neighbourhood	0.647

By encouraging a social dimension, not only is safety and resilience increased, but thriving community life also promotes the general well-being of communities. This element is necessary to transform a neighbourhood into a thriving living space where residents have a sense of belonging and empowerment. It is still necessary to make sure the neighbourhood is not overpopulated, even though the population of the neighbourhood is the least influential neighbourhood based on the fuzzy score. Liveability is influenced by more than just population density. When integrated with public spaces, amenities, and infrastructure, a well-designed high-density community may offer a vibrant,

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walkable, and connected environment. As the respondent indicates, density should be at its ideal level. Too high or too low can cause a few problems. While low density may lead to underutilised commercial areas and poor community interaction, high density may result in overcrowding and strain on infrastructure. Intergenerational communication promotes mutual aid, social learning, and a more welcoming community.

Having a diverse range of ages, genders, and cultural backgrounds in a neighbourhood can promotes resilience and liveliness. Intergenerational communication promotes mutual support, social learning, and a more welcoming community. At this level, community associations must fulfil their roles. One of the community leader respondents emphasised that the association of residents is crucial in bridging the gap between various age groups and ethnic backgrounds, where tolerance becomes an essential principle. Living in a shared neighbourhood fosters a 'give and take' approach among neighbours and requires tolerance, understanding, and respect for one another. The association also ensures that the community has an opportunity to freely and constructively express their concerns.

Nowadays, beyond just the housing, people are searching for amenities that support pleasure, convenience, and wellbeing, such as jogging routes, public parks, shopping centres, cafes, or cultural events. Lifestyle choices also have a big impact on the social dimension. A growing number of current homebuyers are attracted to lifestyle-oriented amenities like gyms, swimming pools, clubhouses, and co-working spaces, especially those who are younger and wealthier. These facilities enhance liveability while providing comfort and convenience. Additionally, being close to recreational and shopping amenities is often regarded as a significant value-added feature. In the long run, these lifestyle aspects make the neighbourhood more appealing, liveable, and sustainable by enhancing the general quality of life in the community and helping to define its identity.

In a basic nieghbourhood unit, provide basic amenities such as a playground, a prayer hall, and a community hall. These areas serve as hubs for community engagement and meetings, offering opportunities for social interaction. However, having excellent facilities alone is not enough. Organising social events, such as gatherings, festive celebrations, and 'gotong-royong' programs, is also essential for bringing these neighbourhoods to life and giving them purpose. Even the best facilities and events cannot fully accomplish their social goals without active community involvement. Most respondents stated that active participation is essential to a livable community. They also discuss the importance of quantity over quality activities based on the in-depth interview. To show that informal public spaces can effectively replace formal halls and become essential centres for social interaction, communities came together to create community gardens and community spaces for gatherings in the neighbourhood.

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The respondents brought up the advantages of community gardening in fostering a livable neighbourhood. These initiatives directly support food sustainability and economic resilience, while also fostering interpersonal relationships and community cohesion. However, the respondents also underlined how local governments may support community initiatives.

Aside from that, respondents elaborate due to the increased investment made in home ownership, communities in urban areas have higher expectations for amenities, community experience, and service quality. This is mainly because homeowners often incur substantial financial expenditures for both the initial purchase of a property at a premium price and ongoing maintenance or service charges. Their demands for improved infrastructure, well-kept facilities, effective security measures, easily accessible parks, and active community initiatives are understandable. In order to guarantee long-term happiness and the survival of liveable neighbourhoods, developers and local authorities must recognise and satisfy these growing expectations.

Additionally, the respondent highlighted three attributes, which are trust, *maqasid syariah,* and art and culture, that should be considered. Trust will influence how individuals communicate, work together, and help one another. A community that has mutual trust is safer, more cohesive, and more lively. In particular, the viewpoint of *maqasid syariah*, a fundamental Islamic paradigm that prioritises the protection of life, wealth, lineage, intellect, and religion, was employed to underscore the importance of fostering social interaction and community engagement. This offers a thorough perspective for creating liveable neighbourhoods that go beyond the physical environment. While art and culture are in defining a neighborhood's character, liveliness, and soul. Cultural events, such as those offered by the local government in specific venues, encourage the community to come together, socialise, and celebrate. These shared experiences foster stronger ties throughout the community. In other words, cultural activities frequently create chances for artists, entrepreneurs, and small companies. A neighbourhood that values the arts and culture may draw tourists, support local artists, and stimulate the economy.

The social component has the most significant influence on the idea of a liveable neighbourhood as it is what truly makes a place come to life and drive it forward. Social interaction, a sense of belonging, and community networks create a welcoming, comfortable, and safe environment. In the absence of a constructive social component, a neighbourhood may be physically complete but emotionally and communally lacking. As a result, the social component should be given top priority when planning and assessing a neighbourhood's liveability. Figure 5 shows the framing ‘soft part’ components of a liveable neighbourhood for a Malaysian housing scheme. By using the fuzzy score, the component below is ranked from most influential to least influential.

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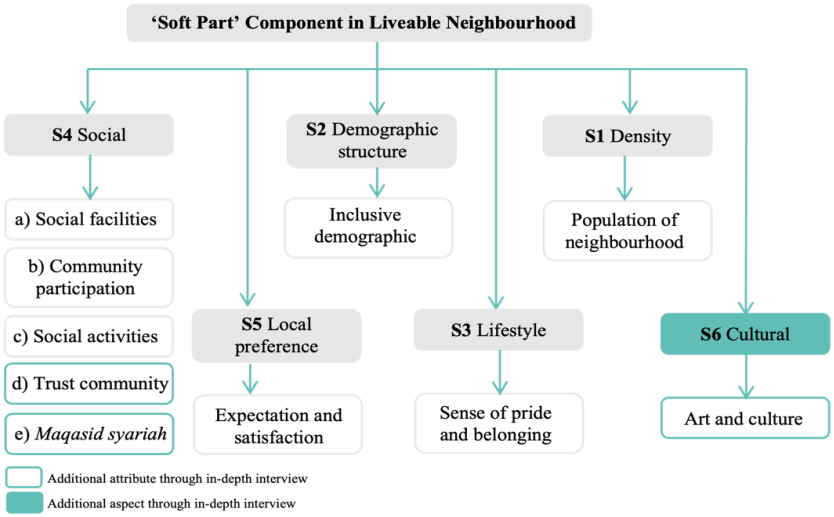


Figure 5: Framing 'soft part' components liveable neighbourhood based on experts' perception

While Table 5 shows the result of a survey the residents' satisfaction experience. Moderate to high levels of liveability are indicated by the overall mean score. People feel comfortable and trusted in their communities, as evidenced by the highest level of satisfaction with the neighbourhood among all attributes ($\bar{x}$ = 3.99), followed by neighbourly manners ($\bar{x}$ = 3.94), and community trust ($\bar{x}$ = 3.60). Nonetheless, community participation in social activities ($\bar{x}$ = 3.47) and social activity facilities ($\bar{x}$ = 3.48) scored lower, which may indicate a lack of accessible or well-maintained communal areas or a lack of opportunities and incentives for locals to take part in planned events. Poor social connections, hectic schedules, and a lack of community resources or activities may discourage involvement. However, by improving these aspects can foster cohesion and enhance neighbourhood liveability.

N6 scores highly in comfort and population density ($\bar{x}$ = 4.48), reflecting a thoughtful layout, sufficient amenities, safety, and supportive infrastructure that promote community trust and engagement. On the other hand, N3 and N5 record lower values in social participation and neighbours' behaviour, which may be the result of weakened social links, poor communication, or a lack of community efforts. This suggests that improving social infrastructure and participation could further improve liveability. Figure 6 highlights the components ranked according to the mean satisfaction scores of the residents. This ranking provides valuable insights into residents' priorities and helps identify aspects that require further improvement.

Table 5: Level of residents' satisfaction in 'soft part' components liveable neighbourhood

Attributes of Liveable Neighbourhood	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	Total Mean
	$\bar{x}$	$\bar{x}$	$\bar{x}$	$\bar{x}$	$\bar{x}$	$\bar{x}$	$\bar{x}$	$\bar{x}$	$\bar{x}$	$\bar{x}$	
Population density in neighbourhood	4.00	3.55	3.10	4.33	3.00	4.48	3.03	4.18	3.76	4.00	3.55
Comfort in neighbourhood	3.90	4.20	4.15	4.00	3.59	4.48	3.61	4.45	4.14	4.33	3.99
Neighbours' manner *(Maqasid Syariah)*	3.83	4.21	3.00	3.83	3.82	3.80	3.88	4.64	4.00	3.89	3.94
Social activities carried out	3.68	3.83	3.25	3.83	3.88	4.00	3.92	4.27	3.38	4.11	3.81
Facilities for social activities	3.63	3.73	4.60	3.67	2.82	4.16	2.80	3.45	3.67	3.56	3.48
Community participation in social activities	3.13	3.55	3.70	3.33	3.47	3.72	3.42	3.91	3.19	4.22	3.47
Trust in community	3.68	3.74	2.60	3.83	3.41	3.6	3.44	4.09	3.76	4.56	3.60
Art and culture	3.23	3.11	4.40	3.50	2.88	4.00	2.85	2.73	3.33	3.67	3.20

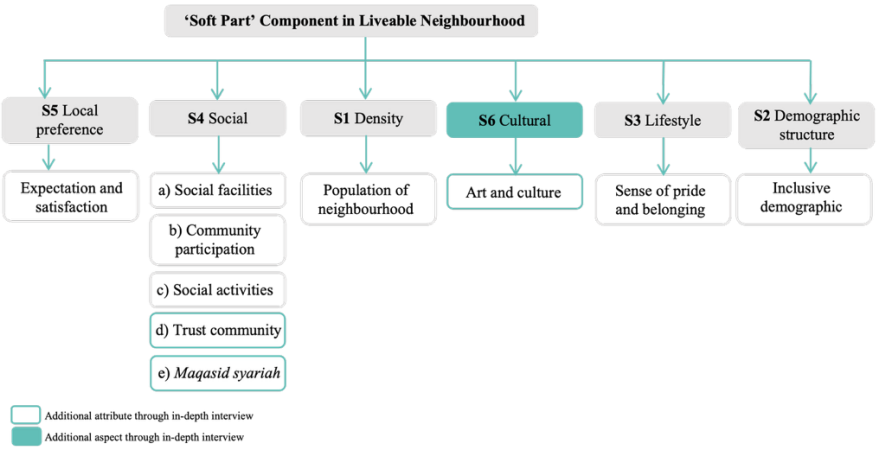


Figure 5: Framing 'soft part' components liveable neighbourhood based on residents' satisfaction

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CONCLUSION

In conclusion, the social dimension significantly contributes to the creation of liveable neighbourhoods by encouraging social, local preferences, mixed demographic structures, community lifestyles, population density, and cultural diversity. It goes beyond the physical environment to address aspects such as social participation, well-being, and cultural expression. Neighbourhoods can become more resilient, inclusive, and in line with the real meaning of liveability by including these components in planning and construction.

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ASSESSMENT OF BUS PRODUCTIVITY LEVEL AND RESTRUCTURING SCENARIOS IN THE WEST BANK, PALESTINE

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Abstract

Developed countries pay great attention to public transport (PT) in terms of development and evaluation, as it is one of the foundations of national success. In the West Bank (WB) of Palestine, the PT is generally neglected and worn out. There is no periodic study of the productivity, efficiency, and effectiveness of bus services. Despite the relatively high number of daily passengers, only 15% use buses due to a lack of confidence in the service. Therefore, this study aimed to measure the productivity of buses on intercity lines in the WB and to identify ways for the bus sector to become more productive. Field surveys for all WB governorates, data from official authorities or previous studies, and two interviews with service providers and decision makers for 22 bus lines were used to collect the required data. PT productivity is a measure of the number of passengers, daily trips, income, and operating expenses. Generally, the PT system in Palestine is non-productive; most routes have fewer than four daily trips, the daily distance covered is less than 100 kilometers; and the daily ridership is less than 120 people per bus. Passengers' trust in buses should be revamped by modernizing the fleet. It is also essential to carry out periodic studies on this sector and collect statistical data. Work with service operators must be integrated at the institutional and legal levels, including organizing and institutionalizing the sector, merging companies and lines, improving and expanding road networks, and providing marketing and necessary financing for this sector. In addition, service providers must be restructured by merging them and merging some weak lines, replacing buses with a capacity of less than 25 passengers to reduce journey and waiting times.

Keywords: Public transportation, bus service, productivity, West Bank.

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INTRODUCTION

The public transport (PT) system is one of the most important axes in urban planning in all of its aspects, and it is the lifeblood of economic and social life in any country. The contribution of the transport sector to the Palestinian national product in 2021 was 1.6% (Ministry of Transport, 2022), and the percentage of the workforce in the transportation sector reached 6.5% (Palestinian Central Bureau of Statistics, 2022).

At present, virtually all PT in the West Bank (WB) of Palestine is provided by privately owned buses, shared taxis, and private taxis, and it is regulated by a traditional system that dates back many years. The Ministry of Transport (MoT) has the authority to regulate the PT sector. Bus services are provided by fragmented private companies, consisting of 86 companies of various sizes, each operating their own bus on a limited number of routes (Ministry of Transport-General Directorate of General Traffic Controller, 2023). Transportation development is probably one of the most difficult issues confronting the future development of the Palestinian economy(Purwoko et al., 2022). There are a variety of reasons for this statement, not the least of which is the context of deep economic, social, and political uncertainty in which Palestinian institutions operate. Furthermore, the transport sector also faces certain unique challenges as a result of Israeli control over major external routes, in addition to physical constraints (roadblocks, poor roads, security checkpoints, etc.) and a lack of a coherent strategy on the part of the Palestinian government, which prevents actors in the sector from being able to propose and implement sectorial improvements.

Passengers mostly use private vehicles or shared taxis when traveling. Only 15% of daily passengers use buses (Rebel Economics & Transactions BV, 2019). The PT system in the WB, in general, faces several problems. The system is not capable of attracting individuals to use buses. This can be attributed to several factors, including an old fleet, with more than 76% of buses manufactured before 2010 (Ministry of Transport, 2022), as well as low frequencies and long waiting times (Olaian, 2017). Furthermore, based on field observations, many of the working buses suffer mechanical problems, inadequate safety measures, and a low level of comfort. At the same time, no comprehensive evaluation criteria were in place for the service. As a result, productivity is severely affected, and the level of service (LOS) offered to customers and the financial sustainability of the bus companies are insufficient.

The current transport sector suffers many problems, as identified in the Transport Sector Strategy (2021-2023) (Ministry of Transport, 2021a) and interviews with the General Director of Road Transport of the Ministry of Transportation. The major problems include: a conventional system, no conducting a demand and supply analysis for the award of several buses and taxis licenses, the WB governorates' lack of geographic continuity due to Israel's

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control over lands, weak coordination among governments, poor state of the road system, and illegal taxis are prevalent in metropolitan and peri-urban regions.

This is a complicated collection of issues, many of which are interconnected. Problem-solving is made more challenging by the split of responsibilities between the Palestinian and Israeli administrations, not least because of the disparity in priorities. As a result, this article presented suggestions on how to grow this sector and increase its productivity in light of the current situation. Therefore, the main objective of the study is to evaluate the productivity of existing public buses in the WB using criteria for route efficiency and effectiveness. The study also offered scenarios for restructuring the passenger transport sector in the WB into a permanent and viable business capable of providing high-quality service and making necessary business investments.

LITERATURE REVIEW

A new sustainable development agenda was adopted by the United Nations in 2015, which included a list of 17 targets. Making cities inclusive, safe, resilient, and sustainable is goal number eleven (United Nations, 2018). Everyone should have access to secure, cheap, accessible, and sustainable transportation systems by 2030 (United Nations, 2015). Prioritizing traffic safety and expanding public transportation should be top priorities (Othman & Hj. Ali, 2020). Lack of urban planning prevents PT providers from providing adequate service if they are not paid more (Lee & Bencekri, 2021). In order to meet transportation needs, people are more likely to use a private vehicle when there are no PT options available (Gorzelanczyk & Madajczak, 2023). To increase bus productivity, one must increase PT demand, especially in bus lines, and diminish private car dominance (Zhao & Zhou, 2018).

Productivity indicators provide crucial information about the performance of the transportation industry, including how effectively carriers move people and products (Cazorla, 2021; Purwoko et al., 2022). Labor (single factor) productivity and multifactor productivity are the two primary metrics for transportation productivity (MFP) (Vaidya, 2014). Cazorla (2021) indicated that improving productivity is done by improving infrastructure and making it sustainable, and increasing asset utilization might result in annual savings of up to $400 billion (Keblawi & Al-Sahili, 2022). Al-Sahili and Abdelmajid (2004) studied travel demand elasticity, which is a major tool for determining the rider's sensitivity to changes in one or more service-related variables.

Performance measurement refers to the examination of an organization's output as a result of the management of its internal resources (cash, people, vehicles, and buildings) and the environment in which it operates (Transportation Research Board, 2003). Six categories of performance metrics were proposed by Carter and Lomax (1992) and Litman (2009), these include

cost-effectiveness, cost efficiency, service utilization/effectiveness, service quality, vehicle utilization/efficiency, and labor productivity.

Vaidya (2014) used 19 operational, financial, and accident-based criteria to assess the relative performance of public urban transportation firms; the criteria included the following examples: average fleet utilization in the year, staff and vehicle productivity, fuel efficiency, passenger kilometers performed, total annual revenue earnings, and annual accident rate. Al-Sahili and Abdelmajid (2003) found that many external and internal factors affect public transportation demand. External factors like income, car ownership, population, employment, and other household characteristics are linked to socioeconomic development. Internal elements, such as PT rates, trip duration, travel times, and service levels, are features of the PT system and are susceptible to policy decisions.

Cambini et al. (2007) and Olaian (2017) mentioned that restructuring the transportation sector was the best solution for increasing productivity, with public transport operators benefiting from lower operational costs by increasing the number of seats used per km. Based on this research review, it is possible to use some of the indicators used to measure bus productivity, as well as predict the size of the demand for this sector in order to make future recommendations to decision-makers on ways to develop and meet future needs.

METHODOLOGY

The mixed-methods methodology was based on field data collection and data from official sources. Due to the lack of some statistical data from the Ministry of Transport or through statistical reports, there were two sources for collecting data: the first was through projects implemented for the benefit of the Palestinian Ministry of Transport, and the second was through interviews with decision-makers and service providers. After collecting the data, it was analyzed to obtain evaluation indicators.

- **Statistical Information**

Statistical data, or statistical analysis, can be obtained from previous studies or official sources. In addition, two important projects are currently being implemented in Palestine. One is the Master Plan project (Road and Transportation Master Plan), while the other is the Orio project (Improving Public Transport Infrastructure in the State of Palestine), which is a PT project. Survey and statistical information were used from these sources, as they have recent and accurate statistics.

- **Interviews**

Interviews with decision-makers and service providers were conducted to collect data from their resources. The first interview was with General Traffic Controller in Ministry of Transport as he is responsible for monitoring and developing the

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current transportation system. The second interview was conducted with an official from the Transport Sector Union in the West Bank governorates, as private companies provide bus service under the supervision of the Ministry of Transport and Communications.

STUDY AREA

The study area consisted of intercity bus lines connecting the ten major cities in the WB (Hebron, Bethlehem, Ramallah/Al-Bireh, Jericho, Salfit, Nablus, Jenin, Tubas, Qalqilya, and Tulkarm) that serve as capital cities for their respective governorates and districts. The study focused on the 22 main bus routes in the WB, with the exception of Jerusalem, as shown in Figure 1, and Figure 2 presents actual photos for the current bus stations in different cities.

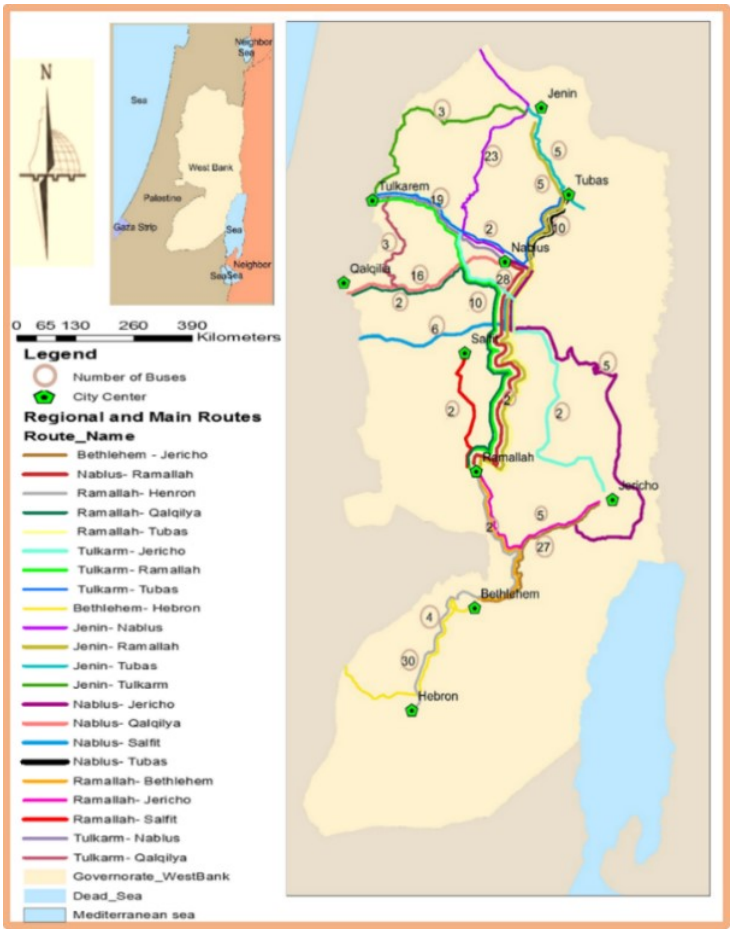


Figure 1: Main Bus Routes in the Study Area



Figure 2: Bus Stations in Different Cities in West Bank

DATA COLLECTION, ASSESSMENT OF TRANSPORT SERVICES, AND RESULTS

Passenger Transport Services in the WB

Passenger transport services in the WB consist of scheduled intercity bus services, local bus services that link small towns and villages to major urban centers, shared taxi services, and individual-use taxis. Figure 3 summarizes the percentage of all types of vehicles in the WB in 2022, while Figure 4 summarizes the number of all buses according to production year.

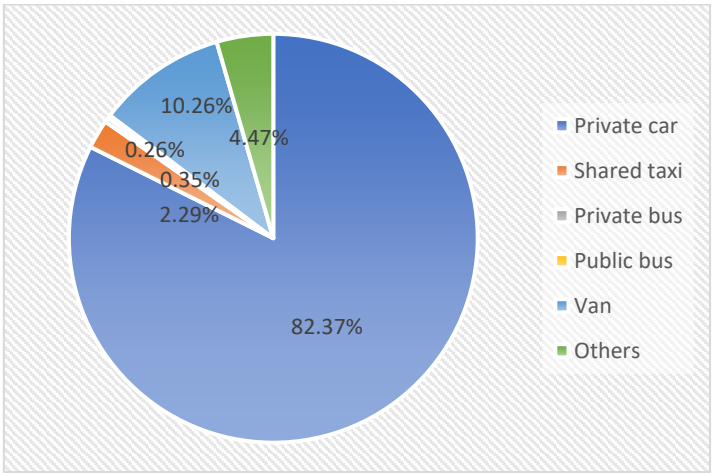


Figure 3: Distribution of Registered Vehicle Types in WB in 2023 (MoT, 2024)

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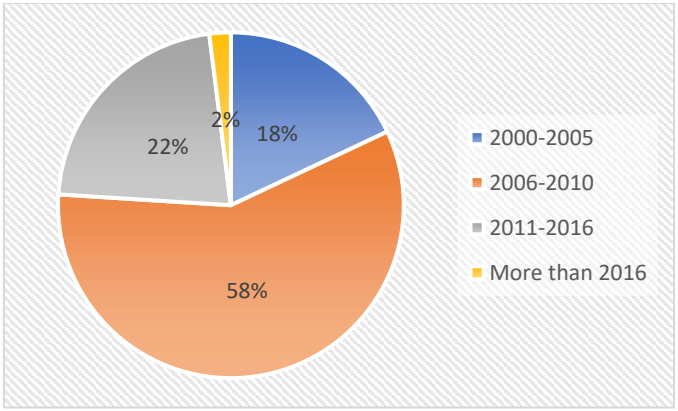


Figure 4: Percentage of Buses According to Production Year (MoT, 2024)

Based on an interview with the General Traffic Controller at the MoT, there is a reluctance to use PT in Palestine in general, and on external roads in particular, with only 35% of travellers using PT for transportation and preferring to use shared taxis. This is due to the general culture among citizens, in which there is no preference for using buses. It is common among people that traveling by bus takes a longer time and is uncomfortable. In addition, there is no actual PT system in place that obliges companies to adhere to a schedule and continuously update their fleet.

Transport Operators

The WB's PT businesses are family-owned and managed in accordance with conventional commercial lines. They are often small businesses that use conventional methods of capital raising, such as bank loans or share subscriptions, to finance fleet renewal and operations. Figure 5 illustrates the number of bus permits for the 22 routes, while Figure 6 depicts the relationship between the number of buses and the number of operating businesses.

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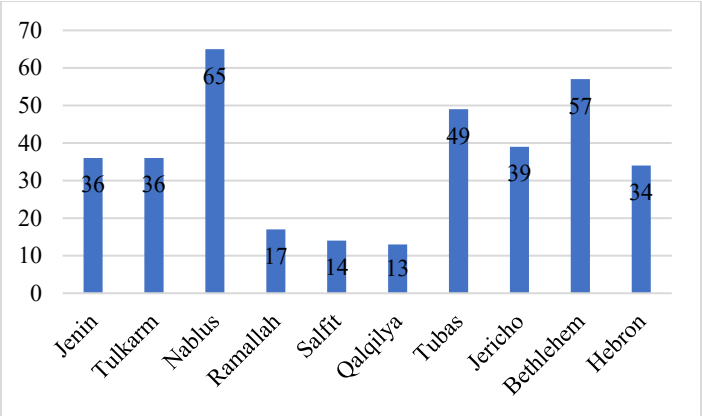


Figure 5: Number of Permits for Main Bus Routes
(Ministry of Transport, 2023)

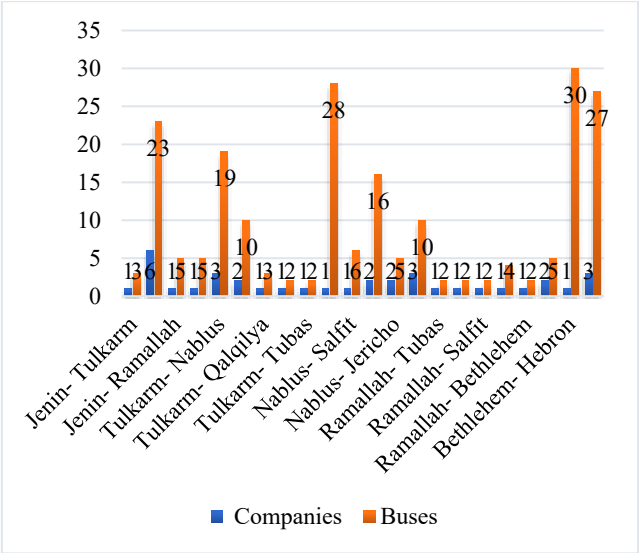


Figure 6: Relationship between the Number of Companies and the Number of Buses on All Routes
(Ministry of Transport, 2023)

There is no direct correlation between the number of buses and the number of operator companies. Thus, no particular standard is followed in this case. The routes are exclusive to specific companies. In addition, when there is a need to add a bus, the MoT asks the service provider company on that route provide one. The companies are working on concession rights for each route, and are not open to tendering.

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Productivity of Transport Operators

The productivity of the transport services and operators on 22 routes was examined according to criteria established by the World Bank (2008), as follows:

- Bus utilization of less than 3-4 trips/day is considered low by any standards.
- Passengers per vehicle per day less than 120, and revenue per vehicle less than 400 NIS are considered low.
- Less than 100 km/day for a bus is considered low.

Table 1 shows the results of checking these standards on those lines for working buses only; not all of the buses are working, as some lines have permits for more than the actual working buses.

Table 1: Actual Bus Productivity for Intercity Routes in the WB

Routes	**Journeys/ Day**	**No. of Permits**	**No. of Working Buses (*)**	**Passenger/ Bus/Day**	**Bus Km/Day**	**Passenger/ Bus Km/ Day**
Jenin-Tulkarm	14	3	3	196	243	0.80
Jenin-Nablus	42	23	14	897	130	6.9
Jenin-Ramallah	6	5	3	130	187	0.69
Jenin- Tubas	6	5	3	210	**48**	4.37
Tulkarm-Nablus	40	19	8	1900	209	9.09
Tulkarm-Ramallah	8	10	5	288	142	2.02
Tulkarm-Qalqilya	**3**	3	1	153	**93**	1.64
Tulkarm-Jericho	/	2	3	/	/	/
Tulkarm-Tubas	4	2	2	**102**	**96**	1.06
Nablus-Ramallah	50	28	26	969	103	9.40
Nablus-Salfit	**2**	6	3	**86**	**18**	4.77
Nablus-Qalqilya	20	16	9	201	**71**	2.83
Nablus-Jericho	**2**	5	1	170	150	1.13
Nablus-Tubas	20	10	8	200	**55**	3.63

Routes	**Journeys/ Day**	**No. of Permits**	**No. of Working Buses (*)**	**Passenger/ Bus/Day**	**Bus Km/Day**	**Passenger/ Bus Km/ Day**
Ramallah-Tubas	4	2	1	**52**	280	0.18
Ramallah-Qalqilya	**2**	2	3	**27**	**56**	0.48
Ramallah-Salfit	4	2	2	**80**	**74**	1.08
Ramallah-Hebron	**2**	4	2	160	**46**	3.47
Ramallah-Bethlehem	4	2	2	160	**60**	2.66
Ramallah-Jericho	20	5	3	1000	247	4.04
Bethlehem-Hebron	20	30	25	432	**19**	22.73
Bethlehem-Jericho	17	27	20	252	**45**	5.6

As a result of working buses only, seven of the 22 routes have relatively good productivity. Some routes are better than the others. Some routes need to increase their ridership, while others need to decrease the number of working buses or parallel shared taxis on those routes.

The average travel time, average speed, and seating occupancy on buses are shown in Table 2. The results show that the percentage of seat occupancy ranges from 24 to 88%. About 30% of current buses are large in size, with more than 49 seats (Ministry of Transport-General Directorate of General Traffic Controller, 2023). The average waiting time was 30 minutes. Some standards limit the delay to a maximum of 5 to 8 minutes of additional travel time for a one-way bus trip (Saberi et al., 2013). Therefore, all routes experience long delays, which can be resolved by replacing big buses with 50 seats, with small buses with a maximum capacity of 20 seats as shown in Figure 7.

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Figure 7: The Two Types of Buses in WB

Table 2: Average Travel Time, Average Number of Passengers, Average Waiting Time, and Seating Occupancy.

Routes	Travel Time (min)	Avg. No. of Passengers per Bus	Avg. Waiting Time (min)	Percentage Seat Occupation (%)
Jenin-Tulkarm	45	14	35	56
Jenin-Nablus	60	13	35	52
Jenin- Ramallah	120	13	40	52
Jenin-Tubas	30	21	20-40	84
Tulkarm- Nablus	40	20	35	80
Tulkarm- Ramallah	100	18	35	72
Tulkarm- Qalqilya	30	17	35	68
Tulkarm- Jericho	/	/	/	/
Tulkarm- Tubas	60	/	35	/
Nablus- Ramallah	75	18	35	72
Nablus-Salfit	40	22	35	88
Nablus-Jericho	80	17	35	24
Nablus-Tubas	45	8	35	68
Ramallah- Tubas	100	7	20-45	32
Ramallah- Qalqilya	100	20	20-40	28
Ramallah- Salfit	45	20	20-40	80
Ramallah- Hebron	150	40	30-45	80
Ramallah-Bethlehem	90	40	30-45	80
Ramallah- Jericho	60	30	35	80
Bethlehem- Hebron	60	18	15-35	60
Bethlehem-Jericho	90	11	35	72
Nablus- Jericho	80	17	35	44

Source: Author's Calculation

About 23% of passengers do not prefer using buses because they have to wait too long before departure (Rebel Economics & Transactions BV, 2019).

This is one of the key reasons that reduces the attractiveness of bus services, thus reducing ridership and productivity levels. As a result, seating occupancy on several routes is low (less than 60%), with only seven routes having a reasonable seating occupancy (80% or more).

Quality of Current PT Service

The results of rating the quality of PT services based on a questionnaire prepared by Rebel Economics & Transactions BV (2019) are presented in Figure 8. Bus service in the southern part of the WB was rated lower than in the north (note that there are almost no large buses in the south), 1 is the lowest quality and 10 is the highest. The overall score for bus service was 6.37. In terms of negative points towards the current bus service, 20% of the users found buses to be uncomfortable, and 23% felt they had to wait too long before departure, as confirmed by the results in Table 2.

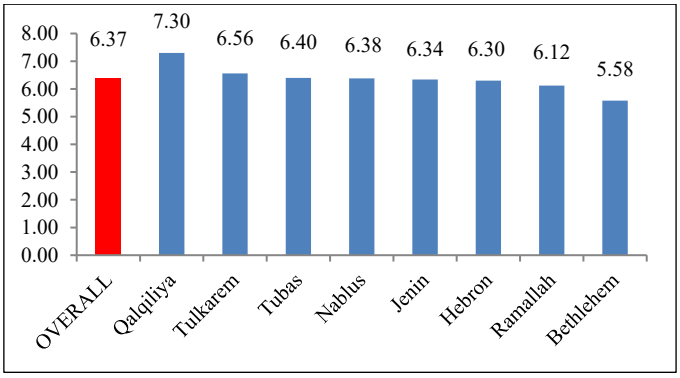


Figure 81: Rating Quality of Bus Service.
(Rebel Economics & Transactions BV, 2019).

RECOMMENDATIONS TO INCREASE PRODUCTIVITY

Based on the previous analysis of the main bus lines in the WB, it has been determined that productivity is low; the following are scenarios for improving service quality and productivity.

Fleet Condition and Renewal

The loss of profitability and decreased financial capacity have had a direct impact on the condition of the fleet and the increase in average vehicle age. Only a few recent buses have been licensed annually. In 2021, the percentage of new registered public buses (2021 manufacture) was 0.26% (Ministry of Transport, 2022); in 2020, it was 0.29% (Ministry of Transport, 2021b); and in 2019, it was 0.32% (Ministry of Transport, 2020). The percentage of new public buses has not

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exceeded 1% in the past three years. This means that the fleet is not periodically updated, and 33% of the fleet's operating buses are now older than the permitted maximum age of 20 years (Ministry of Transport, 2022). In general, most of the buses are old; this could be one of the reasons why passengers use alternative means of transportation, as disclosed by the users. As a result, the bus fleet needs to be updated, and MoT laws need to be changed to shorten the bus's life expectancy, perhaps by 10 years instead of 20 years.

Financial Capacity and Sustainability

Following meetings with the service providers, consideration of the expenses and revenues of various bus operators in the WB, as well as an evaluation of capacity and productivity, the following key conclusions were made:

- The amount received per bus barely covers direct operating expenses (fuel and maintenance account for more than 65% of income); Table 3 includes a breakdown of all operational expenses.
- The majority of operators do not use surpluses to pay for necessary maintenance or fleet replacements.
- Operators can continue using depreciated buses for the rest of their usable lives at the present productivity levels, but they cannot be replaced.

Table 3: Operating Costs for Bus Companies

Expense Items	**Proportion of Total Expenses**
Fuel	35 – 42%
Maintenance and Parts	25 – 33%
Salaries	12 – 16%
Insurance and Fees	1.0 %
Other Expenses	~ 15%

Source: Service Providers (2023)

As a result, the bus industry is currently unsustainable and unproductive. To identify strategies for bringing the sector back to stability and re-establishing an efficient transportation capacity, buses must travel farther, operate longer, and make more trips; the number of passengers and income per bus must rise; and more effective deployment strategies and routes.

Potential for Improvements and Efficiencies

There are many areas where improvements could be made on several levels, and institutional issues must be addressed as well. The main areas identified for improvement are:

- Institutional Level: by developing laws and regulations, reorganizing the passenger transport services sector, developing the road network, and activating the fine system.
- Operators Level: by organizing and structuring the company. Increasing the efficiency of non-operating companies through consolidation, promotion, good marketing, activating smart transportation, and improving the network and road.
- Practical level: by restructuring the network, optimizing fuel consumption, approving bus sizes according to the demand volume, adopting maintenance schedules, training employees, and raising the level of services provided.
- Regulatory framework for the merger of companies (consolidation): by combining small operators into groups that are sufficiently large to improve network, organizational, and operational efficiency, and then restructure their businesses so they can turn a profit after expenses

CONCLUSIONS AND RECOMMENDATIONS

When evaluating the PT, it is important to determine its efficiency and to assess the people's satisfaction in order to encourage them to use it. Generally, the PT system in Palestine is inefficient and unproductive. The proportion of buses to all registered vehicles in the WB is 0.26%; additionally, 50–60% of the registered fleet is really in use. Furthermore, only 2% of the buses are contemporary (newer than 2018). About 76% of the working buses are more than 12 years old. There are no remedial measures to renew the fleet, as the Ministry of Transportation allows buses of 20 years old to operate on the lines, and this is the reason for the reluctance of passengers to use buses; only 6% prefer buses.

There are 86 companies that provide bus transportation services in the West Bank, the majority of which are unproductive due to line damage, and they are also unable to renew their fleet and provide the service at all times. The Ministry of Transportation did not resort to addressing the problem by merging companies and monitoring them through the government. Therefore, to increase productivity, the bus fleet should be updated, with an emphasis on improving bus quality and comfort. Instead of the 20-year life span, provide a 10-year bus life allowance. Some routes must be merged with others to be productive, as the number of passengers, the distance, and the number of daily journeys are insufficient. Service providers must provide specific timetables for the buses and comply with them to reduce waiting time.

Among the proposed scenarios for resolving the bus waiting time problem, based on the interview with the General Directorate of General Traffic Controller, it is possible to suggest replacing large buses (50 seats) with small buses (24 or 13 seats) on external lines and granting companies privileges to replace and upgrade buses. It is also possible to integrate service provider

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companies, their governance, control their efficiency, and give concession areas to government companies in partnership with the private sector.

Therefore, the Ministry of Transportation must balance supply and demand between shared taxis and buses, replace weak bus lines with shared taxis, merge unproductive lines, and restructure service companies while providing some tax breaks to companies to replenish the fleet. More studies on bus and shared taxi lines must be done together to predict the number of buses expected on the lines. Special lanes for buses must be made, and private cars must be prohibited from entering city centers and ministries compound at various times to encourage passengers to use public transport.

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HOW DOES THE RESTORATIVE ENVIRONMENT OF GREEN OPEN SPACE AFFECT THE URBAN STRESS IN PALEMBANG, INDONESIA?

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Abstract

Human-nature connectedness has been perceived as an essential pathway for urban well-being and sustainability. Green open spaces are used to reduce urban stress (US) in cities. This paper aims to determine the level of US among the Kambang Iwak Palembang Park's (KIPP) visitors and how its restorative environment (RE) affects US. A questionnaire-based cross-sectional survey was conducted with 147 visitors who had finished their visit to the KIPP. We analysed the visitors' US level by measuring psychological stress and the effect of the RE using partial least squares (PLS) regression analysis. The results showed that the KIPP's visitors experienced "Moderate" levels of US, meaning their stress manifested for a longer duration but was manageable with coping strategies. The analysis of the RE's influence on US showed a positive value, with dominant factors being compatibility, fascination, and being away. This suggests that time spent in the KIPP's RE led to improved mood and well-being. Therefore, it is necessary to further enhance the KIPP's RE to promote human-nature connectedness and contribute to creating a more liveable city.

Keywords: Green Open Space, Restorative Environment, Urban Stress

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INTRODUCTION

Numerous studies have shown a strong link between urban environments and urban stress (US) (Pelgrims et al., 2021; Xu et al., 2023). City life can be a significant stressor for many people due to factors such as sensory overload, social disconnection, environmental factors, and the fast pace of life (Lederbogen et al., 2011; Moghani et al., 2023; Rishi & Khuntia, 2012). Cities must prioritise tackling the issue of US because living in a city exposes residents to a multitude of interactions that have a profound effect on their emotional responses (ER), behavioural responses (BR), and cognitive responses (CR) (Costa et al., 2020; Rishi & Khuntia, 2012). As cities face rapid urbanisation, incorporating green spaces with restorative environment (RE) into city planning is becoming increasingly important for promoting mental health and overall quality of life. This is evidenced by research on urban parks (Chen et al., 2021; Grigoletto et al., 2023; Nath et al., 2018).

Palembang City, with a population exceeding 1.7 million, has a dense urban environment. This can lead to feelings of crowding, competition for resources, and a general sense of being overwhelmed (D Nguyen et al., 2016; Helmi & Wahab, 2023; Marpen et al., 2022). Further adding to these challenges, a 2023 press release by the Ministry of Environment and Forestry stated that Palembang City's pollution exceeds the WHO standard. The standard is 57µg/m^3/year, while Palembang's pollution level is at 30µg/m^3/year. This means residents are breathing in harmful pollutants. Traffic noise also poses a problem. According to the press release, average noise levels along major roads range from 75-85dB(A), significantly exceeding the Indonesian daytime limit of 55dB(A) for residential areas. This noise can increase frustration and hinder concentration. Indonesian Law No. 26 of 2007 on spatial planning mandates that all cities allocate at least 30% of their area for public green space within a 20-year planning period. Palembang aims to achieve this target by providing green open space amounting to 30% of the city area, which translates to roughly 105.76 km^2, given its total area of 352.52 km^2. However, achieving this goal presents a challenge. On the same note, massive development is happening. Despite its economic and cultural potential attracting global attention, the city's lack of progress on this RE goal hinders its ability to be promoted as a liveable city.

Limited research on US in Palembang, particularly in relation to urban parks, highlights the potential of these parks to reduce stress through outdoor recreation. By promoting park usage and increasing access to green space, Palembang could enhance its residents' mental health and well-being. Furthermore, limited funding for research on US and mental health, a common challenge in developing countries, is likely a factor in Palembang's situation. Data from the Palembang City Health Department in 2023 reveals that the community satisfaction index of 0.72 falls into the "Pre-Healthy Family" category

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(Palembang City Health Service, 2023). This data suggests that Palembang needs to prioritise initiatives that promote better health and an RE for its citizens.

While numerous studies demonstrate a strong link between urban environments and US (Montanari et al., 2024; Pelgrims et al., 2021; Xu et al., 2023), limited research explores the specific role of a green open RE in mitigating stress within the context of Palembang, Indonesia. This study examines the potential of a green open RE to address US in Palembang. Urban stress (US) was measured using validated scales assessing perceived stress through ER, BR, and CR. Green RE will be evaluated based on Attention Restoration Theory, considering factors like opportunities for being away from stressors, the extent of the space, its capacity to hold attention, and its compatibility with users' needs. This research investigates the relationship between perceived US levels and the qualities of green RE. By doing so, it aims to bridge the knowledge gap on how these spaces can function as stress-reduction tools in cities like Palembang. Such cities face challenges in promoting mental well-being and achieving the psychological benefits necessary for a liveable urban environment.

LITERATURE REVIEW

Urban Stress (US)

Urban environments present a multitude of challenges, particularly related to stress and social sustainability (Israel & Wolf, 2016; Paudel & States, 2023). Studies have consistently shown a correlation between urban living and stress levels (Lederbogen et al., 2011; Montanari et al., 2024; Xu et al., 2023). Urban stress (US) is a prevalent phenomenon affecting city dwellers. It arises from various urban factors, including noise and air pollution, overcrowding, and green space scarcity (Ali Khan et al., 2023; Nguyen & Liou, 2024). Moreover, social and economic challenges such as long commutes, high living costs, social isolation, and safety concerns contribute to US (Dillon & Lee, 2023; Hashim et al., 2019). Chronic exposure to this stress can detrimentally impact physical and mental health, manifesting as reduced productivity, concentration difficulties, anxiety, depression, and other mental health problems (Lederbogen et al., 2011; Yang et al., 2019). Kaplan and Kaplan's (1989) Attention Restoration Theory (ART) posits that exposure to nature replenishes directed attention, enhancing CR and ER. Emotional (ER), BR and CR are key indicators of US (Hashim et al., 2019; Mohamad & Hussein, 2020; Rahmani Jami & Mohammadi, 2023).

Green Open Spaces as Restorative Environments (RE)

Human-nature connectedness and green open spaces are intrinsically linked (Dillon & Lee, 2023; Riechers et al., 2022). Both are crucial for fostering a deeper human-nature relationship. Green open spaces are indispensable for creating thriving, liveable cities (Dillon & Lee, 2023; Nath et al., 2018), offering

numerous benefits for people and the planet. As urbanisation progresses, ensuring equitable access to green space is paramount. Green open spaces inherently possess restorative qualities, contributing to reduced US (Polajnar Horvat & Ribeiro, 2023; Sibarani et al., 2023; Van den Berg et al., 2014). The Restorative Environment Theory posits that specific settings can rejuvenate mental and physical well-being. As a branch of environmental psychology, it investigates how environments can be designed to enhance well-being. Exposure to RE correlates with reduced stress, improved mood, heightened focus, and increased creativity. Key restorative qualities include: 1) being away (escaping daily pressures), 2) fascination (capturing attention), 3) compatibility (comfort and ease), 4) extent (space and solitude), and 5) coherence (order and clarity) (Hashim et al., 2019; Mohamad & Hussein, 2020; Van den Berg et al., 2014). The Attention Restoration Theory (ART) proposes a connection between RE and ER, BR, and CR. These environments are characterised by four core elements: being away (escape from daily pressures), fascination (elements that capture attention), compatibility (feeling comfortable and safe), and extent (sufficient space for exploration and solitude). The ART suggests that these characteristics contribute to positive ER, BR, and CR, ultimately leading to reduced stress and improved well-being.

RESEARCH METHODOLOGY

Studied Area

The Kambang Iwak Park Palembang (KIPP) is one of the parks located in Palembang, Indonesia. Its selection can be attributed to its central location, role in providing green open space, and history of attracting high visitor numbers (figure 1). Built during the early 1900s, the KIPP boasts a rich history that serves as a relic of the colonial era (Sinatra et al., 2021). The KIPP continues to thrive today. Originally constructed for the Dutch community as a sporting venue, the KIPP 's central lake offers not only aesthetic beauty but also a practical function: rainwater collection that helps mitigate flooding. The KIPP has transformed into a vital green public space in Palembang City, acting as the city's "lungs." Spanning an estimated 5 hectares (12.35 acres), the park provides a haven for relaxation and recreation. Visitors enjoy various amenities like a children's playground, seating areas, drinking water fountains, and even free Wi-Fi hotspots, allowing them to connect while basking in the shady garden atmosphere. It bustles with activity, especially on weekends. Diverse communities gather here, from music enthusiasts to roller skaters, cycling groups, and even dance and theatre troupes.

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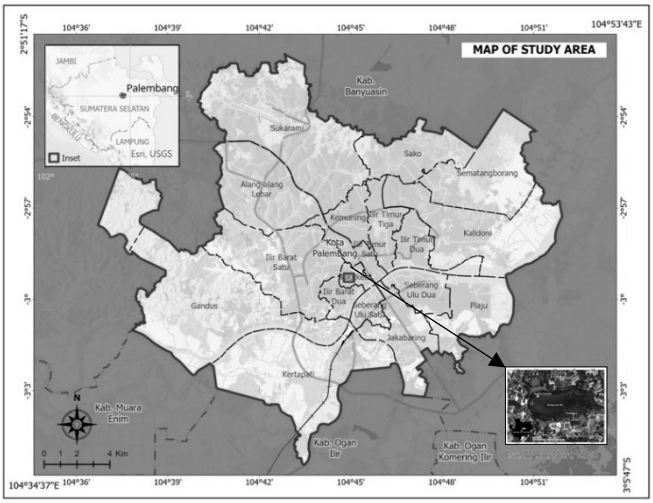


Figure 1. Study Area of Kambang Iwak Palembang Park
Source: Author

The park's jogging track caters to those seeking exercise, offering a scenic path around the lake for joggers and walkers alike. Table 1 presents the soft elements (vegetation) of the KIPP.

Table 1. The Soft Elements (Vegetation) in the KIPP

Type	Condition	Image
Green Cover	Green, uneven, not flowering, and not waterlogged.	
Decorations	There are various types of harmoniously-shaped, healthy ornamental plants. However, the colour of these plants lack diversity.	
Shade	Easy to clean, provides shade for visitors during hot weather, enhances the KIPP's aesthetic appeal, and does not damage the surrounding area.	

Source: Author

Table 2 presents the hard elements (infrastructure) of the KIPP, such as its pedestrian paths, seating, signboards, gazebos, park lighting, rubbish bins, information posts, and drinking water fountains.

Table 2. The Hard Elements (Infrastructure) in the KIPP

Type	Condition	Image
Pedestrian Paths	They are paved with tiles or ceramics and well-maintained.	 
Seating	Comprises cement and iron garden benches, as well as benches facing the water reservoir. Due to the high number of visitors and limited seating, many visitors resort to sitting on the edges of potted plants.	 
Gazebo	It is located in the playground area and is well-maintained. Parents often utilise it while watching their children play, while use it for respite.	
Rubbish Bins	They already separate organic and inorganic waste. The condition of the rubbish bins is good and they are evenly distributed at several points throughout the park.	
Information Posts	It is equipped with computers and closed-circuit television (CCTV) cameras located at several points throughout the park to monitor visitor activities.	

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Type	Condition	Image
Ready-to-Drink Water Fountains	Visitors can drink water for free, and it is in good condition.	

Source: Author

Data Collection and Analysis

This research employed a cross-sectional design using a questionnaire-based survey to investigate visitors' perceived US levels and the RE of the KIPP. Partial least squares (PLS) regression analysis was used to examine the relationship between the KIPP's RE (x) and US (y). The restorative environment construct was measured using the Perceived Restorativeness Scale, encompassing being away, extent, fascination, and compatibility. Urban stress (US) was assessed based on visitors' ER, BR, and CR (Figure 2).

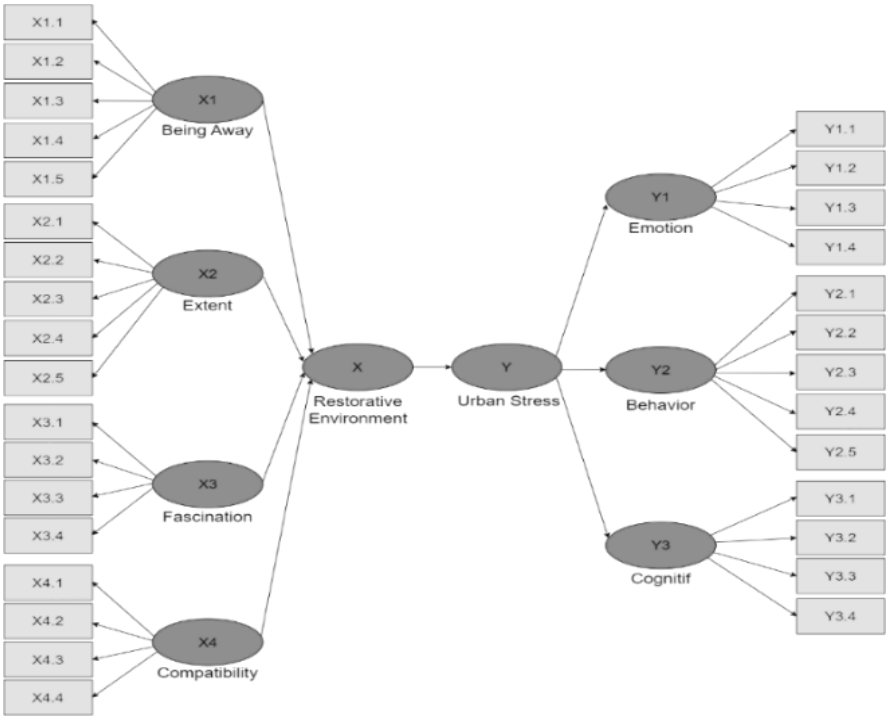


Figure 2. The Structural Equation Models in Partial Least Square
Source: Author

A reflective measurement model was employed for both the RE and US constructs. Partial least squares (PLS) regression analysis was then used to examine the relationship between these latent variables. The RE construct was operationalised using the Perceived Restorativeness Scale, encompassing the dimensions of being away, extent, fascination, and compatibility. Urban stress (US) was assessed based on visitors' ER, BR, and CR.

The study employed a non-probability convenience sampling approach, as described by Rea and Parker (1997). Participants were recruited based on their willingness to participate, presence in the park during data collection, and ability to understand and respond to survey questions. A cross-sectional survey design was used to collect data from 147 visitors who had completed their activities at the KIPP. Secondary information on park profiles and facilities was obtained from relevant agencies and institutions to complement primary data. The respondents' stress levels were assessed by evaluating three variables: ER, BR, and CR (Table 3).

Table 3. The Psychological Variables of Perceived US

Variable	Sub Variable	Indicator	Application in Research
Perceived US	ER	1. Anger 2. Anxiety 3. Disturbances 4. Worry	• ER to US • Feeling anxious due to US • Feeling disturbed due to US • Feeling worried due to US
	BR	1. Social Interactions 2. Socialisations 3. Boredom 4. Negative Behaviours	• Behaviours during social interactions • Behaviours during socialisation • Bored with daily routines • Negative behaviours
	CR	1. Memory Impairment 2. Concentration Impairment	• Frequent forgetfulness due to US • Poor memory or concentration when working or studying

Source: (Rahmani Jami & Mohammadi, 2023)

Four variables; namely, being away, extent, fascination, and compatibility, were used to assess the restorative qualities of green RE (Table 4).

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Table 4. The Variables in an RE

Variable	Sub Variable	Concept	Application in Research
RE	Being Away	A feeling of being in a different place than usual and able to forget about everyday burdens.	• Forgetting the burdens of daily activities. • Free of noise. • Free of pollution. • Free of congestion.
	Extent	A place that provides facilities and recreational opportunities that are easily accessible and enjoyable by visitors.	• A variety of activities to be conducted. • Surroundings that can be enjoyed easily and freely.
	Fascination	An element that attracts visitors to return to the place.	• Boasts many interesting things. • Feeling like you want to spend more time there. • Many facilities that make you want to come back. • Choosing the park as a means of recreation/restoration.
	Compatibility	An element that gives visitors the freedom to do anything in the place.	• Fun activities can be conducted there. • Feeling comfortable. • Finding it easy to interact with others.

Source: (Chang et al., 2008; Hashim et al., 2019; Kaplan & Kaplan, 1989)

The data analysis was conducted in a step-by-step manner. The first step involved gathering visitor information, such as their demographics, health conditions, and perceptions of their experiences visiting the KIPP. This information was collected *via* surveys. It was crucial to verify the data to ensure the overall quality and reliability of the information. This involved identifying and correcting errors, missing data, and inconsistencies. The second step involved assessing the level of US among the visitors of the KIPP. This was accomplished by administering a questionnaire that included statements related to stress levels and measuring visitors' responses on a Likert scale. The responses were then categorised into different levels of US (Table 5).

Table 5. The Categories of US Levels

Score	Classification
20 – 36	None
37 – 52	Mild
53 – 68	Moderate
67 – 84	Severe
85 – 100	Very severe

Source: (Alkharusi, 2022; Yang et al., 2019)

Third, to examine the correlations between the RE of the KIPP and US, PLS analysis was employed (Hair et al., 2021). The PLS analysis involved: a) testing the linearity to assess the linearity of the correlations between variables; b) evaluating the measurement model to assess the validity and reliability of the constructs; c) examining the factor loadings to determine the strength of the correlations between constructs and indicators; d) assessing the model's fit via R^2 and Adjusted R^2; e) testing the significance of the correlations between the constructs; **f) developing a PLS path diagram** to visualise the correlations; **g) converting the path diagram into a structural equation model (SEM) for further analysis; and** h) identifying the dominant influence of an RE on US via path coefficient analysis.

RESULT AND DISCUSSION

This study examined the correlation between the demographics of the KIPP's visitors, such as their age, gender, and occupation, and their stress levels to understand the impact of green spaces on mental well-being. The dataset comprised the demographic profiles of 147 participants. As seen in Table 6, most of the respondents were women (67%) aged 18-29 (37.4%). Most of the respondents were from Palembang City (83%) and had university degrees (66.7%). Over half (52.4%) were employed and a significant portion (30.6%) had retired by the time of the survey. Of the four income brackets, most of the respondents (n=36) earned in the highest income bracket (>Rp.7500000), but the distribution was spread relatively evenly across all income brackets.

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Table 6. The Characteristics of the Respondents

	n	Mean ($\bar{x}$)
Gender		
Gender	67	45.6
Female	80	54.4
Age (Years)		
18-29	55	37.4
30-39	43	29.3
40-49	24	16.3
50-59	15	10.2
60-65	10	6.8
Address/Place of Origin		
Palembang City	122	83
Outside Palembang City	20	13.6
Outside South Sumatra	5	3.4
Education Level		
University Degree	98	66.7
Lower	49	33.3
Employment Status		
Retired	77	52.4
Student	45	30.6
Unemployed	15	10.2
Other	10	6.8
Income Level		
<Rp.2500000	49	33.3
Rp.2500000-Rp.5000000	34	23.1
Rp.5000000-Rp.7500000	28	19
>Rp.7500000	36	24.5

Source: Author

Figure 3 presents the distribution of the visitors across the different US levels. None of the respondents reported "No" or "Very severe" US levels. Most of the respondents (65.9%) reported feeling "Moderate" levels of US followed by "Mild" (n=35) and "Severe" (n=15) levels of US.

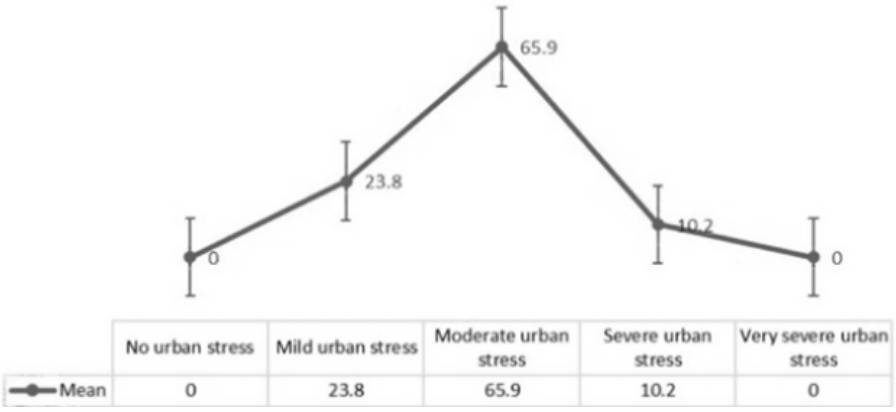


Figure 3. The US Levels of the KIPP's Visitors
Source: Author

A detailed analysis of Table 6 and Figure 3 revealed that the residents of Palembang City exhibit lower average US levels ($\bar{x}$=83) than those residing outside the city ($\bar{x}$=13.6) or South Sumatra ($\bar{x}$=3.4). However, it's crucial to consider the significantly smaller sample size outside Palembang City (n=25) relative to the city's population (n=122). Individuals with university degrees reported higher average US levels ($\bar{x}$=66.7) than those with lower education ($\bar{x}$=33.3). Retirees experienced the highest average US ($\bar{x}$=52.4), followed by students ($\bar{x}$=30.6), unemployed individuals ($\bar{x}$=10.2), and the "Other" category ($\bar{x}$=6.8). A trend of increasing US with higher income brackets emerged, with the lowest income group (<Rp.2500000) reporting the lowest average US ($\bar{x}$=33.3), whereas those with the highest income bracket (>Rp.7500000) reported the highest average US ($\bar{x}$=24.5).

This research defined "Moderate" US as a noticeable level of stress that disrupts daily life without being overwhelming or debilitating. This type of stress lasts longer but can be managed with coping strategies. Numerous urban factors contribute to "Moderate" US, including traffic congestion, noise pollution, overcrowding, lack of green space, and work pressure. To address this, prioritising the development and maintenance of green open spaces, such as parks and gardens, is crucial for promoting urban well-being. By creating readily accessible RE, cities can empower residents to manage stress, fostering healthier and more liveable urban communities.

Urban green spaces significantly contribute to overall well-being and quality of life. Research consistently demonstrates that green spaces with restorative qualities reduce stress, mental fatigue, and depression while improving mood. Table 8 presents the correlations between an RE and US using PLS regression analysis. The equation function (x) represented the KIPP's RE,

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derived from the Perceived Restorativeness Scale (including being away, extent, fascination, and compatibility), while (y) represented US based on visitors' ER, BR, and CR. First, compatibility, encompassing all three dimensions (ER, BR, and CR), exhibited positive $\bar{x}$ path coefficients with relatively high standard errors. The t-statistics for all three were >1.63, indicating a statistically significant and positive correlation between compatibility and lower US. This supports the notion that environments aligning with individual needs (ER, BR, and CR) are less stressful. Secondly, while fascination demonstrated positive $\bar{x}$ path coefficients, these had lower magnitudes and higher standard errors than compatibility. The associated t-statistics were <1, suggesting that correlations may not be statistically significant. Therefore, further research is warranted to confirm or refute this finding.

Table 8. The Results of the PLS Analysis of the Correlation between RE and US

	Original	**$\bar{x}$**	**Std. Error**	**Perc.025**	**Per.975**	**T-Stat**
Compatibility → CR	0.4440	0.3350	0.2534	-0.3223	0.7511	1.7519
Compatibility → ER	0.3432	0.2498	0.2099	-0.1680	0.6641	1.6353
Compatibility → BR	0.3506	0.3400	0.1929	-0.0524	0.6962	1.8185
Fascination → CR	0.2153	0.2034	0.2466	-0.3175	0.6282	0.8729
Fascination → ER	0.1212	0.1973	0.2997	-0.3816	0.5435	0.5279
Fascination → BR	0.0610	0.1247	0.2630	-0.4814	0.5355	0.2320
Extent → CR	-0.078	0.0689	0.1683	-0.2630	0.3594	-0.4682
Extent → ER	-0.179	0.0654	0.2012	-0.3239	0.4082	-0.8927
Extent → BR	-0.328	-0.0070	0.3324	-0.4873	0.5099	-0.988
Being Away → CR	-0.322	-0.1954	0.2546	-0.6334	0.3814	-1.265
Being Away → ER	0.1576	0.2346	0.2406	-0.2984	0.7014	0.6552
Being Away → BR	0.1402	0.1478	0.2011	-0.3012	0.4746	0.6971

Source: Author

Third, the extent of the data revealed mixed results. While the extent of CR showed a negative path coefficient (potentially beneficial), the extent of ER and BR exhibited positive coefficients. The t-statistic for the extent of CR was negative but <1, indicating no significant correlation. Similarly, the other two t-statistics were insignificant. These mixed findings suggest a complex correlation between the amount of exploration and discovery opportunities and stress. Fourth, being away demonstrated a negative $\bar{x}$ path coefficient and a t-statistic <-1.26, signifying a statistically significant and negative correlation with stress. This aligns with the notion that environments facilitating daily life can reduce

stress. However, the positive but insignificant correlations between being away and ER and BR require further investigation.

The data suggests that compatibility and the ability to escape from daily life (being away) are most strongly and negatively correlated with US, highlighting their crucial roles in the KIPP's restorative potential. The impact of fascination remains unclear and warrants further investigation. The correlation between exploration opportunities (extent) and stress appears complex and requires additional research. Overall, these findings underscore the significant impact of an RE on US. To enhance urban well-being, cities should prioritise creating and maintaining accessible green spaces, like parks and gardens. Integrating restorative principles into urban design and promoting multifunctional green spaces is essential. By investing in diverse green spaces featuring natural trails, water features, and ample seating, cities can foster relaxation, social interaction, and a general sense of well-being among residents. This approach contributes to creating not only functional but also supportive urban environments, ultimately reducing US and promoting a healthier urban future.

CONCLUSION

This study sheds light on the role of the KIPP in Palembang as an RE for urban residents. Our findings reveal that visitors to the KIPP experience "Moderate" levels of US, potentially indicating manageable chronic stress. Additionally, the analysis aligns with past research by demonstrating a positive association between the KIPP's restorative qualities (compatibility, fascination, and being away) and reduced US levels. This reinforces the established notion that urban green spaces significantly contribute to well-being and quality of life, integrating with residents' daily experiences. In line with these findings, this study supports the creation and maintenance of urban green spaces as a valuable strategy to promote mental well-being and reduce stress in cities. Therefore, further efforts to enhance KIPP's RE and foster a human-nature connection are necessary to contribute to a more liveable Palembang.

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DISCLOSURE STATEMENT

The author has no competing interests to declare.

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VISITOR'S PERCEPTIONS OF HIGHLAND NATURAL DISASTERS RISK IN BATU, EAST JAVA, INDONESIA: BASED ON GEO-PSYCHOLOGICAL APPROACH

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Abstract

Highland areas have many natural resources that serve as the main tourist attractions; however, there is a risk of natural disasters. Batu Tourist City, located in a highland area in East Java, Indonesia, is prone to various natural disasters, including landslides, floods, and flash floods throughout the year. Visitors become particularly vulnerable to disasters because they generally do not understand the risks of the areas they visit. The research aims to analyse visitors' risk perceptions (VRP) regarding adapting and surviving natural disasters in the highland tourist area. Visitors' risk perceptions (VRP) are based on geographic and psychological approaches, which comprise prior experience (PE), risk management knowledge (RMK), self-adaptability (SA), and tourism risk, such as physical (PR), service risk (SR), and environmental risks (ER) elements. Through quantitative research, the researcher tested 398 samples and 18 hypotheses using partial least squares structural equation modelling (PLS-SEM). Bootstrapping analysis was used for structural models and measurement. The results show a positive influence of PE and RMK on the VRP of tourism. In contrast, SA had a significant effect on visitor psychology but did not positively influence the VRP of tourism. This indicated that psychologically, visitors' awareness, ability to recover from difficulties, and tendency to embrace a positive perspective on safety do not depend on their sensitivity to potential risks. This research concluded that visitors who have RMK exhibit good VRP but not SA. This is contradictory because VRP are linked to psychology, which requires SA when facing natural disaster risks in tourist areas.

Keywords: Geo-Psychological Approach, Highland Tourism Risk, Tourism Resilience, Visitor Risk Perception

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INTRODUCTION

Highland tourism is known for its distinctive and beautiful attractions, but it is also vulnerable to natural disasters. The most significant disasters encompass landslides and flash floods resulting from land conversion or direct natural phenomena (Chen et al., 2020). This study conducted a comprehensive investigation of visitors' risk perceptions (VRP), as they are also vulnerable to the possible dangers posed by natural disasters in the surrounding areas (Blešić et al., 2022). Previous studies have examined VRP and discovered that a lack of preparedness results from unperceived risks (Rittichainuwat et al., 2018). This presents a complex issue for visitors who are influenced by negative VRP of disasters and are more likely to seek out other locations that offer relatively higher perceived safety (Liu et al., 2021).

The primary objective of this study is to analyse VRP in terms of adapting and surviving natural disasters in the highland tourism area, especially in Batu City, East Java, Indonesia. According to regional spatial analysis findings, Batu City is prone to a variety of natural disasters, including forest fires, landslides, flash floods, and droughts (Suprapto et al., 2022). One of the most severe flash flood disasters happened at the end of 2021, damaging and drowning various tourist access locations, including Gunung Picung Adventure Park (BNPB, 2021). These conditions suggest that active and future visitors must have risk management knowledge (RMK) of disasters and the ability to take decisive actions in critical situations (Liu et al., 2021).

Previous research suggests that VRP comprised three views, which were 1) subjective feeling, 2) objective evaluation, and 3) the cognition threshold portion of the negative consequences that may occur during travel mostly related to their psychological condition (Cui et al., 2016; Liu et al., 2021). Various factors influence VRP, including socio-demographic aspects such as age, occupation, and education (Blešić et al., 2022; Khan et al., 2019), Visitors' risk perceptions (VRP) are generated from online reviews and information (Liu et al., 2021), prior experience (PE) with disasters (Fountain & Cradock-Henry, 2020), self-protective measures informed by RMK (Sasaki et al., 2022), and the risk tolerance level (Blešić et al., 2022). One of the instruments used to assess an individual's psychological capacity to tolerate disaster risk is known as The Psychological Preparedness for Disaster Threat Scale (PPDTS) (McLennan et al., 2020; Türkdoğan Görgün et al., 2023). In previous studies, this scale has been applied to tourist visitors by considering both subjective risk parameters and objective risks related to hydro-meteorological hazards (Blešić et al., 2022).

The author refers to the PPDTS scale by considering the effectiveness of the results of previous VRP analyses related to subjective and objective feelings in previous studies. This research also focuses on visitors' knowledge of tourist locations' geographical conditions because literacy of appropriate

geographical conditions can increase RMK (Kamil et al., 2020). Therefore, this research emphasises determining the psychological conditions of tourists (subjective and objective risks of visitors) (Blešić et al., 2022) by integrating geographic approaches (spatial, environmental and regional) (Fournier & Knafou, 2013) based on the Psychological Preparedness for Disaster Threat Scale (McLennan et al., 2020).. Since this combination has rarely been used in prior studies, researchers have decided to refer to it as the Geographical and Psychological Preparedness for Disaster Threat Scale (GPPDTS).

LITERATURE REVIEW

Visitor Risk Perceptions (VRP)

Visitors' risk perceptions (VRP) encompass three types of perspectives: subjective assessments, objective evaluations, and cognitive processes that extend over the potential positive or negative consequences that may arise during the trip (Cui et al., 2016). Subjective assessments can be categorised into two main factors: 1) demographic variables, such as age, gender, education, location of residence, and income, and 2) individual cognitive capacity, which includes personality, information beliefs, values, and psychological preparation (Blešić et al., 2022; Cui et al., 2016). Objective evaluations prioritise physical risks (PR) when evaluating natural tourism resources or beautiful areas, such as land views, water views, biological landscapes, and climate views, followed by equipment risks and performance risks (Cui et al., 2016). Prior studies on VRP examine objective aspects such as PR, financial risk, and service risk (SR) while also suggesting that future research should consider environmental risks (ER), such as geographical conditions or location of residence (Blešić et al., 2022).

Tourists tend to prioritise visible risks rather than those that are not directly visible (Cui et al., 2016). The discussion of expected VRP is deliberately avoided or often not prioritised in order to mitigate excess concern (Cohen, 2009; Wang et al., 2019). Furthermore, in addition to earlier studies that examine objective, subjective, and cognitive factors, researchers also analyse ER as part of the investigation of VRP. Understanding and effectively addressing safety concerns and ER is crucial for implementing effective precautions (Wang et al., 2019).

Highland Tourism Risk

Highland tourism encompasses travel and leisure activities that occur on high-situated lands, typically associated with mountainous areas (Ólafsdóttir & Runnström, 2013). Mountain areas typically offer beautiful scenery, amazing natural beauty, and unique facilities and are exceptionally popular with tourists (Nepal & Chipeniuk, 2005). The popularity of travelling to places with mountains has significantly grown over the years, leading to an increased discussion

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regarding the advantages and disadvantages for the environment, culture, and mountain communities (Mutana & Mukwada, 2018).

Disasters in mountainous tourist areas are frequently overlooked because of the revenue and profits associated with tourism (Chen et al., 2020), even though some risks can be used as opportunities to provide benefits from different perspectives (Bachri et al., 2015). Geological disasters, such as landslides, debris flows, floods, and flash floods, are common risks in hilly and mountainous areas (Bachri et al., 2024; Chen et al., 2020). This condition relates to the concept of risk, specifically because of uncertain circumstances regarding events, results, and the extent of damage caused by natural disasters (Bachri et al., 2022). Therefore, this research expected that the risk associated with mountain tourism is the potential occurrence of events that may threaten the safety of visitors who visit mountainous areas.

Tourism Resilience

Tourism resilience refers to the collective efforts by tourism companies, destinations, communities, and individual visitors to adapt, adjust, and react to various forms of change and disruption (Hall et al., 2017). This resilience is necessary due to the lack of preparation among several stakeholders and individual visitors' high vulnerability to natural disasters (Cahyanto & Pennington-Gray, 2015; Rittichainuwat et al., 2018). Resilience is highly beneficial for tourists when it comes to navigating uncertainty since it involves comprehending both current environmental dangers and possible future risks (Espiner et al., 2017).

Previous works have viewed VRP in terms of PR, encompassing worries for personal safety, family safety, perceptions following the observation of warning signs, and even subjective evaluations of environmental conditions (Blešić et al., 2022). Service risks (SR), in addition to PR, are crucial in ensuring infrastructure and safety service availability; thus, stakeholders must actively pursue this aspect (Chan et al., 2020; Yang & Guo, 2023). Environmental risks (ER) depend on visitors' knowledge of the tourist location and their perception of environmental vulnerability (disaster-prone tourism destinations) (Hao et al., 2022; Sumarmi et al., 2021). The resilience of tourists should prioritise addressing this ER, given that the areas they frequent are typically unfamiliar (Liu et al., 2021). In addition, environmental danger has a significant role in determining the escalating risk of natural tourism, thus necessitating tourists' awareness of this issue (Cui et al., 2016).

Geo-Psychological Approach

A geographical approach as an education subject is necessary to comprehend environmental issues (Utaya et al., 2023) and provide solutions in disaster-prone

tourism destinations (Bachri et al., 2024). The geographical approach to tourism comprises the standards of tourist attractions, their growth, and the geographical aspects of stakeholders (tourists, guides, enterprises, among others) (Fournier & Knafou, 2013). Research on physical factors, such as geology and geomorphology (Bayrak & Teodorovych, 2020), land conversion (Chen et al., 2020), and the impact of weather (Blešić et al., 2022) are all connected with the geographical approach. However, this study will specifically focus on accessibility as it relates to safety infrastructure.

Psychological preparedness for disaster risk primarily focuses on cognitive factors related to risk awareness and understanding, having knowledge about environmental dangers, and developing adaptive responses, particularly in terms of emotional self-awareness and self-adjustment (McLennan et al., 2020). The Psychological Preparedness for Disaster Threat Scale (PPDTS) is a commonly used method for assessing individuals' level of preparedness for disasters. It measures factors such as awareness of potential dangers, adaptive responses, self-awareness, and emotional self-control (Blešić et al., 2022; Türkdoğan Görgün et al., 2023).

The correlation between geographical knowledge and psychological preparedness of visitors in danger-prone tourism is due to the fact that tourists' protective conduct is influenced by their VRP of danger and self-efficacy (Blešić et al., 2022). Self-adaptability (SA) is also a resilience component that can keep the system secure, stable, and orderly during external disruptions and crisis conditions, and it has good "anti-vulnerability" and "self-adaptability" to establish and sustain self-stability (Blešić et al., 2022). Therefore, this research uses the evaluation of VRP, highland tourism risk, PE, RMK, and SA to provide a perspective on tourism risks, including the direct/indirect effects determined using structural equation models (SEM).

RESEARCH METHODOLOGY

The research is based on the Batu tourist city in East Java, Indonesia (The research location map can be seen in figure 1). Data was collected from four locations: 1) Selecta Heritage Park, 2) Coban Putri, 3) Coban Talun, and 4) Paralayang area. Data collection was comprised of a simple random sampling approach and estimation method (Hong, 1998). Simple random sampling was used to build a sample of 398 visitors as respondents. All respondents were informed that the questionnaire was anonymous and that participation was voluntary. The methodology and information points gathered guarantee that the sample is representative.

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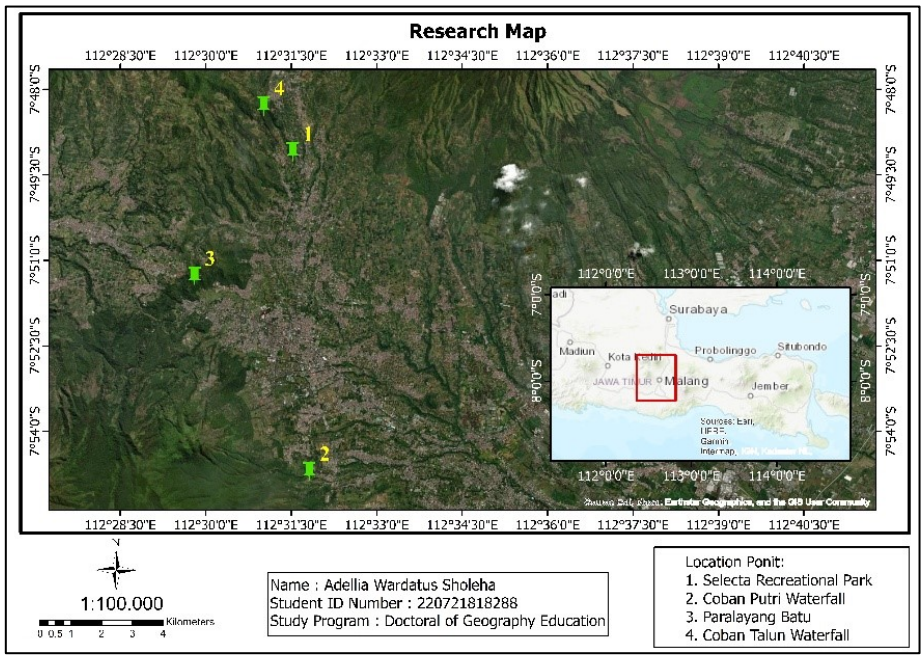


Figure 1. Research Location Map
Source: Author, 2025

The objective of this study is to evaluate VRP of disaster risks in tourist areas, focusing on their understanding of the geographical and psychological factors associated with these risks. The assessment is differentiated based on one independent variable (PE), two moderating variables (RMK and SA), and three dependent variable dimensions (PR, SR, and ER). The indicator as a whole is reflective, and each assessment has several answer options that were scored based on the Likert scale.

In SEM-PLS, researchers need to perform two analysis steps, namely 1) measurement model testing and 2) structural model testing (Hair et al., 2019). The measurement model tests include assessing outer loading, composite reliability (CR), average variance extracted (AVE), and discriminant validity (DV) using the Fornell-Larcker Criterion and the heterotrait-monotrait (HTMT) ratio. The indicators evaluated using outer loading should have values >0.70, CR should be >0.60, AVE should be >0.05, and the HTMT ratio should be <0.90 (Hair et al., 2019). The second structural model test is used to approve hypothesis testing by evaluating R^2, direct/indirect effect, *T*, and *P* using the bootstrapping method and a coefficient product approach (Rasoolimanesh et al., 2023). R^2=0.75, 0.50, and 0.25 can be considered substantial, moderate, and (Hair et al., 2019). Hypothesis evaluation and acceptance are based on *T* exceeding the T-

Table values (N=398=>1.649) and $P<0.05$ (Significant Level 0.05 in one-tailed test) (Rasoolimanesh et al., 2023).

ANALYSIS AND DISCUSSION

The findings of this study were derived from valid data collected from 398 respondents. Information was gathered from 124 males and 274 females. The respondents' mean ages were 18-30 for 294 respondents, 31-40 for 27 respondents, 41-50 for 41 respondents, 51-60 for 18 respondents, and >61 for 10 respondents; all respondents were Indonesian. There were four education levels: 226 respondents had a bachelor's degree, 130 respondents had senior high school education, 23 respondents had postgraduate education, and 19 respondents had junior high and elementary school education. There were 249 visitors with an income ≤IDR 250000; moreover, 91 earned IDR 2,500,000-4,000,000, 36 earned IDR 4,000,000-6,000,000, and 22 earned >IDR6,000,000 based on their age and level of education. The respondents' demographic data comprises the following: 173 respondents are from Malang Regency, 174 respondents from outside Malang (particularly East Java), and 51 respondents from outside East Java.

The results demonstrate that convergent reliability and validity have been proven for all reflective constructs, thereby supporting the continued examination of the proposed model. The evaluation results of the measurement model are shown in Table 1. The researcher also completed the measurement model with the DV test using the Fornell-Larcker criterion and HTMT ratio (Tables 2 and 3).

Table 1. The Assessment Results of the Measurement Model

Latent Variable (Construct) and Reflective Indicators		Outer Loadings	CR	AVE
Prior Experience (PE)			0.801*	0.670*
PE(1)	Experience with previous disaster	0.730		
PE(2)	Information regarding previous disaster	0.899		
Physical Risk (PR)			0.831*	0.552*
PR(1)	Worry about the safety of family and colleagues	0.703		
PR(2)	Worry about your safety during visit	0.771		
PR(3)	Worry about disaster risk in a natural tourist area	0.720		
PR(4)	Concerned after see disaster warning signs	0.775		
Environmental Risk (ER)			0.882*	0.713*
ER(3)	Perception of visiting highland during raining season	0.859		
ER(4)	Perception of sloping condition could trigger threat	0.878		
ER(5)	Perception of steep trails make difficult to keep safe	0.794		
Service Risk (SR)			0.864*	0.679*
SR(2)	Perception availability of danger signs	0.807		
SR(3)	Perception about accessibility easy to avoid disasters	0.854		
SR(4)	Perception of safety infrastructure (ex. alarm sound)	0.810		
Risk Management Knowledge (RMK)			0.862*	0.675*

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Latent Variable (Construct) and Reflective Indicators		Outer Loadings	CR	AVE
RMK(5)	Familiar with disaster warning systems	0.806		
RMK(6)	Understanding indications before disaster occur	0.831		
RMK(7)	Could identify natural preparedness material	0.827		
Self-Adaptability (SA)			0.894*	0.628*
SA(1)	Ability to control feelings in difficult situations	0.750		
SA(2)	Ability to overcome anxiety and fear	0.797		
SA(3)	Ability to think openly when under pressure	0.793		
SA(5)	Understanding to take an action in difficult situation	0.809		
SA(6)	Ability to avoid disasters occur	0.813		

Source: SEM-PLS analysis using SmartPLS (Author, 2023)

Table 2. The Discriminant Validity (DV) using Fornell-Larcker Criterion

Construct	ER	PR	PE	RMK	SA	SR
ER	0.845					
PR	0.464	0.743				
PE	0.066	0.001	0.819			
RMK	0.179	0.167	0.259	0.822		
SA	0.066	0.077	0.205	0.497	0.793	
SR	0.059	0.195	0.027	0.341	0.288	0.824

Note: All significant *Source: SEM-PLS analysis using SmartPLS (Author, 2023)*

Table 3. The Discriminant Validity (DV) using Heterotrait-Monotrait (HTMT) Ratio

Construct	ER	PR	PE	RMK	SA	SR
ER						
PR	0.597					
PE	0.101	0.119				
RMK	0.229	0.207	0.384			
SA	0.085	0.106	0.291	0.601		
SR	0.139	0.241	0.205	0.439	0.350	

Note: All significant *Source: SEM-PLS analysis using SmartPLS (Author, 2023)*

The results of hypothesis testing involving indirect effects demonstrate a correlation that is comparable to direct effects. The SA variable, classified as a moderate variable, is affected by PE and RMK. Then, it also affects the remaining risk variables, H12, H13, H14, H16, and H18, all of which are rejected. In contrast, only the indirect effect (H17) relating to the relationship between RMK, SA, and SR is accepted. The results of hypothesis testing are presented in Table 4.

Table 4. The Results of the Hypothesis Testing

Hypothesis		Direct/Indirect effect	T-Value	P-Value	Supported
H1	PE -> RMK	0.259	5.699	0.000	Yes
H2	RMK -> PR	0.171	2.670	0.004	Yes
H3	RMK -> SR	0.263	4.398	0.000	Yes
H4	RMK -> ER	0.193	3.556	0.000	Yes
H5	PE ->RMK->PR	0.044	2.265	0.012	Yes
H6	PE ->RMK->SR	0.068	3.367	0.000	Yes
H7	PE ->RMK->ER	0.050	2.675	0.004	Yes
H8	PE -> SA	0.082	1.924	0.027	Yes
H9	SA -> PR	-0.008	0.106	0.458	No
H10	SA -> SR	0.158	2.398	0.008	Yes
H11	SA -> ER	-0.030	0.506	0.307	No
H12	PE -> SA ->PR	-0.001	0.088	0.465	No
H13	PE -> SA ->SR	0.013	1.430	0.077	No
H14	PE -> SA ->ER	-0.002	0.460	0.323	No
H15	RMK -> SA	0.476	10.829	0.000	Yes
H16	RMK -> SA -> PR	-0.004	0.106	0.458	No
H17	RMK -> SA -> SR	0.075	2.354	0.009	Yes
H18	RMK -> SA -> ER	-0.014	0.500	0.309	No

Note: T>1.645 and P<0.05 are significant. *Source: SEM-PLS analysis using SmartPLS (Author, 2023)*

The acceptance or rejection of this hypothesis is additionally determined by *T* and *P* in accordance with the primary data that was acquired. A positive correlation is indicated by positive values in the original sample (direct/indirect effect), while the opposite is true for negative values. Graph 1 displays the results of hypothesis testing.

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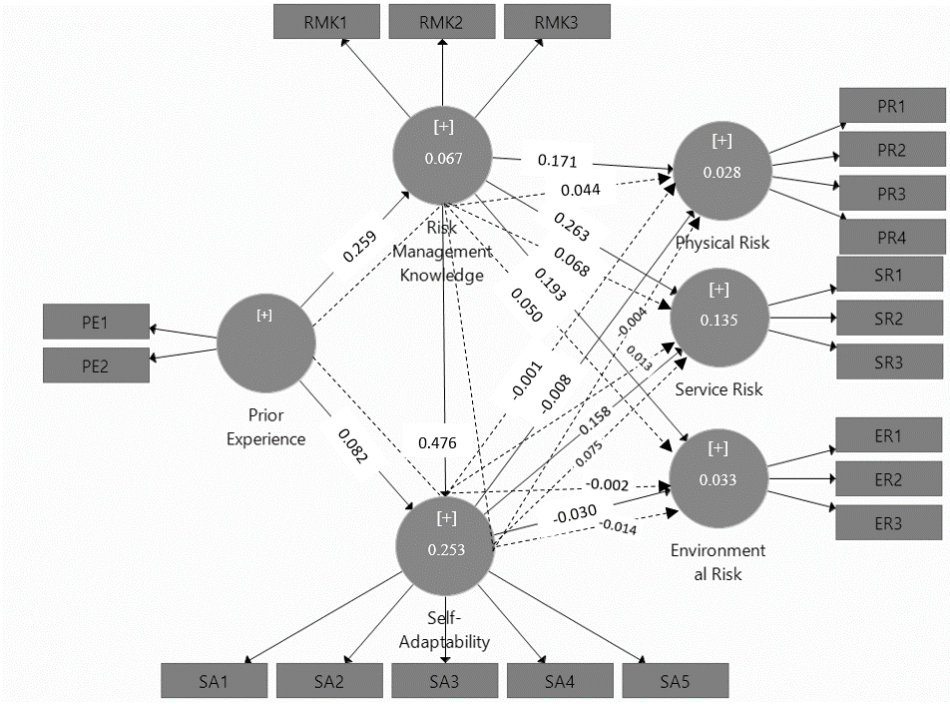


Figure 2. The Final Model as a Result of the Hypothesis Testing
Source: SEM-PLS analysis using SmartPLS (Author, 2023)
Note: Solid arrows indicate direct effects while dashed arrow indicate indirect effects

Initial assessments indicated that the visitors' PE had a significant effect on the moderator variables (RMK and SA) with various levels of influence. The direct effect evaluation yielded positive results for hypotheses H1, H8, and H15, indicating that the results were accepted. The hypothesis is supported by the direct effect values, indicating a correlation between PE and RMK (0.259), PE and SA (0.082), and RMK and SA (0.476) (Graph 1).

The results of this research align with prior studies indicating that acquiring RMK can enhance individuals' ability to recognise and prepare for both PR (Blešić et al., 2022) and ER (Bayrak & Teodorovych, 2020). The highest valued element is the utilisation of RMK to reduce SR, with a score of 0.263. Visitor expectations play a significant role in determining this value since they require not only the presence of tourism support infrastructure but also safety and evacuation infrastructure. Thus, the assessments of H2, H3, and H4 are considered to be valid.

The PE and RMK positively affect physical VRP, as evidenced by the acceptance of H5. Physical risk (PR) is composed of four primary elements:

personal safety, family safety, visiting decisions, and the influence of warning signs suggesting potential hazards. Prior experience (PE) and RMK can increase vulnerability to specific risks during visits (Liu et al., 2021).

Although this does not occur frequently, visitors expect that when they see warning or danger indicators, stakeholders have provisions for enough evacuation resources (Chan et al., 2020). According to feedback from multiple visitors, it can be inferred that while the environment of the visited location is dangerous, they have confidence in the management's ability to anticipate potential disasters; thus, they perceive the management's preparation to be optimal (Chan et al., 2020). Therefore, H6 and its related indicators are accepted.

Visitors' risk perceptions (VRP) regarding environmental aspects is determined by several elements, such as 1) the season or time of visit (both during rainy and dry seasons), 2) the conditions of the slope, and 3) the steepness of the road. Researchers explored the hypothesis to determine the impact of RMK and PE on environmental VRP. The findings indicate that increased awareness of ER is correlated with PE and RMK (Blešić et al., 2022; Liu et al., 2021), supporting the acceptance of H7.

There are differences in the evaluation of disaster risk-related SA. H9 is rejected because SA and the PR of visitors (individuals) have a negative relationship. The rejection of this hypothesis aligns with the lack of correlation between tourists' ability to feel secure or excessively at ease in disaster-prone areas. The probability of a natural disaster threatening visitors and their families will decrease if they possess a sense of assurance, peace, good conditions, and optimism to a fair extent. This is because when individuals feel secure and self-assured, they are likely to adopt a positive attitude, which can lead to reduced perceived threat of potential dangers (Rasoolimanesh et al., 2023).

Then, the assessment of SA and SR generated positive findings; consequently, H10 was accepted. The acceptance of this hypothesis is directly related to the extent to which tourists perceive the safety of the area to be primarily influenced by the ease of accessing it by road. Their level of trust in managing disaster risks is strongly linked to the ease of accessing infrastructure and rescue routes. Thus, H10 can be rejected if visitors fail to react to risk in the presence of warning signs, difficult routes, or insufficient infrastructure.

Most tourists are assured that they can stay safe from environmental hazards once they are aware that the required infrastructure (roads and warning signs) is in place. Therefore, the findings of the study indicate that H11 is rejected. Researchers are also interested in the potential for tourists' adaptation to change during the rainy season and how this may affect their initial VRP. Environmental VRP are unaffected by perceptions of safety (Bird & Gísladóttir, 2020; Fountain & Cradock-Henry, 2020).

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The study has demonstrated that the indirect effects on H12, H13, and H14 have been rejected, showing that SA does not simultaneously receive and give influence. Table 4 demonstrates that PE has a general impact on SA (refer to H8); however, the significance of this effect is quite small (0.082). The findings indicate that PE with disasters can enhance visitors' capacity to adjust to challenging situations. This conclusion aligns with other studies indicating that individuals with PE exhibit a high level of comfort and may disregard potential risks (Bird & Gísladóttir, 2020).

Prior studies have demonstrated that an individual's RMK level impacts VRP in the tourism industry. The direct influence of risk awareness on SA has the highest value (0.476) when compared to other direct and indirect influences. Hypothesis 15 (H15) is accepted based on this value. This hypothesis proposes a significant correlation between awareness and SA, which refers to SA and the influence of RMK (Blešić et al., 2022).

The impact of SA on VRP yielded varied outcomes. The rejection of H16 and H18 suggests that while SA is significantly affected by RMK, VRP of tourism are not significantly influenced by the correlation between the two. The link between the impact of RMK and visitor attention remains unaffected by any variables other than SR. Only H17 is recognised because the relationship between RMK and SA does not have an impact on PR and ER.

The correlation between SA, PE, and RMK suggests that visitors may not recognise the signs of disaster risk in tourism locations. In fact, the psychological condition of individuals has a substantial role in their decision-making and the arrangement of their schedules (Blešić et al., 2022; Rasoolimanesh et al., 2023). Furthermore, the fact that visitors are aware of SR indicates that they frequently focus on external factors or the expectations of management when it comes to safety measures (Yang & Guo, 2023). However, suppose a dangerous tourist location only relies on warning signs and depends on external factors. In that case, it is necessary to enhance tourists' awareness of their vulnerabilities and the potential harm to the ecosystem.

CONCLUSION

This study investigated VRP in relation to tourism risks in Batu Tourism City using a geographical-psychological approach. As a result, 11 hypotheses (H1, H2, H3, H4, H5, H6, H7, H8, H10, H15, and H17) were accepted and seven hypotheses (H9, H11, H12, H13, H14, H16, and H18) were rejected. The accepted hypotheses consist of a positive relationship between PE and RMK on visitor tourism risk attention. At the same time, the rejected hypotheses did not prove a significant relationship between PE and SA to the attention of visitor tourism risk.

In general, the findings of this research add to the knowledge regarding VRP in Indonesian areas prone to the dangers of natural disasters. This study addressed the lack of research by integrating psychological process variables (attention, perception, memory, thinking, and language skills), ER (geomorphological approach and human-environmental interaction), and individual SA (personality traits and emotional control) to enhance the knowledge of the effects on VRP. Concerning the results of research that do not show significance between SA and VRP, there is a critical need for openness regarding tourist areas and providing educational information regarding risky tourism. For further research, it is necessary to give attention to the peak season with a large number of visitors, collect data during the rainy season, and incorporate financial risks to predict different results/influences.

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UNLOCKING ECOTOURISM'S POTENTIAL WITH EXPLORING THE NEXUS OF MOTIVATION, SATISFACTION, AND SUSTAINABLE LOYALTY IN BIOSPHERE RESERVED, PENANG HILL, PENANG, MALAYSIA ECOTOURISM: A TOURIST-CENTRIC PERSPECTIVE

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Abstract

Ecotourism holds immense potential for promoting sustainable development and conservation efforts, making it imperative to explore the underlying factors that drive Pull-external motivation factors and tourist loyalty within this context. Drawing upon a tourist-centric approach, this study investigates the mediating role of tourist satisfaction in the relationship between motivation and sustainable tourism loyalty. This study utilizes a quantitative research methodology to investigate the complex interplay of ecotourism dynamics within the Penang Hill area and its implications for promoting responsible travel and environmental conservation. Utilizing survey data collected from tourists visiting Biosphere Reserved, Penang Hill, statistical analyses, including PLS-SEM employed to analyze the interrelationships among motivation, satisfaction, and sustainable loyalty. Exploring the Pull external motivational factors, such as Nature appreciation, Cultural Heritage, and Recreational factors driving tourists to Biosphere Reserve in Penang Hill ecotourism sites and identifying the components that foster satisfaction, consequently increasing the likelihood of tourists expressing an intention to revisit this ecotourism destination. The findings of this study are expected to provide valuable insights into the mechanisms driving tourist behaviors in ecotourism settings, drawing upon UNESCO's MAB program, thus contributing to the development of effective management strategies for promoting sustainable tourism practices and enhancing visitor experiences at the Biosphere Reserved, Penang Hill ecotourism site. Moreover, the study's contributions extend to the broader discourse on sustainable tourism practices, emphasizing the importance of aligning tourism activities.

Keywords: Pull-external Factors, Motivation, Satisfaction, Sustainable Loyalty, Penang Hill, Ecotourism

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INTRODUCTION

Ecotourism is recognized for its potential to support sustainable development by fostering conservation efforts and promoting environmental awareness. The popularity of ecotourism began in the 1980s, emerging as a significant and innovative movement within the tourism industry (Grigg, 2016).

Penang Hill is considered an attractive place to visit for nature lovers (TheHabitatFoundation, 2018) and located in well-known natural and cultural destinations of northern Malaysia (Salman et al., 2021). Penang Hill is introduced as a significant tourist attraction on Penang Island (Gardner, 2011). This landmark was discovered in the year 1800 (Ruppert, 2017). Referring to Figure 1, Penang Hill is recognized as the newest biosphere reserve in Malaysia and the choice of the perfect fusion of nature, history, and heritage (Connolly, 2022). The Penang Hill Biosphere Reserve, a UNESCO-designated site under the Man and the Biosphere (MAB) program, represents an ideal setting to examine these dynamics (UNESCO, 2022). Understanding what motivates tourists to visit such destinations, how satisfied they are with their travel experiences, and what drives their loyalty can offer critical insights for sustainable tourism management. Given its growing popularity, ecotourism should undoubtedly be the future of tourism and travel. Experiencing nature is a key motivator for both international and domestic tourists worldwide. In tourism, motivation refers to a set of psychological desires that drive and shape behavior and activities (Pearce, 2013).

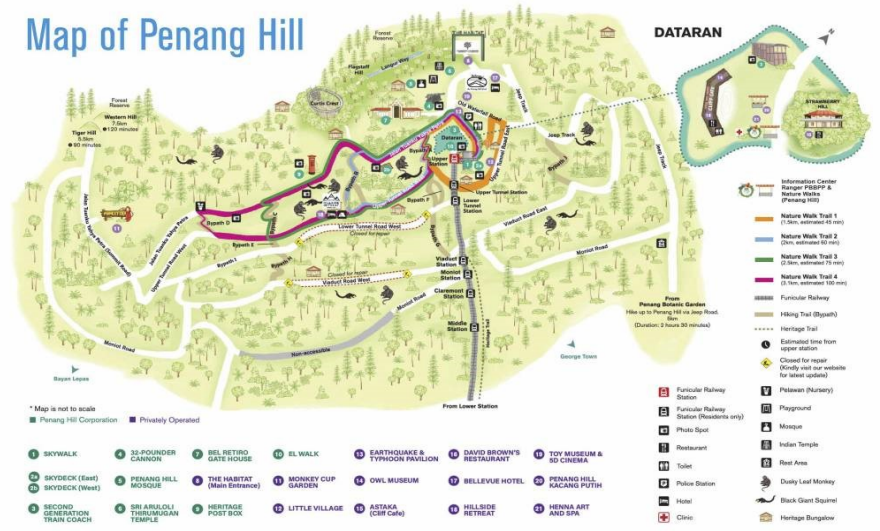


Figure 1 Map of Study Area
(The Biosphere Reserve Penang Hill Tourism Site)

This study aims to explore the nexus of motivation, satisfaction, and sustainable loyalty among tourists visiting the Penang Hill Biosphere Reserve. Specifically, it examines how external pull factors—such as nature appreciation, cultural heritage, and recreational opportunities—influence tourist satisfaction and their subsequent loyalty to the destination. Therefore, ecotourism activities require full consideration of nature and save environmental sustainability (Mukrimah et al., 2015). By focusing on the tourist perspective, this research seeks to contribute to the development of strategies that enhance visitor experiences while promoting sustainable tourism practices.

LITERATURE REVIEW

Ecotourism and Sustainable Development

Generally, ecotourism is defined as a form of tourism that integrates natural resources, rural lifestyles, culture, and local economic activities (Fennell, 2001). Ecotourism, as defined by the International Ecotourism Society (TIES), involves responsible travel to natural areas that conserve the environment and improve the well-being of local people. Sustainable development in ecotourism focuses on balancing environmental conservation with economic benefits and community involvement (TIES, 2015).

On the other hand, there is doubt that ecotourism can make tangible contributions to deliver benefits for the local communities besides conservation (Hunt et al., 2015). According to Riho and Brian (2021) discussions, ecotourism can revitalize the local community by having beneficial economic influences on local businesses and enterprises. Moreover, ecotourism can contribute to the preservation of the nature and environment by raising tourists' concerning environmental conservation (Font et al., 2003). the ecotourism goal is to conserve the existing resources, preserve the environment, bring economic benefits to the destination, and remain sustainable (Mendoza-Ramos & Prideaux, 2018). Ecotourism sites are required to carefully operate and plan their tourism activities, especially if they include local participation (Kiper, 2013). Ecotourism has its principles and those who participate in these activities should adopt some primary and essential notice as follows: respect nature and minimize impacts social, physical, behavioral, and psychological), provide direct financial benefits for both local and industry, cultural awareness, and deliver memorable experiences (Lew, 1998; TIES, 2015). It is important to determine how beneficial is ecotourism in the region socially, economically, and environmentally.

Pull-external Motivation in Ecotourism

Pull-external Factors and Tourist Satisfaction

By aligning ecotourism offerings with tourists' motivations, destinations can enhance visitor satisfaction, promote responsible behavior, and contribute to the

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conservation of natural and cultural resources (Suhartanto et al., 2020). According to previous scholars, tourism motivations are generally categorized into push and pull factors (Xu & Chan, 2016; Yuan & McDonald, 1990). In particular, push factors are stimulators that drive people to travel who are considered tourists, while pull factors expedite the choice of destination associated with its attributes (Uysal & Jurowski, 1994). Thus, motivations reflect the individual's intrinsic and extrinsic travel needs and wants (Dayour & Adongo, 2015). Therefore, tourist motivation in ecotourism can be driven by various factors, categorized into push and pull factors. Push factors are internal desires prompting a person to travel, while pull factors are external attributes of a destination that attract tourists. This study focuses on pull-external factors such as the natural environment, cultural heritage, and recreational activities.

Many individuals are motivated by the need for relaxation and escape from the stresses of everyday life (Smith, 1993). The recreational factor in ecotourism is a significant pull-external factor that attracts tourists to natural and ecologically sensitive areas (Dmitriyev et al., 2021). By capitalizing on recreational aspects such as nature-based activities, scenic beauty, adventure, health and wellness offerings, local cuisine, and shopping experience as motivation factors, ecotourism destinations can engage and satisfy the diverse interests and desires of tourists while promoting sustainable practices and environmental conservation (Chan & Saikim, 2021).

One of the primary external pull factors in ecotourism is the presence of natural attractions at the destination (Lin, 2019). These include unique landscapes, biodiversity hotspots, rare or endemic species, pristine beaches, waterfalls, caves, and other natural wonders (Abdullah et al., 2018) . The appeal of these natural attractions motivates individuals to visit ecotourism destinations to witness and experience the beauty and grandeur of the natural environment (Haukeland et al., 2010).

The cultural and heritage value of a destination can also serve as a significant pull factor in ecotourism (Kiper, 2013). The blend of natural beauty and cultural richness creates a unique and compelling appeal for tourists. This combination allows visitors to not only enjoy the natural environment but also engage with the local traditions, history, and customs, enriching their overall travel experience (Barna et al., 2011; Su et al., 2020). According to Khoshtaria and Chachava (2017) findings, protection of natural diversity and prospects of cultural, and heritage value in tourism and supports interests of local communities, in terms of ecotourism promotion creates a positive environment with new capabilities.

Consequently, the first hypothesis in this research is proposed as follows:

H1: Pull-external motivation factors have a direct effect on tourist satisfaction.

Pull-external Factors and Sustainable Tourist Loyalty

According to the Salleh-Mukri and Shuhaida (2021), UNESCO's Man and the Biosphere (MAB) Program is a global initiative designed to advance sustainable development and conserve natural and cultural resources within designated biosphere reserves. Ecotourism as a sub-sector of sustainable tourism (Sarhan et al., 2016) includes visiting the natural and cultural regions to obtain knowledge or discover environmental-friendly activities (Salman et al., 2022), understanding natural surroundings and landscape, such as flora and fauna, and cultural heritage to provide nature-based experience besides social-economic growth (Kiper, 2013). According to the existing scholars, ecotourism includes the main goals as follows: It should be nature-based, focus on learning, and based on the practices and values linked with environmental, cultural, and economic sustainability (Morgera & Razzaque, 2017; Trouwborst, 2009; Walter, 2013). On the other hand, the concern of environmental sustainability in ecotourism is a long-term maintenance process (Huang & Liu, 2017). Ecotourism operators are suggested to promote ecological facilities such as the green path to motivate tourists while they should consider tourists' convenience as well (Lin, 2019).

Sustainable loyalty refers to a tourist's intention to revisit a destination and recommend it to others, influenced by their satisfaction with previous experiences. In ecotourism, fostering sustainable loyalty is crucial for maintaining visitor numbers while ensuring that tourism practices do not compromise environmental and cultural resources (Carvache-Franco, Contreras-Moscol, et al., 2022). The pull-external motivation factors towards this kind of tourism destination in existing literature have been explained as the cultural and heritage identity of the place (Zhang & Walsh, 2021), nature beauty, and habitat, besides comfortable and convenient leisure services and facilities (Beh & Bruyere, 2007; Moscardo et al., 1996; Wang, 2004). Therefore, the second hypothesis was proposed to investigate this relationship:

H2: Pull-external motivation factors have a direct effect on tourist loyalty.

Tourist Satisfaction and Sustainable Tourist Loyalty

According to the existing literature, satisfied tourists are more likely to develop positive attitudes, emotions, and intentions toward the destination. When tourists' expectations are met or exceeded, they feel a sense of fulfillment and contentment, leading to a higher likelihood of repeat visits (Suhartanto et al., 2020). Chi et al. (2020) examined the relationship between tourist satisfaction and loyalty in the context of nature-based tourism and confirmed a positive association, highlighting those higher levels of satisfaction lead to increased

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loyalty intentions and behaviors. The findings from previous studies revealed that tourist satisfaction mediates the relationship between motivation and loyalty, suggesting that satisfaction acts as a crucial mechanism through which motivation factor influences loyalty (Hermawan et al., 2019). Understanding and enhancing tourist satisfaction is crucial for destination managers and tourism operators in ecotourism sites such as Biosphere Reserves in Penang Hill as it plays a vital role in fostering sustainable loyalty, attracting repeat visitors, and creating a positive reputation for the destination (Hermawan et al., 2019; Pham & Chen, 2015).

H3: Tourist satisfaction has a direct effect on tourist loyalty.

Mediating Role of Tourist Satisfaction

Tourist satisfaction is a key indicator of the quality of the visitor experience and a critical determinant of repeat visitation and positive word-of-mouth (Yoon & Uysal, 2005). When tourists have satisfying experiences that meet or exceed their expectations in terms of the natural surroundings, cultural immersion, recreational offerings, and opportunities for food and shopping, they tend to form a stronger emotional bond with the destination (Fenitra et al., 2022). This emotional attachment cultivates sustainable loyalty, instilling a desire to continue engaging with the destination like Penang Hill ecotourism over time (Carvache-Franco, Carvache-Franco, et al., 2022). On the other hand, tourists' perception of the environmental attributes and their satisfaction with the level of environmental protection and sustainability practices significantly impact their overall satisfaction (Zulvianti et al., 2022).

Therefore, the following hypothesis is proposed in this research to examine the indirect and mediating effects of tourist satisfaction between Pull-external motivation factors and tourist loyalty:

H4: Tourist satisfaction mediates the relationship between Pull-external motivation factors and tourist loyalty.

Underpinning Theory

Self-Determination Theory (SDT) is extensively used to examine factors that drive or hinder human behaviors (Ryan & Deci, 2017). SDT has been widely applied in various fields, including tourism and ecotourism, to understand tourists' motivations and satisfaction (Dodds et al., 2022). Self-Determination Theory (SDT) is chosen for the study of Penang Hill ecotourism due to its relevance to the ecotourism context, its emphasis on intrinsic motivation and psychological well-being, and its potential to offer valuable insights into tourists' motivation factors and their relationship with satisfaction and loyalty (Buzinde, 2020). Applying SDT can help researchers and destination managers understand

the underlying psychological processes and develop strategies to promote sustainable and satisfying ecotourism experiences at Penang Hill. Therefore, in the context of Penang Hill ecotourism, researchers can explore how tourists' satisfaction and engagement with the natural environment, cultural experiences, and sustainable practices contribute to their psychological well-being and intention to revisit (Vaghefi, 2019).

Based on the above literature and discussion, an initial framework is proposed (see Figure 1).

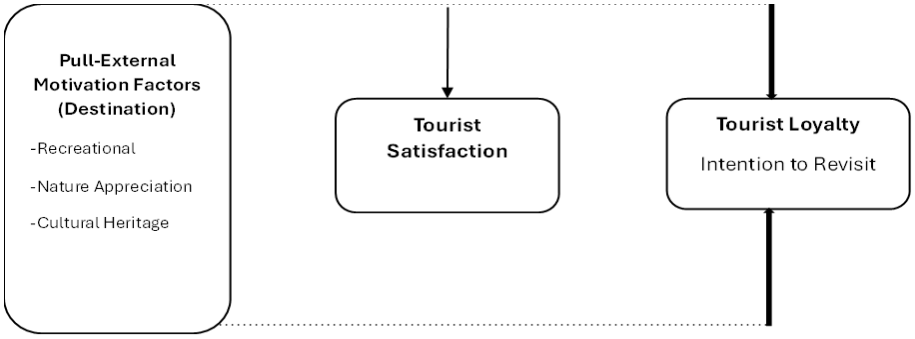


Figure 2: Research Framework

RESEARCH METHODOLOGY

Research Design and Data Collection

This study employs a quantitative research design using survey data collected from tourists visiting the Penang Hill Biosphere Reserve. The survey instrument includes measures of motivation, satisfaction, and loyalty, with items adapted from established scales in tourism research. In this study, a causal research design has been employed using a cross-sectional sample survey (Kazi & Khalid, 2012).

Data were collected from a sample of 505 tourists through a structured questionnaire administered on-site at various points within the Penang Hill Biosphere Reserve (Pallant, 2013; Westland, 2010). The questionnaire included sections on demographic information, pull-external motivation factors, satisfaction levels, and loyalty intentions, developed using a 7-point Likert scale, to achieve the research objectives.

Convenience sampling is employed in this study which is the most suggested technique in existing tourism literature which is not truly representative of the tourist population in Biosphere Reserve Penang Hill in general and in Habitat sites particularly (Preacher & Hayes, 2008; Sharma, 2017).

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ANALYSIS AND DISCUSSION

Data Analysis

As recommended by Hair et al. (2014), content validity was confirmed before testing the theory. To establish validity, the significance and magnitude of factor loadings were examined. Furthermore, the Average Variance Extracted (AVE) was calculated to ensure that the measurement variables adequately represented the related constructs. According to Pallant (2020), the reliability test assesses the degree to which a variable or item is reliable for hypotheses testing. As stated by Sekaran and Bougie (2016), it is crucial to evaluate the reliability of the research instrument to ensure consistent measurement across multiple research items. Therefore, to verify the reliability of the instrument items, Cronbach's alpha (α) was computed, ensuring a minimum value of 0.7. This measure allows us to assess the internal consistency of the items and determine their reliability (Fornell & Larcker, 1981).

Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to analyze the relationships among the variables. PLS-SEM is suitable for this study due to its ability to handle complex models and its robustness in exploratory research contexts.

Descriptive Statistics

This study examined 505 responses, utilizing frequency analysis to characterize the demographic profile of the participants and assess the reliability of the data, as detailed in **Table 1.** The demographic profile of the respondents indicated a diverse mix of ages, nationalities, and travel group compositions.

Table 1: Respondents' Demographic Profile

	Demographic	Frequency	Percentage
Gender	Male	255	50.5%
	Female	250	49.5%
	Prefer not to mention	0	0.0%
Age	19 years old and below	77	15.2%
	20-29 years old	171	33.9%
	30-39 years old	141	27.9%
	40-49 years old	72	14.3%
	50 years old and above	44	8.7%
Race	Malay	204	40.4%
	Chinese	124	24.6%
	Indian	100	19.8%
	Bumiputra	77	15.2%
Education Level	High school and below	109	21.6%
	Diploma/ Certificate	258	51.1%
	Bachelor’s degree	138	27.3%
	Postgraduate degree	0	0.0%

	Demographic	Frequency	Percentage
Occupation Sector	Academic/ Education	107	21.2%
	Business/ Enterprise/	90	17.8%
	Manufacture	140	27.7%
	Service/ Sales	168	33.3%
	Self-employed		
Visit Penang Hill	1 to 3 times	205	40.6%
Biosphere	3 to 5 times	191	37.8%
Reserved	More than 5 times	109	21.6%

Note: Total sample size is 505

ANALYSIS AND DISCUSSION

Testing Measurement Model

The measurement model was evaluated for reliability and validity. Composite reliability and Cronbach's alpha values exceeded the recommended thresholds, and convergent and discriminant validity were established (Hair et al., 2014; Henseler & Fassott, 2010). All the variables in this study were treated as reflective latent variables. SmartPLS Version 4.0 was used for both the measurement and structural model analysis. Additionally, the bootstrapping method with 1,000 resamples was employed to evaluate the significance of tourist satisfaction's mediating role between pull-external motivation factors and tourist loyalty (Streukens & Leroi-Werelds, 2016). Additionally, the current study calculated the effect size (f^2) to assess the magnitude of a predictor variable's impact on the dependent constructs. The f^2 result was derived from the variation in the R^2 value (Cohen, 1988).

The loadings for all reflective items, except four items from the Pull factor, three items from tourism satisfaction, and four items from tourist loyalty that were deleted exceeded the recommended value of 0.5. Composite reliability values (see **Table 2**), which exhibited the degree to which the items indicated the latent construct, ranged between 0.875 and 0.951 and exceeded the recommended value of 0.7. The average variance extracted was in the range of 0.504 to 0.724, which exceeded the recommended value of 0.5.

Discriminant validity was determined by comparing the correlations between variables and the square root of the AVE for that particular variable (Fornell & Larcker, 1981). **Table 3** presents the inter-construct correlations (below the diagonal) and the square roots of the average variance extracted (on the diagonal) of the constructs. This table shows that the square root of the average variance extracted for all factors appeared to be higher than their shared variances. This finding reaffirmed the discriminant validity of the model constructs.

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Table 2: Composite reliability values

Construct	Items	Loading	CR	AVE
Pull-external Factors (PF)	PF1	0.756	0.875	0.587
	PF2	0.845		
	PF3	0.662		
	PF4	0.876		
	PF5	0.665		
Tourism satisfaction	TS1	0.867	0.882	0.714
	TS2	0.836		
	TS3	0.832		
Tourism Loyalty	TL1	0.834	0.887	0.724
	TL2	0.883		
	TL3	0.835		

Table 3: inter-construct correlations

	Pull-external Factor	TS	TL
PF	0.766		
TS	0.604	0.845	
TL	0.653	0.562	0.851

Testing The Structural Model

According to Hair *et al.* (2017), the prime criteria for assessing the structural model are beta values, generated p-values (based on bootstrapping procedure with resample of 5000), the value of R^2 (coefficient of determination), the f^2 values (measure of the effect sizes) and the value of Q^2 (measure of the predictive relevance). The results of the structural model are displayed in Tables 3 and 4. The predictive accuracy (R^2) of the proposed framework was calculated utilizing the proportion of variance explained. The R^2 values for tourism satisfaction and tourism loyalty were 0.817 and 0.431, respectively (Table 5). By conducting the blindfolding test in PLS, the results affirm that the Q^2 values for tourism satisfaction and tourism loyalty were 0.814 and 0.420, respectively, which are greater than zero, indicating a satisfactory level of predictive relevance for the study's endogenous constructs.

The bootstrapping with 5,000 resamples was used to examine the significance of relationships within the proposed framework (Jalali et al., 2020). Table 4 summarizes the structural model generated by SmartPLS 4.0. As illustrated in Table 4, the main model only assesses the direct effect. Based on the findings, Pull-external factors (β=0.904, $p \leq 0.05$) and (β=0.793, $p \leq 0.05$) displayed a significant positive effect on tourism satisfaction and tourism loyalty.

Hence, H1, was supported. While the influence of tourism satisfaction (β=-0.154, p>0.05) on tourism loyalty is not significant. Thus, H4 was not supported. The indirect effect was determined by using the bootstrap approach, as recommended by Preacher and Hayes (2008). The result of the assessment of the mediating effect demonstrated that tourism satisfaction did not mediate the relation between the pull factor and tourism loyalty (β=-0.140, p ≤0.05). Hence, H3 was not supported.

Table 4: Assessment of Structural Model Results

Effect	Beta (β)	Direct (P value)	Indirect (P Value)
PF -> TS	0.904	0.000	-
PF -> TL	0.793	0.000	-
TS -> TL	-0.154	0.356	-
PF -> TS -> TL	0.140	-	0.356

Table 5: Results of R Square (R^2) Adjusted Values, and Predictive Relevance Based on Q^2

Construct	R Square (R^2)	Q^2
Tourism satisfaction	0.817	0.814
Tourism Loyalty	0.431	0.420

Implications for Management

The findings underscore the importance of managing and enhancing key pull factors to boost tourist satisfaction and loyalty. For Penang Hill Biosphere Reserve, this involves preserving natural attractions, promoting cultural heritage, and providing diverse recreational opportunities. The Penang Hill management and stakeholders should prioritize the conservation of its unique biodiversity, scenic landscapes, and pristine environments. This involves implementing robust environmental protection measures, such as controlling visitor numbers to prevent over-tourism, ensuring waste management systems are efficient, and promoting conservation education among visitors. Penang Hill can attract different tourist segments, including adventure seekers, families, and wellness tourists, thus boosting overall satisfaction and sustainable loyalty. Furthermore, creating engaging and informative content as an effective marketing and communication strategy that showcases natural beauty, cultural heritage, and recreational opportunities can entice potential visitors.

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CONCLUSION

This study highlights the importance of understanding the interplay between motivation, satisfaction, and sustainable loyalty in ecotourism settings. By focusing on the tourist-centric perspective, the research provides valuable insights for developing strategies that enhance visitor experiences while promoting sustainable tourism practices. These findings can inform the development and management of ecotourism activities and programs at Penang Hill, leading to more satisfying and meaningful experiences for visitors.

The study findings also suggest that managing Pull-external factors effectively can lead to higher satisfaction and loyalty among tourists, contributing to the sustainable development of the Penang Hill Biosphere Reserve. Future research could extend this framework to other ecotourism destinations to validate and refine the proposed model, ultimately supporting broader efforts to align tourism activities with conservation goals and sustainable development.

This paper outlines the potential of ecotourism in Biosphere Reserved in Penang Hill, providing a comprehensive understanding of tourist motivations, satisfaction, and loyalty. It offers practical insights for managing ecotourism destinations, contributing to the sustainable tourism discourse.

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LANDSCAPE VITALITY ASSESSMENT OF ASSOCIATED SPACE UNDER OVERPASS: A CASE STUDY OF CHONGQING, CHINA

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Abstract

Urbanization has improved traffic flow via overpasses, yet underpass spaces lag in landscape development, falling short of residents' expectations. This leads to reduced aesthetics, potential misuse, and underutilization of urban land. This study analyzed the landscape vitality of 21 underpass spaces in Chongqing's urban interchanges. Influencing factors were classified into natural, physical, and event environmental factors based on landscape perception theory, Alexander's pattern language, and environmental behavior theory. Vitality indicators were identified through literature review, behavioral observation, and focus group interviews. An evaluation system with five criteria was constructed using grey relational analysis and analytic hierarchy process: natural vitality (0.0824), locational vitality (0.2139), spatial vitality (0.2805), facility vitality (0.3386), and cultural vitality (0.0846). These criteria involve 19 indicators, with activity facility quantity having the highest weight (0.1489). Five underpass spaces were evaluated—Egongyan, Huanghuayuan, Sujiaba, Yanggongqiao, and Wulidian—and their landscape vitality ranked. Key areas for improvement include plant aesthetics, entrance accessibility, activity space suitability, noise control, facility quantity, space management, and cultural features. This study provides guidance for future urban underpass space optimization.

Keywords: Space under Overpass; Public Space; Landscape Perception Theory; Evaluation of Landscape Vitality

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INTRODUCTION

As China's *14th Five-Year Plan* has become effective (Xinhua News Agency, 2021), urban development priorities have shifted to enhancing existing assets, efficiently utilizing land, and long-term development of underground spaces. As a significant form of landscape, underpasses and their associated spaces are crucial for optimizing urban vitality. Chongqing, a mountainous city, has witnessed the construction of numerous overpasses, the number of which had reached 290 by 2023 (NetEase News, 2023). This has now created diverse overpass spaces (Figure 1).



Figure 1: Various Overpasses in the Main Urban Area of Chongqing
Source: The Paper News (2024) https://www.thepaper.cn/

Overpasses, while alleviating traffic congestion, often create the underutilized spaces that result in environmental neglect and poor management (Figure 2), which has negative effects on urban life and urban aesthetics (Yang H., 2021). In response, Chongqing's 2022 Action Plan has been published to promote ecological restoration and improvement, with the aim of enhancing public space utilization and improving the quality of life (Chongqing Municipal People's Government, 2022) (Figure 3). In this study, a model is developed to evaluate and revitalize these underpass spaces, with practical suggestions made.



Figure 2: The Space Under the Bridge is Disorderly and the Utilization Rate is Low
Source: Photographed by the author (2024)



Figure 3: The Space Under the Overpass is Transformed into a Graffiti Art Area and Sports Place
Source: People's Daily Online (2024) http://cq.people.com.cn/n2/2024/0522/c365401-40852083.html

From a theoretical perspective, an evaluation system is established in this study to enrich the research on underpass space and landscape vitality. Practically, it enhances the utilization of urban public spaces, improves the quality of life for residents, promotes public health, and supports socio-economic development. Through empirical analysis, vitality deficiencies are identified and strategies are developed for improving the utilization of underpass spaces in Chongqing.

LITERATURE REVIEW

Landscape Vitality Evaluation

Recent research has underscored the significant contribution of urban green infrastructure and public spaces to urban vitality, with ecological indices, mixed functionality, and efficient transportation identified as the key influencing factors for the vibrancy and functionality of urban areas (Niu et al., 2021; Wang et al., 2022; X. Zhang et al., 2022). At present, various advanced tools play an essential role in the evaluation of these factors, such as Geographic Information Systems (GIS) and spatial analysis now. They are applicable to assist the effort on precise urban planning and sustainable development (Miklós & Špinerová, 2019).

Space Under the Overpass

Underscoring a transformation of underpass areas into vibrant urban spaces, recent research has highlighted the role of public art in landscape enhancement and community engagement (Hassan A. Youssef, 2022; T. Liu et al., 2022). In the studies carried out in many cities like Tokyo and Kuala Lumpur, an investigation is conducted into cultural and aesthetic integration as part of urban planning (Qamaruz-Zaman et al., 2012; Sheng et al., 2018;). In some other studies, the synergy of public spaces with transportation and acoustics is examined for events (Bauer C. et al., 2015; Hauck Th. et al., 2011). In China, the relevant studies focus on the enhancement of human interaction (Kuang Hao, 2013) through plant configuration (Liu CH. et al., 2005; Qin ZC. et al., 2019),

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landscape design (Li Wei, 2015; Liang Jing, 2004), and space utilization (Yang Xin et al., 2020; Zhao Xueye, 2017).

However, there is often a lack of attention paid by the current studies to the unique challenges posed by mountainous urban environments. Although complex topography affects the practice of urban design and space utilization, there remain few models constructed to address these geographic and infrastructural complexities. Moreover, the research conducted in China relies heavily on qualitative analyses, which results in a lack of robust quantitative methods. Despite the recognition given to the importance of various tools like GIS and spatial analysis in urban planning, they are still applied inadequately to the utilization of underpass spaces in mountainous regions.

Related Theoretical Foundations

Environmental behavior research focuses mainly on the interrelationship between environment, human psychology, and behavior (Xu Feng & Shen Heyong, 2005). In this sense, people, environment, and behavior are considered the fundamental elements in landscape vitality evaluation. As the urban public activity space for the daily life and leisure of urban residents, the underpass space can be analyzed in the event mode and spatial mode to determine the influencing factors for the vitality of landscape in the urban underpass spaces.

Based on previous research, the factors affecting the landscape vitality of urban public spaces are typically analyzed from natural, physical, facility, cultural, and sensory perspectives. By interpreting a series of theories such as landscape perception, Alexander's pattern language, and environmental behavior, the influencing factors of landscape vitality in underpass spaces are categorized into natural environmental factors, physical environmental factors, and event environmental factors. They involve microclimate elements, vegetation elements, external spatial environment, internal spatial environment, personal cognitive characteristics, and socio-cultural characteristics.

RESEARCH METHODOLOGY

In this study, a field research is conducted through behavioral observation, focus group interviews, and grey statistical methods in seven underpass spaces distributed in the main urban area of Chongqing. With the use of survey data, the Analytic Hierarchy Process (AHP) is followed to determine the weight of each evaluation criterion. On this basis, a scientific and rigorous landscape vitality evaluation system is constructed.

The survey focuses on the areas within the Inner Ring Expressway built in Chongqing, initially covering 21 typical underpass spaces with the common characteristics of underpass spaces in the main urban area (Figure 4). The scope of survey was narrowed in line with the principles shown in Table 1 for the scientific selection of evaluation criteria and the better construction and

assessment of the evaluation system. There are seven overpasses selected for in-depth research, namely Yanggongqiao Interchange, Wulidian Interchange, Panlong Interchange, Niujiaotuo Interchange, Huanghuayuan Interchange, Sujiaba Interchange, and Egongyan Interchange.

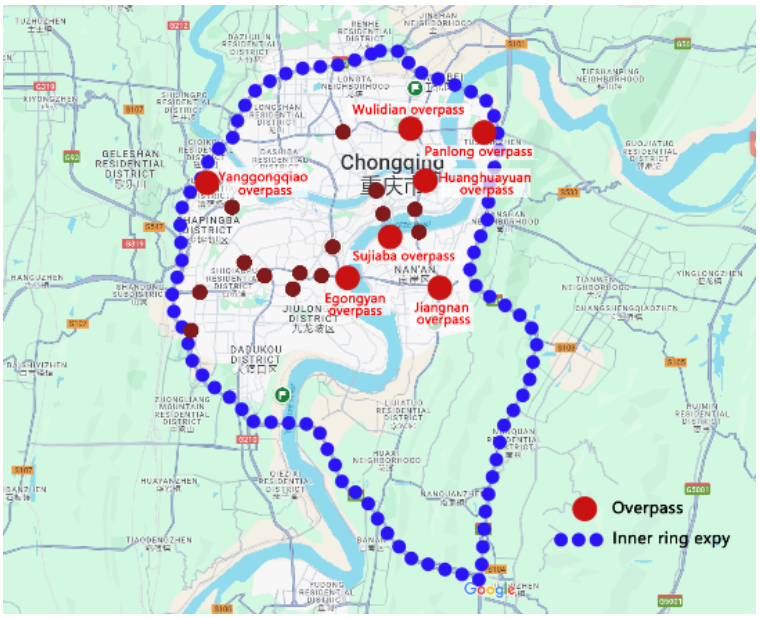


Figure 4: Distribution of Survey Respondents
Source: drawn by the author based on Google Maps

Table 1: The Selection Criteria

Selection Criteria	Description
Geographic Location	Situated in the urban core areas with high pedestrian traffic and well-developed surrounding functions.
Functional Use Type	Primarily designated for park and green space purposes, facilitating public activities.
Diversity	Selection includes overpasses with varied locations, sizes, and construction dates to enhance the generalizability of the study.

Determination and Optimization of Factors and Indicators

A literature review was conducted on the Web of Science platform using the following keywords: 'landscape vitality assessment,' 'under overpass space landscape evaluation,' and 'overpass landscape assessment.' Then, an analysis was conducted to reveal that scholars have focused on five major factors affecting the evaluation of landscape vitality, which are natural, locational, spatial, facility, and cultural elements (L. Liu et al., 2023; Wang et al., 2022b; F. Zhang et al., 2022).

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The environmental indicators for urban underpass spaces were initially screened through a literature review. Subsequently, optimization and validation were performed through behavioral observation and field survey (Figure 5). Through frequency analysis, the number of relevant indicators was reduced from 57 to 42. Finally, optimization was achieved via focus group discussions, each of which consists of one moderator and four participants. Thus, the number of indicators was further reduced to 25, thus ensuring scientific rigor and specificity.

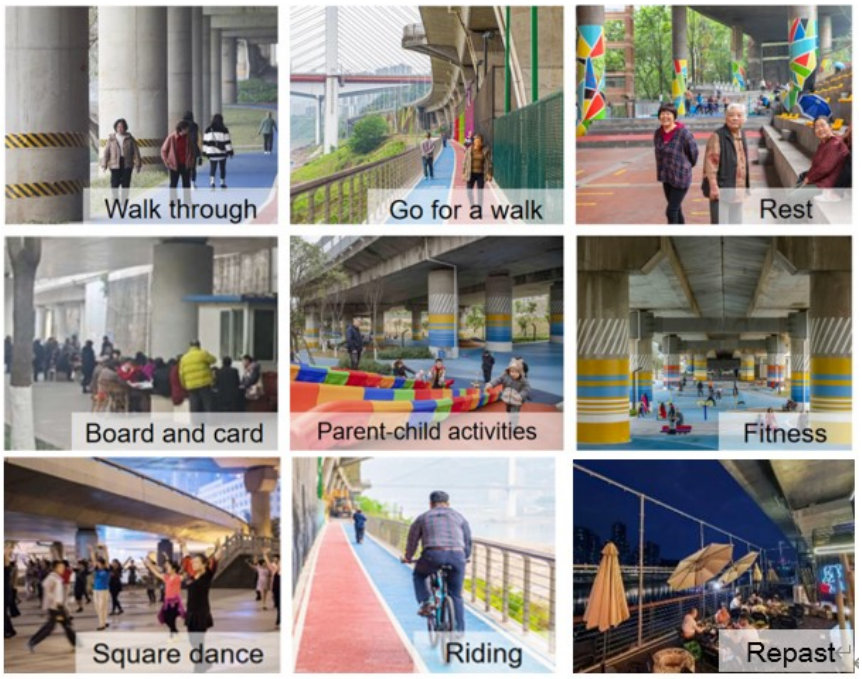


Figure 5: Activity Types in the Attached Space Under the Overpass
Source: Photographed by the author (2024)

The grey statistical method was adopted to quantify the importance of indicators, which minimizes the compromises caused by differing opinions and prevents the influence of outliers. Thus, the scientific integrity of weight calculations is ensured (Zhao Guodong, 2020). This method was then applied to identify the factors affecting the vitality of underpass spaces. Initially, the indicators were listed in a survey form. A total of 30 postgraduate students used a Likert scale of 1-7 to rate each indicator based on their understanding and perception, with the importance levels divided into high, medium, and low grey classes. With grey relational grade functions constructed for each class, decision vectors were calculated for each indicator.

For calculation, $f_k\ (ij)$ represents the whitening function value of the j-th evaluation indicator with importance level i, where k is the number of grey classes (k=1, 2, 3); d_{ij} indicates the score for the importance level i of the j-th evaluation indicator. The formulas used to calculate $f_k\ (ij)$ for high, medium, and low are expressed as Equations (1), (2), and (3), respectively. In these equations, i ranges from 1 to 7 and j ranges from 1 to 25 (Figure 6).

High
$k=1$

$$f_1(ij)=\begin{cases}1 & d_{ij}\geq 7\\ \frac{d_{ij}-4}{7-4} & 4<d_{ij}<7\\ 0 & d_{ij}\leq 4\end{cases}$$

Medium
$k=2$

$$f_2(ij)=\begin{cases}0 & d_{ij}\leq 1\\ \frac{d_{ij}-1}{4-1} & 1<d_{ij}<4\\ 1 & d_{ij}=4\\ \frac{7-d_{ij}}{7-4} & 4<d_{ij}<7\\ 0 & d_{ij}\geq 7\end{cases}$$

Low
$k=3$

$$f_3(ij)=\begin{cases}0 & d_{ij}\geq 4\\ \frac{4-d_{ij}}{4-1} & 1\lhd d_{ij}\lhd 4\\ 1 & d_{ij}\leq 1\end{cases}$$

Figure 6: Construct the whitening function

In the grey class decision-making model, the decision coefficient $n_k(j) = n(ij)f_k(ij)$, where $n_k(j)$ represents the decision coefficient of the j-th factor within the k-th grey class; $n(ij)$ denotes the number of experts evaluating the importance level i of the j-th factor. Comprised of the grey class decision coefficients $\{n_3(j), n_2(j), n_1(j)\}$, the decision vector of each indicator represents the importance levels "Low," "Medium," and "High," respectively. The selection of indicators is based on the highest coefficient in the decision vector, with only those deemed "High" retained, and those rated "Medium" or "Low" discarded.

Evaluation of Landscape Vitality of Attached Space Under Overpass

In the study areas, the behaviors of respondents within the observation zones were monitored. Additionally, surveys and interviews were conducted in those public spaces with a higher level of foot traffic.

Under the established evaluation system, the Likert five-point scale ranging from '1' (very poor) to '5' (very good) was adopted to rate the evaluation factors. Surveys were conducted from March to May, on both weekdays and weekends, from 8:00 AM to 8:00 PM. Suitable weather conditions were chosen to avoid the adverse effects on crowd activities. Out of 524 collected questionnaires, 517 were valid, which means a validity rate of 98% with a Cronbach's alpha of 0.884.

To score the vitality of the landscape under each overpass, the weighted scores of each indicator from user ratings were summed. A higher composite score indicates a more significant contribution to landscape vitality. The formula is presented as follows:

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$$\mathbf{S} = \sum_{i=1}^{n} C_i T_i$$

In the formula, $\mathbf{S}$= Comprehensive score of landscape vitality of attached space under urban overpass;

C_i= The composite weight of each landscape vitality evaluation index;

T_i= The average scores corresponding to each index;

$C_i T_i$= Evaluation score for each indicator.

Figure 7: Calculation Formula

ANALYSIS AND DISCUSSION

Data analysis and interpretation of evaluation index

Subsequent to further optimization and selection (Table 2), a comprehensive evaluation system was established for the vitality of underground spaces created by urban elevated roads. This involves five criterion levels (natural vitality, locational vitality, spatial vitality, facility vitality, and cultural vitality) and 19 indicator levels (microclimatic comfort, plant coverage, and plant aesthetics, etc.) (Figure 8). Experts were also invited to calculate and rank the importance of the existing indicators (Table 3). With the relative importance of each indicator comparatively scored, the results were analyzed to validate the rationality and feasibility of the proposed evaluation system.

Table 2: The Result of Screening Indicators for Assessing the Vibrant Landscape of Urban Overpass Subordinate Space

Dimension	No.	Index	Average value	Variable coefficient
Nature	1	Microclimatic comfort	5.53	0.13
	2	Plant coverage	5.57	0.16
	3	Plant aesthetics	5.57	0.13
Location	4	Ease of access	6.33	0.10
	5	Surrounding land use type	6.37	0.12
	6	Surrounding population density	5.93	0.17
Space	7	Spatial scale suitability	6.33	0.12
	8	Amount of active space	5.87	0.14
	9	Terrain design and processing	5.57	0.14
	10	Walking system	5.97	0.15
	11	Noise interference	5.67	0.12
	12	Site protection and safety	5.97	0.11
Facility	13	Number of open space facilities	6.10	0.12
	14	Number of active facilities	5.80	0.15
	15	Convenient service facilities	5.77	0.10
	16	Sketch construction aesthetics	5.63	0.13
Culture	17	Space management and maintenance	5.73	0.15
	18	Historical culture and urban characteristics	5.53	0.15
	19	Activity variety richness	5.67	0.17

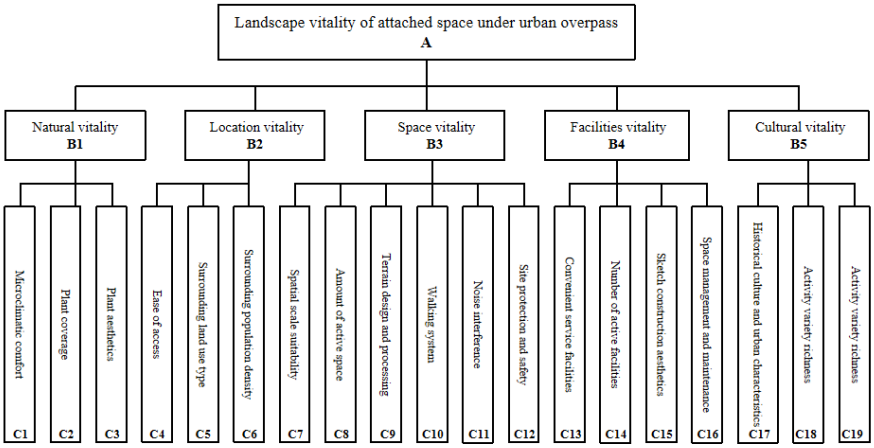


Figure 8: Construction of Evaluation Index System of Landscape Vitality of Attached Space Under Urban Overpass
Source: self-drawn by the author.

Table 3: Evaluation Weight Result

Criterion layer	Criterion weight	Index level	Index weight	Resultant weight	No.
Nature	0.0824	Microclimatic comfort	0.2395	0.0197	16
		Plant coverage	0.1373	0.0113	19
		Plant aesthetics	0.6232	0.0514	6
Location	0.2139	Ease of access	0.5889	0.1260	2
		Surrounding land use type	0.1593	0.0341	13
		Surrounding population density	0.2519	0.0539	7
Space	0.2805	Spatial scale suitability	0.1272	0.0357	12
		Amount of active space	0.3357	0.0942	3
		Terrain design and processing	0.1671	0.0469	10
		Walking system	0.2111	0.0592	6
		Noise interference	0.0619	0.0174	17
		Site protection and safety	0.0971	0.0272	14
Facility	0.3386	Number of open space facilities	0.2129	0.0721	5
		Number of active facilities	0.4425	0.1498	1
		Convenient service facilities	0.1069	0.0362	11
		Sketch construction aesthetics	0.2378	0.0805	4
Culture	0.0846	Space management and maintenance	0.1865	0.0158	18
		Historical culture and urban characteristics	0.2341	0.0198	15
		Activity variety richness	0.5794	0.0490	9

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Descriptive Analysis

The survey included 284 men and 233 women, with most participants aged 30-39. Notably, there were fewer elderly participants as the survey sites were near the light rail stations. However, Yanggongqiao and Huanghuayuan attracted many participants aged over 50 for engagement in group activities.

The respondents were comprised mainly of office workers, followed by retirees, with incomes ranging from 2000 to 5000 RMB. Outdoor activities were preferred during warmer months, especially in riverside areas like Sujiaba and Huanghuayuan, with more comfort provided by abundant vegetation. Weekends were the most popular visiting times, while the morning and afternoon were the peak periods. Most participants engaged in activities for 1-2 hours. The majority of them visited these areas once daily for various activities such as resting, walking, group activities, family outings, exercise, and sightseeing.

Overall Vitality Assessment Comparison and Analysis

According to Table 4, the Egongyan underpass scores the highest in overall landscape vitality. It is followed by Huanghuayuan, Sujiaba, Yanggongqiao, and Wulidian in descending order.

From a natural perspective (Table 5), Egongyan scores the highest due to its superiority in plant coverage, comfort, and aesthetic appeal. This indicates user satisfaction with the plant design. Sujiaba and Yanggongqiao score the lowest. Yanggongqiao is disadvantaged by poor roadside greenery and a complex environment difficult to maintain. Sujiaba hampers user activities due to dense, unruly vegetation. Wulidian is more appreciated for plantings, while Huanghuayuan performs moderately.

Table 4: The Score Data of Landscape Vitality Evaluation of the Research Object

Criterion layer	Egongyan	Wulidian	Sujiaba	Huanghuayuan	Yanggongqiao
Natural Activity	0.3067	0.2734	0.2433	0.2670	0.2571
Location Activity	0.6492	0.6568	0.6934	0.7387	0.5978
Space Activity	0.8809	0.6666	0.6743	0.6716	0.7469
Facility Activity	1.1052	0.5712	0.8212	0.6848	0.5215
Cultural Activity	0.3010	0.2242	0.2320	0.2870	0.2713
Global Scoring	3.2430	2.3923	2.6442	2.6490	2.3946

Table 5: Natural Vitality Level Index Score

Evaluation Object	Type	Microclimatic comfort	Plant coverage	Plant aesthetics	Natural vitality
Egongyan	Average	3.15	4.06	3.86	0.3067
	Composite	0.0622	0.0460	0.1985	
Wulidian	Average	3.12	3.62	3.32	0.2734
	Composite	0.0616	0.0410	0.1708	
Sujiaba	Average	3.14	3.15	2.83	0.2433
	Composite	0.0620	0.0357	0.1456	
Huanghua yuan	Average	3.14	3.72	3.16	0.2670
	Composite	0.0620	0.0421	0.1629	
Yanggong qiao	Average	3.16	3.90	2.93	0.2571
	Composite	0.0624	0.0441	0.1506	

Regarding location, Sujiaba and Huanghuayuan score significantly higher as their accessibility is improved by the sharing of entrances with light rail stations. Egongyan scores high for surrounding land use but low for entrance setup, making it hard to find for non-residents. There is no significant difference in population density score across all five sites. (Table 6)

Table 6: Location Vitality Level Index Score

Evaluation Object	Type	Ease of Access	Surrounding Land Use Type	Surrounding Population Density	Location Activity
Egongyan	Average	2.08	5	4	0.6492
	Composite	0.2631	0.1705	0.2156	
Wulidian	Average	3.11	3	3	0.6568
	Composite	0.3928	0.1023	0.1617	
Sujiaba	Average	2.98	3	4	0.6934
	Composite	0.3755	0.1023	0.2156	
Huanghua yuan	Average	3.06	4	4	0.7387
	Composite	0.3867	0.1364	0.2156	
Yanggong qiao	Average	1.95	4	4	0.5978
	Composite	0.2458	0.1364	0.2156	

According to Table 7, Egongyan scores highest due to its clear functional zoning and excellence in management and maintenance. Sujiaba and Huanghuayuan follow it closely, providing diverse and well-defined activity areas. Yanggongqiao, despite its large activity area, is monotonous and noisy. Despite its ample space, Wulidian is greened mainly with limited activity areas.

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Table 7: Space Vitality Level Index Score

Evaluation Object	Type	Spatial scale suitability	Amount of active space	Terrain design and processing	Walking system	Noise interference	Site protection and safety	Space vitality
Egongyan	Average	3.29	3	3.24	3.09	3.26	3.24	0.8809
	Composite	0.1176	0.2826	0.1522	0.1834	0.0568	0.0883	
Wulidian	Average	3.11	1	3.09	3.05	3.03	3	0.6666
	Composite	0.1113	0.0942	0.1453	0.1811	0.0529	0.0819	
Sujiaba	Average	3.20	1	3.02	3.05	3.36	3.08	0.6743
	Composite	0.1145	0.0942	0.1421	0.1811	0.0585	0.0840	
Huanghua yuan	Average	3.22	1	2.99	3.03	3.23	3.14	0.6716
	Composite	0.1152	0.0942	0.1402	0.1799	0.0563	0.0856	
Yanggong qiao	Average	2.83	2	3	3.09	2.93	3.21	0.7469
	Composite	0.1011	0.1884	0.1407	0.1782	0.1510	0.0875	

Egongyan scores the highest at 1.1052 due to its abundance of rest facilities, convenience amenities, and culturally themed structures. Reflecting the traditional customs in Chongqing, this attracts visitors for rest and interaction. Also, many tourists are drawn to its wartime-themed buildings and exhibits. Sujiaba and Huanghuayuan follow it. Sujiaba offers sports and fitness facilities for daily activities, while Huanghuayuan scores high in aesthetic appeal. (Table 8)

Table 8: Facility Vitality Level Index Score

Evaluation Object	Type	Number of open space facilities	Number of active facilities	Convenient service facilities	Sketch construction aesthetics	Facility Activity
Egongyan	Average	4	3	3	3.21	1.1052
	Composite	0.2884	0.4494	0.1086	0.2589	
Wulidian	Average	1	1	3	2.99	0.5712
	Composite	0.0721	0.1498	0.1086	0.2407	
Sujiaba	Average	1	3	2	2.82	0.8212
	Composite	0.0721	0.4494	0.0724	0.2273	
Huanghua yuan	Average	3	1	2	3.05	0.6848
	Composite	0.2163	0.1498	0.0724	0.2463	
Yanggong qiao	Average	1	1	2	2.82	0.5215
	Composite	0.0721	0.1498	0.0724	0.2272	

Table 9: Cultural Vitality Level Index Score

Evaluation Object	Type	Space management and maintenance	Historical culture and urban characteristics	Activity variety richness	Cultural Activity
Egongyan	Average	4.02	3.93	3.25	0.3010
	Composite	0.0637	0.0778	0.1595	
Wulidian	Average	3.29	3.28	2.18	0.2242
	Composite	0.0520	0.0650	0.1071	
Sujiaba	Average	3.14	3.23	2.41	0.230

Evaluation Object	Type	Space management and maintenance	Historical culture and urban characteristics	Activity variety richness	Cultural Activity
	Composite	0.0497	0.0641	0.1182	
Huanghuayuan	Average	3.80	3.69	3.13	0.2870
	Composite	0.0601	0.0731	0.1538	
Yanggongqiao	Average	3.74	3.19	3.03	0.2713
	Composite	0.0591	0.0633	0.1489	

Culturally, Egongyan ranks the highest, followed by Huanghuayuan, Yanggongqiao, Sujiaba, and Wulidian. In the top three sites, cultural themes are integrated. Egongyan is the most prominent, but the other two lack cultural and regional elements. The top three sites are excellent in management and activity diversity. Notably, Sujiaba scores significantly lower in these aspects, requiring more attention. (Table 9)

In this study, the space in Egongyan showed a greater natural vitality due to excellent plant coverage and aesthetic design. This highlights the importance of well-designed natural environments. In contrast, Yanggongqiao and Sujiaba perform poorly in organized vegetation, affecting aesthetics and functionality. Sujiaba and Huanghuayuan, near light rail services, have a higher level of locational vitality due to enhanced accessibility. This is distinct from Egongyan with its inadequate entryway design. Egongyan also excels in facility and cultural vitality for providing extensive amenities and integrating the cultural themes reflective of Chongqing's heritage, which highlights the importance of strategic planning and investment in underpass areas for vibrant, functional, and culturally enriched urban spaces.

CONCLUSION

Under-overpass spaces can improve natural, locational, spatial, facility, and cultural vitality. Beneficial in creating visually appealing environments, high-scoring spaces excel in plant aesthetics, activity space suitability, rest facilities, small structure aesthetics, and urban cultural reflection. In contrast, low-scoring spaces are characterized by poor plant aesthetics, inadequate entrance accessibility, insufficient activity spaces, noise interference, and a lack of facilities. Poor management and maintenance, combined with an absence of urban and cultural elements, lead to underutilized environments. For better user experiences and functionality, it is necessary to enhance these aspects.

In this study, strategies are proposed to enhance the vitality of underpass space based on indicator weights, field surveys, and site evaluations. Also, it is proposed to improve natural vitality with vertical greening and suitable plants, optimize the entrances and integrate underpass spaces into the urban framework. Spatial vitality can be enhanced by improving utilization, introducing

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diverse functional areas, and improving comfort. Facility vitality can be enhanced by adding seating, lighting, amenities, and small structures. Cultural vitality can be enhanced by improving management, increasing resident participation, incorporating historical elements, adding art installations, and introducing commercial operations.

LIMITATIONS AND FUTURE PROSPECTS

There is a necessity to improve the evaluation criteria developed for landscape vitality in urban underpass spaces. The initial criteria are subjective and biased, despite expert input. In the future, these should be refined using more scientific methods and diverse underpass types should be included for broader applicability. As the optimization strategies proposed in this study are not comprehensive, multidisciplinary theories should be applied to develop more detailed and applicable strategies.

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SMALL AND MEDIUM-SIZED ACCOMMODATION BUSINESSES' REACTION TOWARD GOVERNMENT-INITIATED SUPPORT PROGRAMMES

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Abstract

Small and medium-sized enterprises are the heartbeat of many nations, especially developing countries. Many governments view this type of business enterprise as playing a significant role in a country's pursuit of economic development. It is no wonder governments, through their agencies, instil various support programmes to ensure the survival and growth of these enterprises. The question remains, though, how effective are the support programmes? This study examined the reaction of Small and medium-sized accommodation businesses that contribute to the tourism industry, towards government support programmes. In-depth interviews were conducted with sixteen SMAB respondents on Perhentian Island, a famous island destination in Malaysia. The research revealed that although most SMABs were aware of support programmes, their involvement varied. Bureaucratic issues, complicated fund application processes, and lengthy procedures are some of the challenges identified. Additionally, the challenges were exacerbated by government officers who lacked adequate skills, had limited knowledge of SMAB operations, and were not up to date on the current conditions facing SMABs. Therefore, recommendations from the two actors were provided to enhance the implementation of the support programme.

Keywords: Support programmes, Island destination, Small and Medium-sized Accommodation Businesses, Qualitative

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INTRODUCTION

In the context of small and medium-sized enterprises (SMEs) development, there are two key actors involved: those that require support (SMEs) and those that provide the support (government and other private organisations) (Kahveci, 2023). SMEs frequently require support programmes (SPs) and have their expectations (Sambajee & Dhomun, 2015). Fu et al. (2019) have reported an increase in the role of SMEs in supplying tourism services, creating jobs, and contributing to the general economy (Sobaih et al., 2021); however, the research on SMEs to date has been limited, and it is crucial to understand the problems that SMTEs are facing to be able to equip them with the necessary skills and qualifications.

Incidentally, the extensive demand for tourism accommodation stimulated the emergence of various Small and Medium Accommodation Businesses (SMABs) establishments (Sobaih et al., 2021). The accommodation sector is a crucial component in the tourism supply chain (Dimitriadou et al., 2023), and it is considered a dominant sub-sector within the tourism economy. In Malaysia, SMABs are considered accommodations with a two-star rating and capacity below 100 rooms, actively managed by the owner or managers (Hassanli & Ashwell, 2020). Furthermore, SMABs are capital-intensive firms, implying a relatively sizeable minimum survival scale compared to other service firms (Petti et al., 2017; Hassanli & Ashwell, 2020). Hence, this idea has given rise to numerous governmental policies aimed at enhancing and supporting the survival and growth of SMABs through SP's implementation.

There are two categories of SP: financial and non-financial support provided by government agencies to support SMEs (Burhan et al., 2021; Park et al., 2020). Previous research (Park et al., 2020; Chadwick & Raver, 2020) reported that SMEs' attitudes might influence the SP's effectiveness. In this context, SMABs' attitude refers to the owner's attitude, which is derived from the positive or negative evaluations vis-à-vis the SP implemented by the government. This paper focuses on the SPs provided by the government and how SMABs react to receiving those SPs on Perhentian Island, a famous Malaysian island destination.

LITERATURE REVIEW

Support Programmes (SPs)

Recognising the importance of SMEs, the government has implemented various support programmes that provide a conducive business environment for SMEs to operate efficiently (Burhan et al., 2021; Park et al., 2020; Zulkefli et al., 2021). Caliendo et al. (2020) reported that support programmes are crucial in unlocking economic growth in developing countries, especially regarding SMEs' performance. Hoang (2016) identified a positive relationship between support

programmes and SMEs' business performance. Therefore, support programmes are critical in reinforcing the SMEs to contribute more effectively to the nation's economy (Amir et al., 2024).

Support programmes for SMEs can be principally categorised into two types: financial and non-financial support. There are two categories of support programmes, financial and non-financial, which are part of the effort geared towards stable and productive SMEs (Zulkefli et al., 2022). Financial support refers to financial provisions for starting new businesses, which are also known as start-up loans. Formal financial resources can be provided by commercial banks, investment banks, savings and loan associations, and the government, together with support from donor agencies (Bakhtiari et al., 2020; Xiang & Worthington, 2017; Zulkefli et al., 2022). However, financial access remains the most significant obstacle SMEs face (Xiang & Worthington, 2017; Petti et al., 2017). Meanwhile, non-financial support encompasses non-monetary values, such as human resources, marketing, consultancy, and infrastructure programmes (Sambajee & Dhomun, 2015).

Many studies indicate that most SMEs in developing countries encounter challenges in receiving support programmes. Empirical research has demonstrated that government services frequently involve lengthy and complex procedures (Zulkefli et al., 2021). This predicament necessitates SMEs to obtain specific knowledge before applying for the SP (Caliendo et al., 2020; Sambajee & Dhomun, 2015). The inefficiencies of the support programmes are exacerbated by the government's inadequate skills and knowledge in accommodating the needs of SMEs (Yusoff *et al.,* 2014). Obeng and Blundel (2015) note that most SMEs reported failing to obtain adequate guidance and information due to the hostility and uncooperativeness of government agencies (Obeng & Blundel, 2015). Consequently, these unpleasant experiences derived from the complicated process and procedure influence support programmes (Sambajee & Dhomun, 2015). However, all the benefits or predicaments mentioned above would not be achieved or foreseen if SME operators were unaware of such programmes. Hereby, awareness is the knowledge of an object's existence, along with a specific understanding of its functions and effects.

SMABs' Reaction

Reactions are mental processes that determine an individual's actual and potential responses in the social world. Furthermore, prior research has also shown that SMEs' reactions during the process are an important factor in how businesses respond to government policies and programmes (Razumovskaia et al., 2020; Obeng & Blundel, 2015; Najib et al., 2021). Actual and potential responses are usually directed towards some entirely and are described as a mindset judgment of a person towards a value. SMEs' reactions are a crucial factor in assessing the

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effectiveness of government policies and programmes (Crick & Lindsay, 2015; Obeng & Blundel, 2015; Najib et al., 2021). According to several studies, there are two types of reactions towards an object (policies and programmes), namely negative and positive responders (Pitlik & Kouba, 2015).

First, positive reactions refer to those with a positive attitude toward policies and services, as well as greater access to government agencies. When firms perceive government institutions, they have positive reactions towards government implementation, which helps minimise compliance and generate a high level of cooperation (Najib et al., 2021; Obeng & Blundel, 2015). Obeng and Blundel (2015) found that SMEs receiving more support from the government had higher satisfaction with government services.

Second, there are negative reactions of SMEs to the government policies and programmes provided. Past studies show that SMEs are unaware of the availability of government programmes implemented in their businesses due to their being unclear about the government procedures and processes involved in applying these programmes (Sambajee & Dhomun, 2015; Oduro, 2019; Razumovskaia et al., 2020).

RESEARCH METHODOLOGY

Malaysia contains 13 states and a federal territory. The study focused on Perhentian Island, a premier island destination in Terengganu, on the east coast of Peninsular Malaysia. The federal government gazetted Perhentian Island as a Marine Park Area in 1994 under the Malaysian Fisheries Act 985 (amended 1993). This act was enacted to conserve and protect the island's marine flora and fauna from being damaged by fishing and other human activities. Figure 2 illustrates the Perhentian Archipelago, which comprises two main islands: *Perhentian Kecil* (smaller island) and *Perhentian Besar* (larger island), which covers 1,392.1 hectares (Nasir et al., 2017). Most tourism-related businesses on Perhentian Island are owned and operated by small to medium-sized enterprises (SMEs). There were 47 SMABs in 2016 out of the many SMEs in the Besut District Council (2017).

The researchers reviewed policy documents deemed critical in advocating for the growth and development of SMABs on Perhentian Island. Five policy documents were reviewed and spread from the federal to the local government levels. They were;

1) The Strategic Review of Malaysia's Tourism Industry Policy 2013.
2) The National Ecotourism Policy 2016-2025.
3) The East Coast Economic Region Master Plan 2008-2020.
4) The Terengganu Structure Plan 2006-2020.
5) The Special Area Plan Kuala Besut 2009-2016

Table 1: Types of support programs implemented.

Support programmes	**Federal level**	**State level**	**Local level**
Funding	1. Funding support and access to micro-credit facilities for local entrepreneurs to upgrade their resorts, such as soft loan schemes. 2. Microcredit/revolving fund for local operators to upgrade their existing septic tank chalets, restaurants, and passenger boats.	1. Providing tourism Grants for tourism operators from the budget of the state's annual event	Not applicable
Human resources	1. Encourage more tie-ups between hotels/resorts on tourism islands and training institutions. 2. Training programmes engaged by the tourism NGOs 3. Providing training for resort operators, boat operators, boatmen, and jetty personnel 4. Encouragement of local operators' participation in training programmes	Not applicable	1. Development of entrepreneurship and hospitality training centre Management, finance, and product marketing training, accommodation management training, Hospitality training
Marketing	1. Use appropriate and innovative promotional tools to reach out to niche markets. 2. Offer customised tourist experiences to niche markets rather than a generic experience. 3. Launch an integrated marketing and promotion between stakeholders, industry players, and the local community in packaging, information, etc. 4. Position *Kampung Raja-Besut-Perhentian*	1. Annual Event Tourism: Visit Terengganu 2. Promotion in the portal Tourism Malaysia and Tourism Terengganu	1. Multi-Channel Promotion: 2. Annual tourism calendar for the district, state and key players (hotels, homestays, etc.) 3. Tourism packages: Marine tourism packages. 4. Annual Activity Calendar: Riverine and sea sport

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Support programmes	**Federal level**	**State level**	**Local level**
	Island-Jerteh ecotourism cluster is a "must-visit destination" that combines coastal, nature, and cultural elements. 5. Promoting Perhentian Island as the main tourist venue		
Consultancy	1. Consultancy services provided to upgrade their businesses, loans and applications for the star rating	Not applicable	Not applicable
Infrastructure	1. Improve the Design of tourist jetties to International standards in terms of comfort, aesthetics, and safety. 2. Improve the role of mainland jetties as staging/departure points to the island by providing complete facilities during the transit. 3. Upgrade basic infrastructures and utilities 4. Careful consideration of water supply, electricity, and waste disposal facilities 5. Improve the traffic system, parking facilities, and pedestrian walkways within the jetty area 6. Improve tourism facilities	Not applicable	1. Efficient signage system 2. Extension of Tourist Information Centre operational hours 3. Direct public transportation route to the *Rancangan Kawasan Khas, i.e.,* Special Area Plan. 4. Extension of taxi service time to 9.00 p.m 5. Boat services operate on time and according to the schedule 6. Centralised car park specifically for visitors to Perhentian Island

Numbers 1–3 were policy documents inscribed by the federal government. Numbers 4 and 5 are by the state and local governments, respectively. These documents encapsulated five support programmes: funding, human resources, marketing, and infrastructure programmes, as shown in Table 1.

The researchers used a face-to-face and semi-structured interview to explore SMABs' reactions to government support programmes. Such a technique could provide rich and comprehensive data contributing to highly valuable insights and understanding (Maxwell, 2020). This study applied a case study, referring to a single location setting (Maxwell, 2020), to unlock SMABs' reactions. Additional criteria were that SMABs must be actively managed by locals and registered with the Ministry of Tourism, Art, and Culture of Malaysia and the local authority. Purposive sampling was used to select respondents. This study interviewed 16 respondents (R1-R16) who were the owners and operators of SMABs. Interviews were tape-recorded, transcribed, and thematically analysed.

ANALYSIS AND DISCUSSION

Respondents' Profile

Most respondents (75%) were males compared to females (25%). Most respondents were aged between 40 - 49 years old (50%), followed by 30-39 years old (37.5%) and 50-59 years old (12.5%). Notably, 56.3% of the respondents did not acquire any related experience when they started their business, and only 43.7% obtained their work experience via the business.

Most of these businesses were owned by Terengganu locals (56.3%), while the rest were owned by outsiders, including Malaysians and non-Malaysians (43.7%). The percentage of respondents who managed their business for more than 15 years (62.5%) was significantly higher than that of those who had managed their business for less than 15 years (37.5%). Additionally, most SMABs on this island had a sole proprietorship (68.8%), while the others (31.2%) operated as a partnership business. In terms of business structure, most respondents resumed their family business (43.7%), followed by personally owned businesses (37.6%) and companies procured from their previous owners (18.7%). Notably, most of these SMABs started their business by utilising financial support from the government.

Awareness of Support Programmes

Respondents were questioned "*whether they are aware of any current support programmes provided by government agencies in Perhentian Island and how they find the related information."* It was found that all the respondents were aware of such programmes. Furthermore, they believed there were sufficient channels to

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obtain information on Perhentian Island's existing programmes. According to the respondents, the three vital channels comprised associations, government agencies, and self-explored means.

The analysis reveals that local operators use multiple channels to access information related to tourism management and support programmes on Perhentian Island. A key finding is the central role of the Operators' Association of Perhentian Island, which acts as an intermediary by disseminating crucial information and updates, as noted by most respondents. Respondents such as R1 and R5 emphasised the association's function in ensuring that local stakeholders stay informed, indicating strong intra-community networking.

Furthermore, a few respondents also received information from government agencies about the programmes implemented via fax, email, phone calls, and consultation and training programmes. However, four respondents (R7, R11, R9, and R15) claimed that they initiated self-exploration by searching through the media, such as television, the internet, and government portals, indicating that the information flow in Perhentian Island consists of both the findings found that the information flow in Perhentian Island is a blend of formal institutional communication (through the association and government) and individual initiative.

Diverse Involvement in Support Programmes

Respondents were questioned about the reasons for their involvement in the support programmes. The findings indicate that local operators and stakeholders on Perhentian Island have varying degrees of involvement with government support initiatives. Those who actively participated mentioned practical benefits, including improved revenue, skill development, increased company exposure, and enhanced staff capacity. For example, some respondents even involved their staff with several training opportunities, including entrepreneurship and marine conservation, provided by government agencies. The respondents' tendency to actively participate in the support programmes was to sustain and build a positive relationship with the local government. As highlighted by R16, they see involvement with government agencies as an investment in maintaining governmental credibility and support, which is reflected in their strategic engagement approach.

Conversely, 60% of respondents stated that they did not participate in government programmes due to time constraints with existing commitments, high or unjustifiable fees, programme content misaligned with their needs, and the availability of options for internal training. Respondent R9, for example, was dissatisfied with the training's cost-benefit ratio, describing it as a financial loss. This result reveals a perception gap between programme offerings and participant

expectations, which may stem from poor targeting, ineffective communication, or a perceived lack of value.

Understanding the Process and Procedure of Funding Programmes

Respondents were questioned about the SMABs' understanding of the application process and procedure under the financial programmes implemented. According to the findings, Small and Micro-Scale Accommodation Businesses (SMABs) have low involvement and face considerable barriers to accessing government funding programs. Most respondents acknowledged that these programs existed, but were unclear about the application process. Only six respondents indicated that they were familiar with the procedure and responded favourably, suggesting that knowing the processes involved in the bureaucratic process was crucial in gaining access to assistance.

Many respondents were aware of the funding programmes, but many still did not understand the process flow and application procedures for the funding programmes. Moreover, the respondents claimed that applying for government funding programmes necessitated accommodating a significant challenge. Notably, the requirements needed and the high risk involved were considered as the recurring reasons. The findings highlight a critical gap between policy design and local business capacity. While a minority succeed due to process knowledge, most SMABs struggle with administrative complexity and structural limitations.

The Importance of Support Programmes

The respondents were asked, *"From the support programmes provided, did you realise the support programmes are important for your business?"* The result revealed that seven respondents believe support programmes are crucial for business development on Perhentian Island. For instance, R2 clarified that government agencies actively helped local operators start and expand their businesses through the funding programme. Government agencies have actively assisted local operators in starting and expanding their businesses through funding programs. The Ministry of Tourism, Arts, and Culture (MOTAC) has provided training, funding, consulting services, and improved services to local operators. However, nine respondents felt that government support was not crucial, as most operators did not receive funding support. They believed that hard work and motivation were essential for business success. Respondent R9 stated that he did not consider government support a crucial factor in his business, as he had not received any support.

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Mixed Feelings on Satisfaction with Support Programmes

The study found that most respondents expressed dissatisfaction with the funding application process, citing inefficiency and sluggish services provided by government agencies. Respondents had to wait over a year for their application results, while others reported tardiness in providing information and application results. Some respondents also reported that government officers did not inform them when their applications faced problems, and they received no information about the funding application result. However, some respondents praised the government's work in providing programs to local operators, with some stating that they had learnt various skills and knowledge in areas such as marketing, financial management, and customer service. Some respondents, however, expressed dissatisfaction with the agencies' ability to provide helpful suggestions for problems related to their business operations, claiming they were unfamiliar with business operations and management. This statement was also confirmed by respondents R3, R7, and R8.

Support Programmes' General Impacts on SMABs' Performances

This study assessed the impact of support programmes on the performance of SMABs on Perhentian Island. The results were mixed, with half of the respondents indicating positive impacts and half showing negative ones. The results found that various funding schemes, including tourism funds, government tourism grants, and soft loan schemes, provided financial support to SMEs. However, some respondents reported that the government's assistance during monsoon seasons affected their income and business operations. Regarding non-financial aspects, five respondents acknowledged that support programmes positively affected their business management, with their business operating systematically and smoothly. Support programmes also enhanced the skills and knowledge of local operators and workers, with the government providing training programs at no charge. Additionally, the government's influence was evident in the marketing prospects, with increased tourist arrivals and higher operator income. The findings highlight the government's efforts to develop Perhentian Island through support programs to help SMABs grow further.

DISCUSSIONS

The result revealed that all SMAB respondents were aware of and acknowledged the implementation of support programmes by the governments in their business areas. This may not be unusual, given that the area, specifically Perhentian Island, is considered one of Malaysia's premier island destinations. This notion contradicts Sobaih et al. (2021) and Xiang & Worthington's (2017) idea that SMEs are mostly unaware of the existence of support programmes and may

remain unwilling to engage with them. Nevertheless, without SMEs' critical awareness, the support programmes cannot be implemented effectively.

While all SMABs, at least all the respondents, were aware of the support programmes dedicated to them in Perhentian Island, this does not mean that they would completely engage physically in the support programmes. Findings revealed low involvement from the SMABs in the support programmes, especially in human resources programmes. More than half of SMABs were not involved in the support programmes due to government agencies' inability to provide market-related information and equivalent training that meets their businesses' demands. This finding is consistent with other Malaysian researchers like Jaafar and Maiden (2012) and Amir et al. (2024). From perception to support: The role of political bureaucracy in rural tourism development in Lombok, Indonesia. *Planning Malaysia*, *22*., who found that government agencies failed to supply the latest information and guidance to the SMABs. Pitlik and Kouba (2015) and Soibah et al. (2021) suggest that SMEs' low involvement is attributed to their perception that the government's support services were irrelevant to their needs. However, some SMABs were satisfied with sufficient information being channelled via government agencies, operators' associations, and self-exploration.

The finding also pointed to the operators' lack of time and task pressure due to the operational nature of running SMABs in an island destination, disengaging them from participating in programmes. This result is confirmed by Chadwick and Raver's (2020) findings, which found that the primary reasons for the SMEs' low involvement are time- and task-pressured scenarios experienced by their managers. This situation renders it difficult for managers to participate in out-of-house training programmes.

Most SMABs acknowledged and understood the intention of the support programmes. However, SMABs could not accept how the support programmes were implemented. For instance, most respondents claimed they were unsuccessful in fulfilling the government's requirements and thus failed to follow stipulated procedures, such as providing business information, financial reports, and guarantees. In the broader context, SMEs are often unaware of their needs and lack a clear understanding of the support programmes' process and procedures (Park et al., 2020; Doh & Kim, 2014). Thus, SMEs must understand the processes and procedures involved, which are critical factors in developing their businesses (Doh & Kim, 2014). Moreover, the process and procedure related to the funding programmes' application were tedious and cumbersome (Zulkefli et al., 2021).

Therefore, it is not unusual for most SMABs on Perhentian Island to face difficulties in receiving financial support from government agencies. The majority of small resorts also experienced difficulties in obtaining government

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funding, according to other studies (Zulkefli et al., 2021; Mustapha & Awang, 2020).

Unpleasant conditions also existed due to several barriers, including bureaucratic issues and complex processes and procedures. In Malaysia, Zulkefli et al. (2021) found that the primary factors for SMEs' rejection of involvement in support programmes include inconsistent knowledge and information on government procedures and processes.

Additionally, other obstacles included government officers' lack of current skills and knowledge in dealing with the operational features of SMABs. Thus, a majority of SMABs exhibited adverse reactions. These SMABs considered government officials to be unhelpful, unknowledgeable, and possessing unsystematic coordination (Mustapha & Awang, 2020; Zulkefli et al., 2022). The respondents were supplied with insufficient guidance and information on relevant policies and programmes. Furthermore, it was found that treatment by government officers toward the operators was inequitable. Petti et al. (2017) postulate that SMEs did not receive equal treatment due to having negative associations with government agencies.

Nevertheless, most support programmes that contained non-financial features resulted in more benefits for the local operators than the financial aspect. Most SMABs received substantial benefits from the support programmes such as training, marketing, and consultation. This finding is consistent with previous studies, which have found that training programs provide benefits in management, promotion, knowledge, and skills (Ismail & Othman, 2014; Yusoff *et al.,* 2014). Besides, the skills in digital technology should be sought. Adam and Alarifi (2021) note that digital transformation enhances SMEs' ability and flexibility in addressing business issues.

CONCLUSION

This study highlights the importance of accommodating and being receptive to SMABs' feedback in designing and implementing more effective support programmes. SMABs should continue participating in these programs, providing them with the latest management knowledge and industry information. These goals can be achieved through formal consultation, training programs, or collaboration with other entrepreneurs.

The study provides empirical evidence on the reactions of SMABs towards support programs, whether financial or non-financial, underpinning their effectiveness. It is particularly relevant to tourism destinations, where clients are primarily international and domestic tourists. The COVID-19 pandemic has further modified the relationship between tourism demand and supply. The research study aims to understand SMABs' reactions to support programs that help them climb the economic growth ladder. However, the support programmes

have not had a positive impact on their behaviour, and their openness does not necessarily correlate with positive engagement. Government agencies must take action to ensure the success of government-initiated support programs.

By understanding SMABs' pressing management and operation issues and accommodating them in future support programs, the relationship between the two parties could be harmonised, mitigating adversity. However, the study is limited because the data were collected before COVID-19, which has distorted the supply and demand system for goods and services. Future research should incorporate the latest programs, particularly those with financially based content, designed by the government to help SMABs prepare for such calamities.

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THE ADAPTABILITY OF TRADITIONAL COMMERCIAL AND RESIDENTIAL BUILDING SPACES TO CONFUCIAN BUSINESS CULTURE IN SHANDONG, CHINA

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Abstract

Traditional commercial and residential buildings emerged to accommodate commercial and residential demand. Continuously increasing and expanding, resulted to the formation of a certain scale of the ancient district complex. Previous studies have primarily concentrated on the architectural components and decorations of traditional commercial and residential buildings, neglecting the adaptive evolution of the building's internal spaces and functions. This study examines the adaptive evolution process of traditional commercial and residential buildings. The study explores the internal spatial configuration characteristics based on spatial syntax theory by observing traditional commercial and residential architectural spaces. The findings emphasize the positive influence of Confucian and commercial cultural concepts on architectural space and spirit. This study provides valuable insights into the adaptability of traditional commercial and residential buildings to culture and contributes to an improved understanding of traditional commercial and residential buildings. At the same time, it provides adaptive perspectives on the sustainability of culturally influenced traditional commercial and residential buildings and suggests sustainable strategies for the preservation of architectural culture.

Keywords: Confucian Business Culture, Adaptability, Spatial Configuration, Sustainable

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INTRODUCTION

In order to meet the needs of residential and commercial use, traditional commercial and residential buildings emerged and gradually formed an ancient commercial district complex of a certain scale. As the main architectural body composing the settlement pattern of ancient commercial district, traditional commercial and residential buildings were deeply influenced by Confucian and commercial cultures in the formation process and showed unique architectural cultures. Culture is the main factor in the evolution of human architecture, and it plays an important role in the environmental and social development of a place, as well as in sustainable development, and architecture symbolizes the cultural evolution of a society (Owoicho et al., 2024).

Currently, the accelerated urbanization process in China has led to the decline of traditional architectural development with the purpose of giving priority to economic orientation. In particular, the ancient commercial district, which is an important historical architectural area for the inheritance and presentation of traditional trade and commerce culture, includes numerous traditional buildings. In physical form and abstract expression, architectural works embody a society's culture and hidden environmental factors (Krauth et al., 2021). The results reveal that from this perspective, an architectural work embodies a society's cultural and hidden environmental factors in physical form and abstract expression. Through the spatial combination of architectural elements, it conveys the concepts and themes of the culture and architecture of that specific region. Referencing the ideas and themes of past architecture achieves a deeper concentration on architectural history, signifying a higher position than previous methods (Kamali, 2024). Therefore, architectural sustainability should be researched and protected accordingly.

Much research has been conducted in recent years on architectural heritage and sustainability, involving building reuse, upgrading, energy-efficient construction, and the development of sustainable building materials (Li et al., 2024). Researchers have focused mainly on the morphological and technological renewal of housing developments, and few studies have explored the cultural logic and connotations that have shaped this phenomenon (Eggan et al., 2018). In particular, the study of traditional commercial and residential buildings has been confined to a series of superficial aspects such as architectural decoration and function, ignoring the deeper mechanisms and cultural influences that shaped the spatial organization of the buildings. In addition, the continuity of traditional commercial and residential buildings has rarely been explored. Architectural continuity is the result of architectural adaptation. Adaptive architecture is a multidisciplinary field that includes buildings that are designed to adapt to their environment, inhabitants, and objects, as well as buildings that are driven entirely by internal data (Holger, 2010). Adaptive architecture is concerned with buildings

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specifically designed to adapt (to their environment, to their inhabitants, to the objects in them), whether this is automatic or through human intervention (Maria et al., 2021). Regarding the adaptability of architecture, most studies have been conducted in terms of natural environments such as topography and hydrology, ignoring the spatial adaptability of culture. Therefore, there is an urgent need to explore the cultural and adaptive formation aspects of its space under modern conditions.

Through space syntax, the purpose of this study is to examine the adaptive changes in traditional commercial and residential buildings, as well as the cultural factors behind them. Spatial syntax is a quantitative language that explores the interrelationships between spatial configurations and human societies by analyzing the structural characteristics of human habitats, including cities, buildings, and landscapes (Mohamed et al., 2024). Space syntax can analyze the regularity of spatial functions and forms. The article concludes by exploring the deep mechanism between Confucian culture and architectural spatial configuration from an adaptive perspective.

LITERATURE REVIEW

Numerous studies have explored how architectural spaces adapt. As these studies reveal, architectural space epitomizes and is influenced by culture. It is powerful evidence of the embodiment of social relations. Architecture has been adapting to cultural development and social change (Anggoro et al., 2024). The process of integration of architecture, spatial structural characteristics, and functional relationships are key considerations (Subbotin et al., 2020).

Confucian merchants are practitioners who apply traditional Chinese culture, especially Confucianism, to commercial activities. The Confucian merchant culture has emerged through nearly a thousand years of practice by Chinese Confucian merchants. It has two basic characteristics: Ren an Li. Ren is benevolence and the Li is propriety(Rao et al., 2022). The inheritance of this traditional culture is passed down from generation to generation as a habit, and the operation of rituals is maintained by this habit.

In order to adapt to the development of social productivity and the needs of the commodity economy, China's traditional commercial and residential buildings have gradually developed from a single traditional residential model into a composite commercial and residential building model that integrates residential and commercial (Chen, 2018). The interpretation of the regional, contemporary, and cultural characteristics expressed by the building. Morphology is used to describe spatial forms and construction patterns through the three levels of city, street, and building and to illustrate the regional, contemporary, and cultural characteristics expressed by architecture (Wang et al., 2015). Meanwhile, the characteristics of the area under the traditional gathering

of commercial and residential buildings are expressed in three patterns of strip, dendritic type, and enclosure under the typological analysis (Cheng et al., 2022). This settlement pattern was formed to adapt to the external natural environment (Seuntjens et al., 2024). From a superficial analysis, the variability in the spatial configuration of traditional commercial and residential buildings mostly depends on the choice of the external natural environment. However, through space syntax, it is possible to show the inherent cultural mechanisms affecting spatial configuration from a quantitative point of view (Ayyıldız et al., 2024).

Traditional commercial and residential building patterns emerged from the craft production economy. Functional spaces are often adapted to the different business models in the building. However, the commercial demand for personnel has also increased dramatically, so in addition to the work areas, the living quarters for the employees have also been incorporated into the building.

RESEARCH METHODOLOGY

Space Syntax Theories

Since this study is a quantitative study of traditional commercial and residential architectural space from the perspective of Confucian and commercial culture, it is reasonable to choose space syntax as the basis for conducting the study. This is because the space syntax theory provides a quantitative approach to characterizing spatial connections and defining spatial properties. In particular, spatial configurations are studied in relation to socio culture. The distinctive characteristics of societies exist within spatial systems, and their knowledge is conveyed through space itself and through the organization of spaces (Takahashi et al., 2024). Space syntax refers to the relational characterization of space as a conformation, emphasizing that this characterization is the form of human behavior. Human behavior thus contains social knowledge (Hassan et al., 2024).

Space syntax theory was developed by Bill Hillier. He argued that science fosters creativity and started a conversation about connectivity, a fundamental concept used to study and understand spatial configurations and spatial relationships (Rauof et al., 2023). Space syntax involves connection values, control values, depth values and local integration as local variables for characterizing the structure of the local space (Yazdi-Bahri et al., 2024). Integration and depth are holistic variables that are used to characterize the structure of the overall space, and comprehensibility is a variable that describes the degree of correlation between a local variable and the overall variable (Garau et al., 2024).

To address the questions of this study, Visibility Graph Analysis (VGA) will be used. This analysis will be accomplished using Depth Map X, a space syntax Software. Figure 1 below shows the relationships of the space syntax used.

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Integration is regarded as one of the most numerous and important covariates in space syntax analysis. It reflects how closely a node in the system is linked to more other nodes and is categorized into integration and local integration. Among them, the integration degree indicates how closely a node is connected to all nodes within the whole system (Lee, 2024).

Connectivity is the number of nodes in the system that are directly connected to a node as the connection value of that node. The higher the connectivity value of a space, the more closely this space is connected to the surrounding space, the stronger its influence on the surrounding space and the better its spatial permeability (Moqadam et al., 2024).

The visual clustering coefficient (CC) is a first local measure of some of the nodes, defined as the number of vertices connected within the current vertex neighborhood versus the number of vertices that could be connected (Turner, 2004).

Visual control (VC) pertains to whether the space viewed from a node to other immediately visible nodes is greater or less than that perceived (Sharmin et al., 2018). Therefore, a controlling point can present a large number of areas, each of which sees relatively less (Leite et al., 2018).

Visual Entropy (VE) was suggested to address the global complexity of a configuration regardless of its geometric characteristics. Entropy values can be used as a possible indicator of the degree of orderliness of the system at a location (Netto et al., 2019). A higher level of visual entropy correlates with higher levels of randomness, interference, or unpredictability in physical space arrangements. At the same time, regularity and clear patterns in the system correspond to lower entropy from with leading to higher levels of prediction (Dursun et al., 2007).

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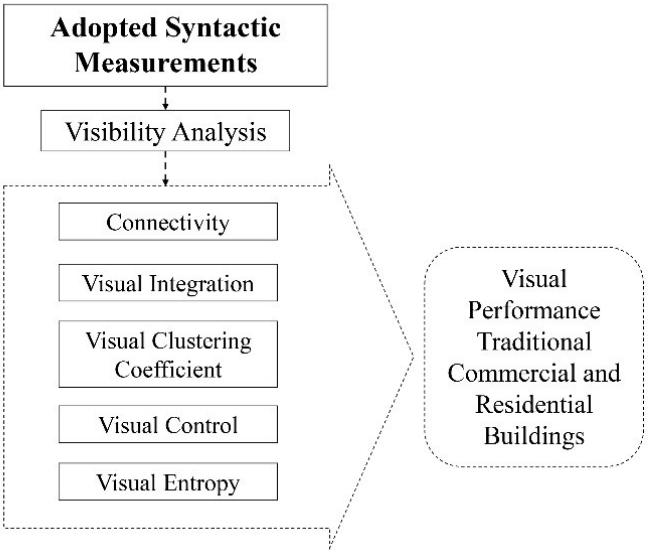


Figure 1: The adopted syntactic measurements subjected

Case Studies

A traditional commercial and residential building built in 1883 was selected as a case study for this research. As shown in Figure 2, the building is located in Qi County.



Figure 2: Location of building

The commercial nature of this building is financial. The building is named Da Dutong. The following Table 1 shows the basic distribution of the case.

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Table 1: Information of Case

Content of Architecture	
Structure	Courtyard style
Height	Single
Function	Commercial and residential
Commercial Function Types	Financial
Location	Street Facing Buildings
Year of Architecture	Dynasty of Qing (1884s)

Figure 3 illustrates the various spaces within the analyzed building. The structure of the building is courtyard-style. According to the location and function of the rooms in the courtyard, they are divided into a reversely-set house, hall, side house, main house, and yard. Commercial functional areas in commercial and residential buildings generally have three types of spaces for customers: street-level spaces, courtyard spaces, and exclusive spaces. The reversely-set houses of non-street-facing buildings are generally used for functions such as rest and storage. In this case, the red area is interior space, and the grey area belongs to yard space. Since the building belongs to the two-entry courtyard style, the blue belongs to the front yard, and the green belongs to the backyard. The front yard is primarily used for commercial and staff living, while the backyard is the owner's living area. The entrance of the building is divided into a main entrance and a secondary entrance. The second courtyard serves as the primary space for the entire building.



Figure 3: Space Division of Building

ANALYSIS AND DISCUSSION

Having analyzed the collected data and focusing on identifying elements of Confucian business culture and the influence of Confucian business culture on the evolution of traditional commercial and residential buildings. The main features of traditional commercial and residential buildings, as well as the key values are derived from Confucian business.

Figure 4 below shows a visual analysis of a building using connectivity measurements. The diagram shows the connectivity of the areas in the space in warm and cold colors. The warmer the color, the higher the connectivity. Conversely, the cooler the color, the lower the connectivity of the space(Rao et al., 2022). The results show that the space at the transition between the front and back yards is the place with the highest connectivity, indicating that this location has the strongest accessibility. Because the courtyard serves as a link between the functional areas, especially this node runs through the front and back yards of the building. As a critical node, this is in line with its positional relationship. At the same time, all other spaces in the building are well connected to this area. In addition, the main house and the hall have the highest connectivity among the interior spaces. The main house is located in the deepest part of the building and takes on the role of the owner's daily residence and reception of business noble guests. The Hall serves as a semi-open transitional space that connects the front and back yards. This result is therefore consistent with the characterization of the function of the space.

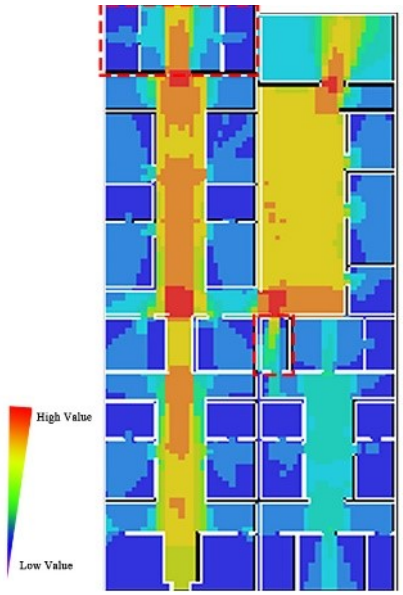


Figure 4: Visual analysis using Connectivity measurements

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Figure 5 below shows a visual analysis of a building using integrated measurements. The results show that the highest integration occurs in the main axis area of the building, which indicates that this area has the highest accessibility and the best traffic flow. This also clearly indicates the location of the highest accessibility paths in the building. At the same time, the high level of integration of the interior space is mainly found on this side of the main entrance. The whole area linked by the main entrance is functionally in the main position and the main body of use is the owner of the building. Meanwhile, the area linked by the secondary entrance is mainly used by apprentices and employees. This result shows the core areas in the building.

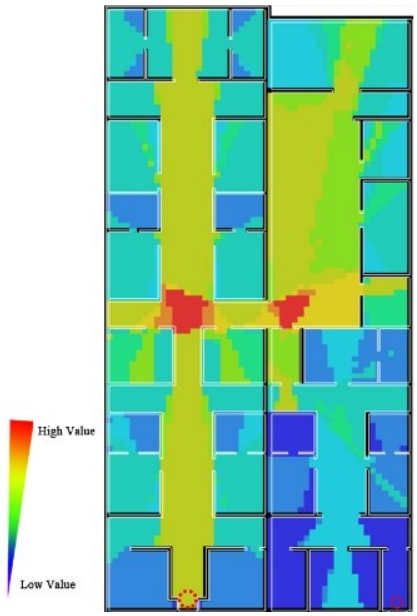


Figure 5: Visual analysis using Visual Integration measurements

Figure 6 shows the visual analysis of buildings using the visual clustering coefficient measure. The results show that the area with the highest visual clustering coefficient value is the reversely-set house located in the front yard, next to the main entrance. This area performs the function of currency exchange and money transaction. Customers who need to exchange money need to come here to do so. The daily flow of money requires a high level of privacy, while the higher flow of people also requires a higher level of attention to the space.

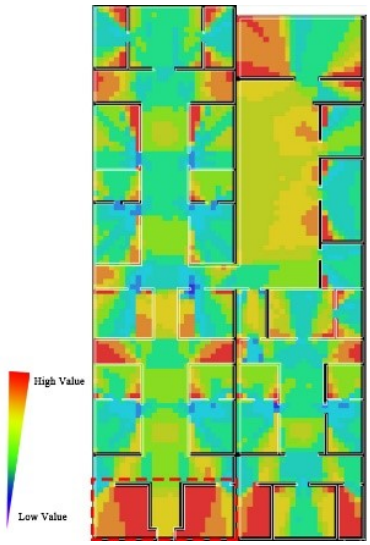


Figure 6: Visual analysis using Visual Clustering Coefficient measurements

Figure 7 below shows the visual analysis of the building using controlled measurements. The results show that the maximum value of the visual field control occurs in the area in and around the entrance of the main house. Therefore, this area has the highest value of control and has the greatest influence and control over other spaces, occupying the main position in the building. This result is consistent with the character of the main house. Also, the courtyard path that appears to have high control values matches the function of its main path.

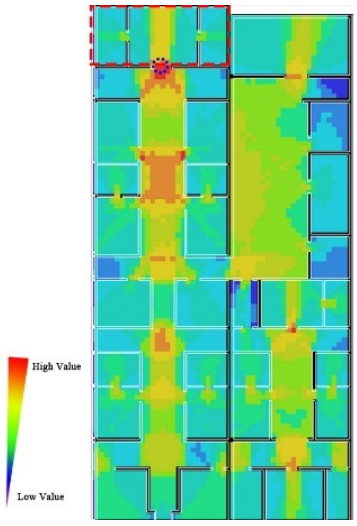


Figure 7: Visual analysis using Visual Control measurements

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Figure 8 below shows a visual analysis of the building using the visual entropy measure. The results show that the area used by the employees is where the entropy value is low, especially in the area of the dining room and the kitchen in the backyard. This area is responsible for the daily life of the employees, in addition to the dining room space is responsible for the dining needs of all the people in the building. Therefore, the mobility of people in the area is high, the functions are diversified, and the activities are more frequent and complex. Areas with higher entropy values are on the side of the main entrance. The area of the main entrance requires more stability and low activity in the space.

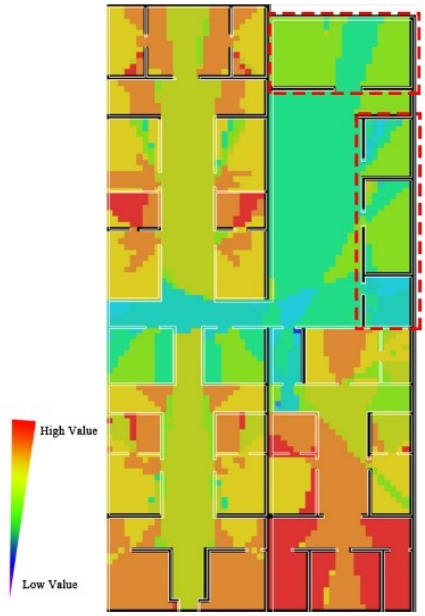


Figure 8: Visual analysis using Visual Entropy measurements

Table 2 shows the average visual field values for each house and functional area in the building. There is a large difference in visual accessibility and controllability between the interior spaces of the front and back yards. Backyards have higher accessibility and control values than front yards. Front yards have higher attention and mobility and therefore higher visual clustering coefficient and visual entropy values. In addition, the mean values for interior spaces were less correlated with space dimensions.

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Table 2: Average visual field values for each space.

Type of Space	Visual Integration	Visual Clustering Coefficient	Visual Control	Visual Entropy
M-MH	3.75	0.69	0.93	2.58
M-SH-F	3.23	0.67	0.89	2.60
M-RSH-F	2.62	0.91	0.94	2.70
M-SH-B	3.42	0.67	0.85	2.60
M-RSH-B	4.13	0.73	0.77	2.26
S-MH	2.83	0.73	0.95	2.57
K	3.78	0.66	0.65	2.23
H	4.70	0.74	0.64	2.09
S-SH	2.51	0.67	0.91	2.68
S-RSH	2.56	0.74	0.90	2.73
DR	3.79	0.79	0.94	2.32
T	1.91	0.91	0.87	2.85

Abbreviation	Name
M-MH	Main Entrance-Main House
M-SH-F	Main Entrance-Side House-Front Yard
M-RSH-F	Main Entrance-Reversely-set House-Front Yard
M-SH-B	Main Entrance-Side House-Backyard
M-RSH-B	Main Entrance-Reversely-set House-Backyard
S-MH	Staff Entrance-Main House
K	Kitchen
H	Hall
S-SH	Staff Entrance-Side House
S-RSH	Staff Entrance-Reversely-set House
DR	Dining House
T	Toilet

Figure 9 below shows the detailed numerical variation of the relevant view situations in the building. The connection values of the various spaces in the building vary considerably, with the yard space being overall higher than the interior space. It indicates that the traffic flow in the courtyard space is smoother. Other visual field values vary less, especially the visual entropy value of the building, which ranges basically between 1.5 and 3, indicating that the areas are clearly divided and the overall architectural space is more stable.

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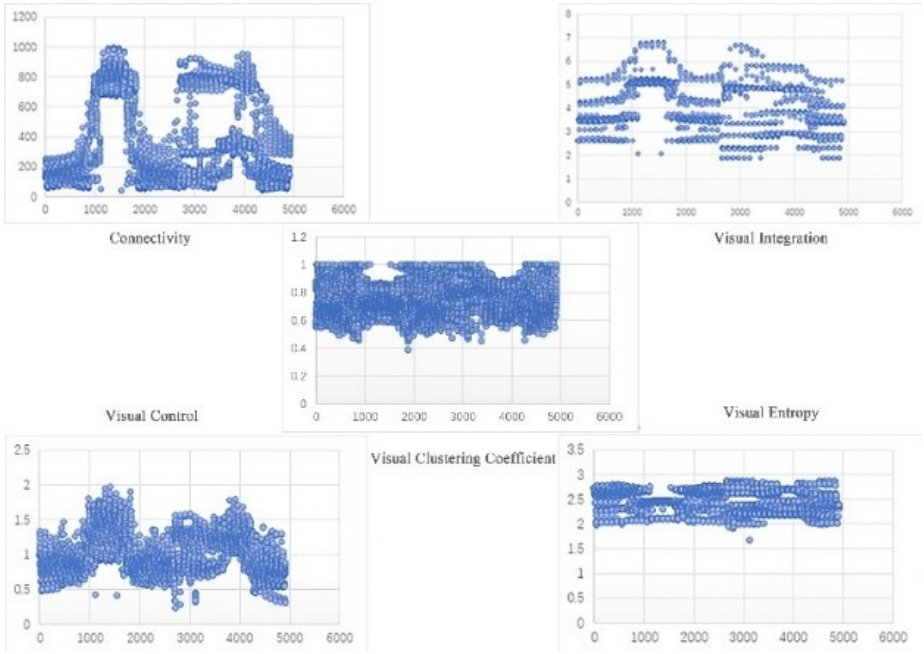


Figure 9: Point -like analysis of visual value measurement

Figure 10 below shows the comparison of 12 interior spaces in terms of visual values. As can be seen from the figure, when the visual integration of the localized space is at high values, the visual clustering coefficient, visual control, visual entropy values are relatively at low values. Visual accessibility indicates the degree of enclosure of the space. For example, hall belongs to the semi-enclosed indoor space, which connects the front and back yards in front and behind, and is the way to the two courtyards with the highest accessibility. At the same time, the frequent human activities and semi-open structure reduce the privacy and instability of the space, resulting in low visual clustering coefficient, visual control, and visual entropy values. This result is consistent with the structure and function of the space.

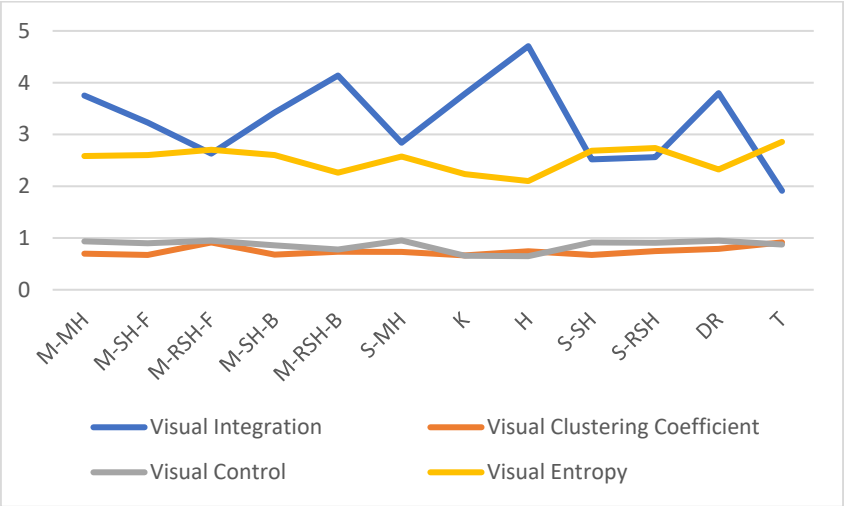


Figure 10: Data comparative analysis of twelve interior Spaces

CONCLUSION

Taking traditional commercial and residential buildings as the research object, this study explores the phenomenon of cultural migration and fusion in space through the quantitative study of spatial syntax, which measures the spatial relationship and emphasizes the influence of Confucian business culture on the adaptation of traditional commercial and residential buildings. The concept of customer first is the core content of Confucian business culture, which originates from the concept of reverence for benevolence and respect for propriety in Confucianism, and is carried over to business, i.e., customer first. It is reflected in the relationship between merchants and customers, mainly through the quality of service provided by merchants. The main house, as the highest-ranking space in the building, serves not only for the owner's living but also as a place of hospitality for receiving noble guests. As a result, the space expresses this important idea.

Traditional commercial and residential buildings have been influenced by the idea of rituals in Confucian and commercial culture in the spatial configuration, especially in the living space area. The hierarchy in the space is emphasized. The hierarchical concept of traditional Chinese architecture is deeply rooted, which is reflected in many aspects of architectural space. Although traditional commercial and residential buildings integrate the openness of commerce, they are still influenced by the cultural environment, and the architectural space continues and adapts to this idea, so that there is a hierarchy in the domination of space by the personnel. The degree of domination of space depends on the identity, status, and ability of the user, which is consistent with

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the results of the analysis of spatial syntax. This hierarchy expresses the inequality in inhabited space and further illustrates the imbalance in the distribution of social resources.

Meanwhile, the limitation of this study is the exploration of the external environment of the building, especially the street spatial scale outside the building, which has an influence on the structure and changing characteristics of the forecourt space. Subsequent studies can incorporate the influence of the external environment, such as street scale and topography, on the spatial adaptation of traditional commercial and residential buildings. This can provide sufficient reference for the sustainability of traditional commercial and residential buildings.

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DISCLOSURE STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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BABAE KA, HINDI BABAE LANG: DEVELOPING A FRAMEWORK FOR GENDER-RESPONSIVE IMPLEMENTATION OF A WOMEN-FRIENDLY CITY IN MALAYSIA

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Abstract

Gender equality is a critical aspect of creating an inclusive city. The debate on gender equality objectives centres on balancing practical and strategic needs and classifying gender mainstreaming as integrationist or transformative. Consequently, women are often excluded from participation. This study focuses on gender-inclusive activities and infrastructure elements to enhance Subang Jaya, Malaysia, as a Women-Friendly City, and aims to develop a gender-responsiveness framework. The researchers reviewed 29 years of peer-reviewed literature on gender mainstreaming from 1995 to 2024 to examine scholarly trends in gender equality in urban settings and women-friendly cities. The researchers also reviewed the guidelines, including the New Urban Agenda, Sustainable Development Goals, Convention on the Elimination of All Forms of Discrimination Against Women, UN Security Council Resolutions, UNESCO Priority Gender Equality Action Plan, UN Human Rights, Environment, Gender Equality, Selangor Women's Policy, and Subang Jaya Women-Friendly City Action Plan. A qualitative method was used to conduct semi-structured interviews with stakeholders (e.g. city council members, urban planners, and state assembly women of Subang Jaya) to validate the gender-responsiveness framework. The proposed framework comprises 12 components: (1) governance and leadership, (2) safety, (3) housing and land rights, (4) economic security, (5) education, (6) health, (7) transportation, (8) environment and resilience, (9) art, media, and culture, (10) infrastructure and services, (11) urban spaces, and (12) peace and security.

Keywords: Women-Friendly City, Gender-Responsive, Gender Equality, Subang Jaya.

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INTRODUCTION

Urban areas are home to most of the global population and serve as complex spaces shaped by both natural and cultural elements. However, access to these spaces is not equally experienced, especially when factors such as gender, age, ethnicity, and sexuality are considered (Rojas-Rueda et al., 2019; Nyelele & Kroll, 2020). The concept of urban rights, including housing, participation, and freedom of expression, must be inclusive to ensure an equitable city life (Lefebvre, 1996; Harvey, 2013).

Since the 1980s, critical urban studies have highlighted how urban spaces reflect and reinforce gender inequalities, often shaped by male-dominated planning and governance systems (Bondi, 2013; Koskela,1999; Fenster,1999a;) Hayden, 1985; Wekerle, 1984; Efe Güney et al. 2020, Kaypak 2014, Koskela 1999; McDowell, 1999; Chang et al. 2022; Bansal et al., 2022). Research has shown that women and marginalised groups frequently experience public spaces as unsafe or inaccessible, leading to social exclusion (Browne, 2007; Garcia-Ramon et al., 2004; McShane & Coffey, 2022).

In response, the concept of "women-friendly city" women-friendly cities has emerged (Arjmand, 2017; Khakpour et al., 2017; Short, 2014). These initiatives aim to incorporate gender-sensitive infrastructure and planning, ensuring equitable access to healthcare, education, employment, and safety (Kaypak, 2016; Malhotra and Dobriyal 2021; Tekinbaş 2015). Feminist movements and international bodies such as the UN and World Bank have championed these transformations to address systemic gender disadvantages in urban environments (United Nations, 2005).

Despite progress in developed countries, there is limited research in developing countries such as Malaysia. This study addresses this gap by focusing on Subang Jaya as a case study to develop a gender-responsiveness framework for a Women-Friendly City. It aims to bridge academic and practical approaches to promote inclusive urban planning within Malaysia's socio-political and economic contexts.

LITERATURE REVIEW

The Inclusive City

The inclusive city is "a place where everyone has the power to participate productively and positively in the opportunities the city has to offer, regardless of the property, gender, age, race, or religion" (United Nations, 2002). Although it targets third-world cities, this concept suggests universal standards. The right to the city is the main criterion for inclusion, as stated in the UN's broad agenda for human rights (United Nations, 2002; UNCHS, 2000), encouraging governments to promote inclusion and sustainability. Scholars have linked inclusive cities with social sustainability and spatial accessibility (Dempsey et al.

2011; Liang et al. 2021). Lefebvre (1996) wrote about the rights of a city . While gender is not explicit in his conception (Simonsen, 2005; Vacchelli & Kofman, 2018), it involves access for every resident: *"Complemented by the right to difference and the right to information ... should modify, concretise and make more practical the rights of the citizen, an urban dweller and user of multiple services. It would affirm, on the one hand, the right of users to make known their ideas on the space and time of their activities in the urban area; it would cover the right to the use of the centre, a privileged place, instead of being dispersed and stuck in ghettos (for workers, immigrants, the 'marginal' and even the 'privileged')"* (Lefebvre, 1996). Access is applied to the physical environment and information via the ICT infrastructure. These services must be guaranteed to everyone, recognising differences in gender, age, and disability (de Oliveira Neto & Kofuji, 2016). For greater inclusivity, the focus should be on citizens' needs rather than on ICT services. The fear of crime while walking at night particularly affects women (Cho & Park, 2017; Pain, 1997, 2000; Painter, 1996), depriving them of free movement and creating gender inequality. This can be reduced through neighbourhood and street designs (Cozens et al., 2005; Seo & Lee, 2017).

Gender Mainstreaming and The Women-Friendly City

Gender mainstreaming has been applied in urban planning to safeguard inclusion and equality between both women and men (Urban Development Vienna, 2013 Guevara, 2020;). Gender mainstreaming, which began in the 1980s in Europe, aimed to prevent discrimination based on sex, race, religious beliefs, disability, age, or sexual orientation (Treaty of Amsterdam, 1999). "Gender refers to a person's social gender rather than just the biological differences between women and men and also includes the respective person's upbringing according to gender roles, social expectations, and (behavioural) norms of women/girls and men/boys" (Urban Development Vienna, 2013). Gender mainstreaming represents a social agreement that respects the everyday lives of women and men, translating to gender-sensitive urban planning and ensuring planning decisions considerering both female and male perspectives. The concept of a women-friendly city emerged in the 1970s when women's activists in North America demanded safety in daily life. The 1980s focused on women's safety, in terms of urban planning and gender integration. Women-friendly cities gained global recognition through the 'European Declaration for Urban Women (ECWC)' in 1994 and 'UN Habitat II Urban Women's Life' in 1996. Gender mainstreaming acknowledges that women and men experience urban environments differently, requiring specific attention throughout the planning stages, from goal formulation to implementation and evaluation (Urban Development Vienna, 2013) (Figure 1).

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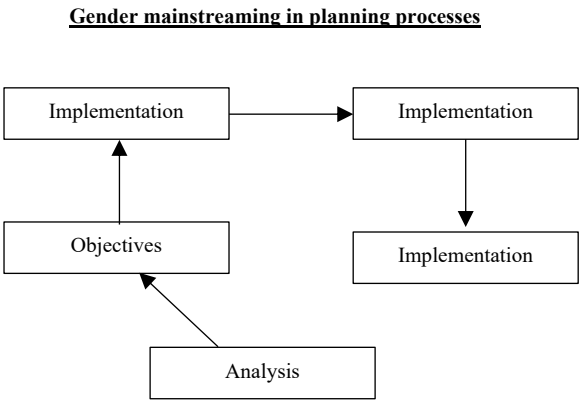


Figure 1: Diagram of gender mainstreaming in the planning process
Source: Urban Development Vienna (2013)

Gender Equality in the Malaysian Context

Malaysia has demonstrated its commitment to gender equality by ratifying the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) and endorsing the Beijing Declaration, recognising the importance of advancing gender equality and women's rights (UNDP, 2023). In recent years, there has been an increased focus on addressing social and environmental inequalities, with the World Economic Forum emphasising social justice for greater inclusion (Jenkins 2020). Policies related to the Women's Friendly City include the New Urban Agenda (NUA); Sustainable Development Goals (SDG); Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW); UN Security Council Resolutions (SCR); UNESCO Priority Gender Equality Action Plan (2014–2021, 2019 Revision); the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP); UN Human Rights, the Environment, and Gender Equality (2021); Selangor Women's Policy; and the Subang Jaya Women's Friendly City Action Plan. Despite these commitments, progress towards gender equality in Malaysia remains slow, with a major concern being inadequate sexual harassment legislation, leaving women vulnerable without proper legal protection. Malaysia's gender gap index ranking of 103 of 146 countries (UN WOMEN, 2014; UNDP, 2023) shows significant disparities between men and women in terms of education, economic participation, political representation, and access to resources.

RESEARCH METHODOLOGY

The researchers conducted a comprehensive review of 29 years of peer-reviewed literature on gender mainstreaming, from 1995 to 2024. They examined scholarly

publishing trends related to gender equality in urban settings, gender mainstreaming in urban or city planning, and women-friendly cities. This extensive review led to a thematic synthesis of existing literature and identified key themes and trends. Additionally, the researchers reviewed various guidelines, including the New Urban Agenda (NUA), Sustainable Development Goals (SDG), Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), UN Security Council Resolutions (SCR), UNESCO Priority Gender Equality Action Plan (2014–2021, 2019 Revision), the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), UN Human Rights, the Environment, and Gender Equality (2021), Selangor Women's Policy, and the Subang Jaya Women-Friendly City Action Plan. This comprehensive literature review and policy analysis aimed to develop a gender-responsiveness framework for a women-friendly city for further validation by experts.

To validate and refine the developed model, the researchers conducted interviews with six experts from February to May 2024 to gain insights into the planning and operational processes of Subang Jaya as a Women-Friendly City and to ensure the model's practical applicability and effectiveness. Semi-structured interviews were conducted with city council members, urban planners, and state assembly women in Subang Jaya, as shown in Table 1.

Table 1: Interviewee and selection criteria

Interviewee	Selection criteria
City Council Member 1	Department of Corporate & Strategic Management
City Council Member 2	Department of Corporate & Strategic Management
Urban Planner 1	Department of Urban Planning
Urban Planner 2	Department of Urban Planning
City Council Member 3	Department of Community Development
State Assembly Women Of Subang Jaya	State Assembly Women Of Subang Jaya

ANALYSIS AND DISCUSSION

The results are presented in the following two sections. The first section presents the gender-responsive framework for a women-friendly city, including 12 components (Figure 2). This framework was developed through a literature review and policy analysis and validated by six experts through semi-structured interviews. The second section is divided into three stages: planning, implementation, and evaluation. The results were summarised based on the Selangor Women's Policy, the Subang Jaya Women-Friendly City Action Plan, and expert interviews.

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Gender-Responsive Framework for A Women-Friendly City

Through a literature review and policy analysis validated by six experts, the researchers developed a gender-responsive framework for a women-friendly city comprising 12 components. The details of these 12 components are listed in Table 4.0.

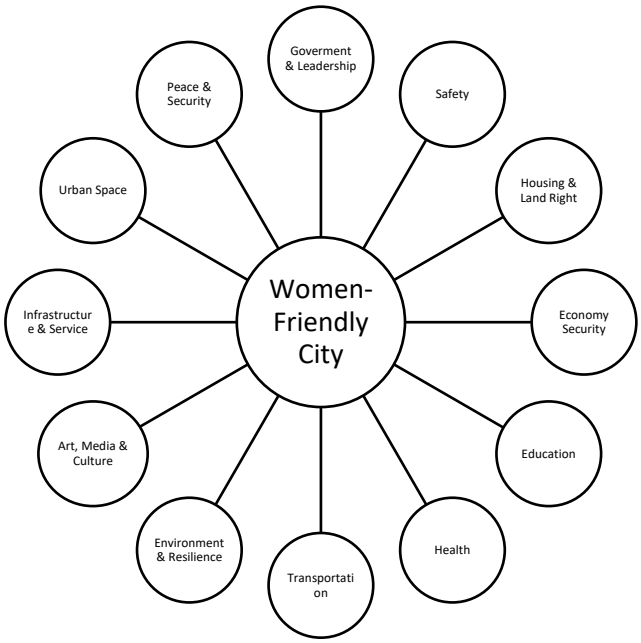


Figure 2: Model for Women-Friendly City

Planning

Selangor was the first state in Malaysia to implement a gender-mainstreaming (GM) initiative in line with the Selangor Women's Policy. The Selangor Women's Policy has five key principles and seven main goals that guide GM initiatives aimed at promoting gender equality and empowering women in the state (Table 2).

Table 2: Selangor Women's Policy

Key Principles	Main Goals
Key Principle 1: Gender Mainstreaming in Development	Goal 1: Promote a gender-sensitive development framework strategies.
Key Principle 2: Economy and Livelihood	Goal 2: Improve the socio-economic status and autonomy of marginalized women. Goal 3: Narrow the gender gap at all levels and aspects of the labour market
Key Principle 3: Representation and Leadership	Goal 4: Accelerate the participation, representation, and decision-making of women in public and political life
Key Principle 4: Safety and Well-being	Goal 5: Enhance the health, well-being, and mobility of women. Goal 6: Freedom from violence, freedom from fear
Key Principle 5: Creativity and Innovation	Goal 7: Realize the creative talents and innovation of women

Subang Jaya is in the District of Petaling, Selangor, with a land area of 161.8 square kilometres. The demographics of the women in Subang Jaya comprise 49% of the total population. Subang Jaya developed the Women Friendly Green City Action Plan (BHMW) aligned with the Selangor Women's Policy, focusing on inclusivity and empowerment. The BHMW ensures that no group is left behind in town planning and development by empowering communities to overcome rising costs and poverty, especially for B40 women. The Women Friendly Green City Action Plan (BHMW), comprising of four strategies and action plans (Table 3), was proposed by Mayor YBrs TPr. Hajah Noraini binti Haji Roslan.

Table 3: Subang Jaya Women-Friendly City Plan

Strategy	Action Plan
Strategy 1: Healthy Lifestyle	Women's Health and Well-being Active Lifestyle and Women's Personality Recognition and Inclusive Development of Women
Strategy 2: Socio-Economic Improvement	Quality Education Socio-Economic Status and Autonomy of Women
Strategy 3: Safe Cities	Inclusive Urban Planning for Women Education and Awareness
Strategy 4: Infrastructure	Women-Friendly Infrastructure

As stated by City Council Member 1, " *some advancements have been made in the legal framework, but substantial equality for women remains unachieved. Policymaking in Malaysia that focuses on women has been led by*

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the Ministry of Women, Family, and Community Development to protect women, prevent discrimination, and enhance their status. While efforts to develop female resources and improve formal equality have progressed, improvements in labour, family, and welfare are still needed. Previous policies have mostly benefited underprivileged women, leaving many others unaddressed, and failed to meet diverse needs across provinces and urban settings."

"*Women face insecurity in public restrooms, transportation, parking lots, childcare facilities, and walkways. Despite legal advancements, many women still experience difficulties in daily life*," as stated by City Council Member 2.

The Subang Jaya Women Friendly City Action Plan, proposed by Mayor Ybr's TPr. Hajah Noraini binti Haji Roslan following her 2017 inauguration, aims to move beyond existing women's policies. The plan takes a comprehensive approach to city planning considering women's perspectives, with the objective of reducing the difficulties women face and promoting their societal participation.

Implementation

The "Women Friendly Green City Action Plan" employs strategies to create a women-friendly city environment (as shown in Table 3). It aims to minimise women's daily inconveniences by incorporating their perspectives into policymaking. The Women Empowerment Selangor (WBS) managed women's policymaking until the launch of this action plan, which shifted the focus to comprehensive governance incorporating women's perspectives into every city policy implemented by the Subang Jaya City Council. While WBS oversees women's policy management, each office develops specific programs, with civic groups involved in planning, implementation, and assessment to promote Gender Mainstreaming, the Gender Mainstreaming (GM) Project in Selangor has taken a phased approach.

City Council Member 1 stated: "*In the first year (2017), four pioneering departments conducted gender training workshops and audits, and developed Gender Action Plans led by Gender Focal Points (GFP) and teams (GFT). This work earned recognition from the Westminster Foundation for Democracy (WFD), citing GM Selangor in its Gender Responsive Budgeting Manual. The second year included an Appointment Letter Presentation Ceremony for new GFPs and GFTs, expanding to include Klang Municipal Council (MPK), Hulu Langat District and Land Office, and Islamic Education Division, JAIS.*"

The Women Friendly Green City Action Plan focuses on delivering substantial benefits to women through practical policy. According to City Council Member 3: "*We identified women's inconveniences in the city*

environment and modified them into women-friendly alternatives. We assessed women's needs through expert advice and public surveys to improve facilities." In June 2017, the policy expanded to four areas: "Equality, Inclusivity, Wealth, and Empathy"

The following activities and initiatives align with the gender responsive framework for a women-friendly city:

(a) Governance & Leadership
The Women's Leadership Academy (AKW) provides a platform for women's representation in Selangor, aiming for 30 percent representation in public and political life. Initiatives include leadership training, lifelong learning, research grants by the Empowerment Institute (IWB), a Women's Health Forum on "Women and Public Health in the COVID-19 Pandemic Era", and the Cakna Webinar Series on "Family Responsibility Sharing."

(b) Safety
The Domestic Violence Committee, chaired by the Selangor State Standing Committee on Public Health, Unity, Women's Development, and Family, conducted discussions to address domestic violence during COVID-19 pandamic. The Special Domestic Violence Complaints Hotline (SELamat Line) on 03-64195027 launched on 1 November 2021 with state agencies and NGOs to address domestic violence issues.

(d) Education
Implementation of the "Women in Science and Technology + COVID-19 = What is the Best Formula" 's Forum on the International Day of Women and Girls in Science, observed February 11th by the UN.

(e) Health
The city council conducted health roadshows under the Gaya Hidup Sehat Program, including a workshop for Subang Jaya women on managing work and family stress.

(f) Art, Media & Culture
The Orchid Book documented the accomplishments of the Selangor Women's Policy Organisation. The Proceedings of the Hybrid Selangor Women's Conference was published with 17 papers from the 2021 Conference at the HaSSel Expo. The Teacup Series event highlighted the importance of data in gender development planning.

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(g) Infrastructure & Services

The City Council provides women's infrastructure in buildings under its administration. "*As of September 2020, there were 141 dedicated women´s parking bays, 185 women's toilets, 16 lactating rooms, nine women's swimming pools, and three women's gyms across the city. The council upgraded pedestrian walkways with women-friendly features, landscaping, tree shades, and placemaking in hawker areas, and installed over 100 CCTVs and streetlights in SS15, SS16, and Puchong Utama*", as indicated by Urban Planner 1.

Urban Planner 2 highlighted that the council enforces a 2% + 2% parking bay allocation for commercial premises, with 2% for women and 2% for disabled drivers. These parking bays are for single female drivers, pregnant women, and women with children, located near entrances and lifts. The bays have LED lighting and CCTV cameras connected to the MPSJ Headquarters for monitoring, along with panic buttons and buggy services.

City Council Member 2 stated, "*We built an institutional framework involving expert and civic groups (government agencies, SJCC Internal Department, State Assemblyman, developers, NGOs, Higher Learning Education, and local communities). This enabled women to participate in planning and policy execution through diverse methods – regular meetings, expert group meetings, online feedback system, and on-site monitoring*." To strengthen the "Women Friendly Green City Action Plan", the Subang Jaya City Council developed guidelines for facilities and promoted the project by certifying qualified private sector facilities.

Evaluation

To assess the implementation of initiatives, Subang Jaya a Women-Friendly City. As stated by state assembly women of Subang Jaya "*the incorporation of Universal Design and Crime Prevention Through Environmental Design into new and existing buildings enabled the city to reduce crime rates by 17 % between November 2019 and November 2020.*" This decline resulted from enhanced safety features and inclusive designs that discouraged crime and increased residents' security. This success demonstrates the effectiveness of the Universal Design and CPTED principles in creating safer cities for women.

The success of Subang Jaya's Women-Friendly City is attributed to Mayor's leadership, including project reviews, citizen engagement, and problem-solving. As stated by Urban Planner 2, "*The "Women-Friendly City" goes beyond gender equality and mere institutional improvement and is drawing a very positive response from Subang Jaya residents. The key to the success of the project is the strong and persistent efforts of the Subang Jaya Mayor, the city government's top policy decision maker. She thoroughly reviewed the status of*

the projects regularly and actively collected the opinions and ideas of citizens as well as each department of the city government by holding presentations and assessment sessions. The City Mayor led the women-friendly city project task force team, checked problems in the process of carrying out the project, and provided solutions to resolve them."

The Project influenced city governance by encouraging public servants to include women's perspectives in policy making. Through citizen governance, women participated actively in policy development and evaluation, becoming crucial to the project's success, as noted by City Council Member 3: "*One of the most significant changes made by the "Women Friendly City Project" Women Friendly City Project within the city government is that public servants of the city government began to understand the need to consider women in policymaking. Through a wide range of education, training, and workshops, they recognized the importance of incorporating women's perspectives into the fulfilment of their duties.*"

CONCLUSION

Cities aiming to be women-friendly must ensure that urban development efforts respond to both men and women's needs. Women experience cities differently, making it crucial to prioritise their need for sustainable development. Although Sustainable Development Goals (SDGs) provide a global framework, their achievements rely on local actions. Developing gender responsiveness for a women-friendly city is essential, focusing on SDG 3, promoting gender equality, and women's empowerment. The gender-responsiveness framework comprises 12 key components: (1) governance and leadership; (2) safety; (3) housing and land rights; (4) economic security; (5) education; (6) health; (7) transportation; (8) environment and resilience; (9) art, media, and culture; (10) infrastructure and services; (11) urban spaces; and (12) peace and security. By adopting a gender-sensitive perspective across these components, cities can create environments that better serve women's needs and promote inclusivity and safety.

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Table 4: Components for Women-Friendly City Model

	New Urban Agenda (NUA)	**Sustainable Development Goals (SDG)**	**Convention on the Elimination of all forms of Discrimination Against Women (CEDAW)**	**UN Security Council Resolutions (SCR)**	**UNESCO Priority Gender Equality Action Plan, 2019 REVISION, 2014–2021**	**United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)**	**UN Human Rights, The Environment, and Gender Equality, 2021**
1. Governance & Leadership							
i. **Women & Girl Empowerment** in all fields and levels, ensuring equal rights and participation in **Decision-Making.**	√	√	√				
ii. **Stakeholder Dialogue** with women.	√						
iii. **Women Participation** at urban and territorial policy and planning.	√						
iv. **Gender-responsive budgeting** in financial planning and management.	√						
v. **Civic responsibility and women's participation in governance** through access to information and communication technologies.	√	√					
2. Safety							
i. **Eliminate violence and harassment** against women and girls in all private and public spaces.	√	√	√				
ii. **Eliminate harmful practices** against women and girls.	√	√					
iii. **Improve road safety** and incorporate it into sustainable transportation infrastructure design, prioritizing the needs of women and girls.	√						
3. Housing and Land Right							
i. **Gender-responsive housing** policies.	√						
ii. Gender-responsive solutions for land and property rights, with a focus on securing land tenure for women.	√	√	√				
4. Economy Security							
i. **Equal pay for women**	√	√	√				
ii. Improve livelihoods, working conditions, and income security for women in the **informal economy.**	√	√					

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iii. **Gender-responsive policies to eradicate poverty.**			√								
iv. **Equal economic rights** for women.			√	√							
5. Education											
i. **Equalize educational access** for all.			√	√							
ii. **Gender-responsive facilities** for safe and inclusive learning.			√								
6. Health											
i. **A healthy and secure environment** for women and girls	√										
ii. **Eliminate harmful practices** against women and girls.	√		√	√							
iii. **Access** to adequate, inclusive, and quality **health-care services**	√		√	√							
iv. **Improve nutrition** for adolescent girls, pregnant women, breastfeeding mothers, and older adults.			√	√							
7. Transportation											
i. **Gender-responsive planning and investment** for sustainable **urban mobility.**	√		√								
ii. Improve **road safety** and incorporate it into sustainable transportation infrastructure design, prioritizing the needs of women and girls.	√		√								
8. Environment & Resilience											
i. **Gender-responsive policies** for **urban** resilience.	√										
ii. **Gender-responsive urban** and **territorial development and planning.**	√										
iii. **Women empowerment** in **climate change** planning and management.			√								
iv. Reduce **gender-based discrimination** in environmental issues.											√
v. **Gender-responsive environmental policies.**											√
9.Art, Media & Culture											
i. **Gender equality** in **cultural life.**									√		
ii. Women's **equal participation** in **cultural life.**									√		
iii. **Gender equality in media** through increased representation of women in leadership and decision-making roles.							√				
iv. Ensure **women journalists' safety.**							√				
v. **Gender-responsive reporting.**							√				
10. Infrastructure & Services											
12. Peace and Security											
i. Women representation in **decision-making** for **conflict resolution and peacebuilding.**							√				
ii. **Safeguard women and girls** from gender-based violence during armed conflicts.							√				
iii. **Provide aid** to women and girls, including **victims of violence**.							√				

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IMPACTS OF RISK PERCEPTION ON THE BEHAVIOURAL INTENTIONS OF TOURISTS TRAVELING TO SOUTHEAST ASIA

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Abstract

Southeast Asia, geographically close to China and rich in tourism resources, is a popular destination for Chinese tourists. However, the rising number of outbound Chinese tourists has been accompanied by increasing safety concerns, posing significant threats to tourists' lives and assets and influencing their future travel intentions (TIs). This study examines the impacts of six dimensions of perceived risk—social (SOCR), financial (FINR), physical (PHYR), facility (FACR), psychological (PSYR), and functional (FUNR)—on the behavioural intentions (BIs) of Chinese tourists to Southeast Asia. Using a questionnaire survey and structural equation modelling, we analysed the responses of potential tourists. The findings reveal a high overall level of risk perception (RP) among tourists, with SOCR, PHYR, and FINR significantly and adversely affecting their BIs. This research highlights why it is important for tourism enterprises and destination governments to enhance destination risk management and reduce tourists' RPs to improve their TIs.

Keywords: Behavioural Intention, Risk Perception, SEM, Southeast Asia, Tourism

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INTRODUCTION

The safety of tourists is a critical global concern that significantly affects both tourists and destinations (Zou & Meng, 2020). Decisions regarding tourist destinations are closely linked to perceived travel risks, with safety and security being key factors in choosing a destination (Henderson, 2007; Hall, Timothy, & Duval, 2012). Southeast Asia, given its proximity to China and rich tourism resources, is particularly attractive to Chinese tourists (Liu, Yu, & Wang, 2019). As the largest source of outbound tourists globally (Huang et al., 2021), China accounted for 169 million outbound trips in 2019, representing over 12% of global tourism (Bao, 2020). However, the rising number of Chinese tourists in Southeast Asia has coincided with an increase in safety incidents. For example, telecommunication security issues in northern Myanmar had disrupted normal travel (Guangming Net, 2023). In May 2023, a Chinese couple tragically died while on vacation in Bali (Global Times, 2024a), and a shooting at Siam Paragon in Bangkok in October 2023 resulted in the death of a Chinese tourist (BBC, 2023). These frequent and alarming safety incidents have heightened public concern about travel safety in Southeast Asia, significantly affecting tourists' willingness to visit the region (Liu, Yu, & Wang, 2019). In early 2024, countries like Singapore, Malaysia, and Thailand (Global Times, 2024b; China Daily, 2024) announced visa-free policies for Chinese tourists. Consequently, the issue of outbound travel safety is again in the spotlight. Therefore, it is essential to examine the risk perceptions (RPs) of Chinese tourists travelling to Southeast Asia and how these perceptions influence their travel intentions (TIs).

Recently, many scholars have focused on how RP factors influence tourists' decision-making behaviours (Matiza, 2020; Sönmez & Graefe, 1998). Most studies have explored the concept, influencing factors, and evaluation of tourism RP (Huynh, 2020; Cui et al., 2016; Garg, 2015), treating it as a holistic variable (Seong & Hong, 2021). However, there is a lack of research concerning the impact of distinct RP dimensions on behavioural intentions (BIs). Moreover, empirical studies have not yet explored how these various dimensions affect Chinese tourists' TIs to Southeast Asia. To fill this gap, this study targets potential Chinese tourists to Southeast Asia using a questionnaire survey to analyse the impact of six risk dimensions—social (SOCR), financial (FINR), physical (PHYR), facility (FACR), psychological (PSYR), and functional (FUNR)—on tourists' BIs. This research aims to help tourism practitioners develop more effective marketing strategies and provide insights for policymakers to enhance tourists' security and satisfaction, thereby attracting more Chinese tourists to Southeast Asia.

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LITERATURE REVIEW

Tourism Risk Perceptions (RPs)

This study employs the Perceived Risk Theory as the underlying framework, which posits that individuals' RPs significantly influence their decision-making processes (Bauer & Hancock, 1960; Moutinho et al., 2011). In 1960, Bauer first introduced the concept of PSYR in marketing, highlighting the importance of studying consumers' RPs (Bauer & Hancock, 1960). Subsequently, Mowen and Minor (1995) later defined "risk perception" as the likelihood of the occurrence of negative outcomes. Building on this, Lepp and Gibson (2003) considered RP as a subjective variable, representing the probability of actual risks during the travel process. Moutinho et al. (2011) further elucidated that tourism RP is a function of uncertainty and outcomes, primarily stemming from the product, purchase channels and locations, social, psychology, economics, and tourist experiences. As a theoretical concept in cognitive psychology, RP has been applied across various disciplines, such as sociology, management, and tourism, to gain deeper insights into people's psychological and behavioural responses (Dang, 2022).

Tourism RP has been identified as a construct with multiple dimensions (Cui et al., 2016). For example, Moutinho (1987) researched PHYR, PSYR, and FINR aspects of tourism, suggesting that understanding consumer behaviour requires examining complex interactions among various influencing factors. Lepp and Gibson (2003) identified seven risk factors: health, political instability, terrorism, unfamiliar food, cultural barriers, political and religious dogma, and crime, which were further summarised into three dimensions: PHYR, SOCR, and FUNR. Quintal et al. (2010) categorised tourism RP into five dimensions: PHYR, PSYR, FUNR, SOCR, and FINR. Xu et al. (2013) and Yao and Hou (2019) added FACR, highlighting the impact of destination infrastructure and service facilities on travel safety and experiences. After studying the impact of RP on BIs during the Covid-19 pandemic, Matiza. T (2020) pointed out that, although tourism risk is divided into multiple dimensions, health, PSYR, and SOCR are most likely to influence tourists' future travel possibilities. Bae and Chang suggested that tourists' RP can be divided into two dimensions: cognitive risk and affective risk. The cognitive risk dimension refers to individuals' perception of the vulnerability and intensity of risk, while the affective risk dimension refers to the anxiety or concern individuals face when encountering risks (Bae & Chang, 2021). Based on the above research, the six dimensions of risk—SOCR, FINR, PHYR, FACR, PSYR, and FUNR—were selected due to their relevance to the tourism context and their documented impact on travel behaviour in previous research (Quintal et al., 2010; Xu et al., 2013; Yao & Hou, 2019). This study empirically analyses the impact of these six dimensions of risk on BIs. By incorporating these multiple dimensions of risk into the context of international tourism, we aim to gain a

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nuanced understanding of their individual and collective influence on travel behaviour.

Tourists' Behavioural Intentions (BIs)

Behavioural intention (BI) is defined as the subjective probability that an individual will perform a specific behaviour (Mahardika et al., 2020), and it is considered the best predictor of individual behaviour (Prasetyo et al., 2020). According to the Theory of Planned Behaviour, BI manifests as the willingness of individuals to exert effort and plan to execute specific behaviours (Ajzen, 1991). Generally, the stronger the willingness to engage in a certain behaviour, the more likely it is to be implemented (Prasetyo et al., 2020). In the context of consumer behaviour, BI can also be reflected in the willingness to recommend products or services to others (Sun & Sun, 2022). Thus, the more evident the BI, the stronger the inclination to recommend it to others.

Correlation between Tourists' Risk Perceptions (RPs) and Behavioural Intentions (BIs)

Risk perception (RP) is a crucial factor influencing tourist decision-making behaviour (Dang, 2022). However, there is no consensus in the academic community regarding the impact of RP on tourists' BIs. Some scholars argue that RP does not significantly affect tourists' BIs (Susanto et al., 2021) because potential tourists may exhibit adaptive behaviour, reducing RPs to levels they find acceptable (Lee et al., 2012). Nevertheless, most scholars agree that tourists' RP does influence their BIs (Zorlu et al., 2023; Sánchez-Cañizares et al., 2021; Zhu & Deng, 2020; Bae & Chang, 2021). They argue that tourists generally tend to avoid risks (Susanto et al., 2021), and RPs are more or less consistent with reality (Sánchez-Cañizares et al., 2021). When individuals have high RPs, they are more inclined to avoid those risks, resulting in lower BIs (Zhu & Deng, 2020). Based on this, this paper proposes the following hypotheses:

H1: SOCR negatively impacts tourists' BIs to travel to Southeast Asia.
H2: FINR negatively impacts tourists' BIs to travel to Southeast Asia.
H3: PHYR negatively impacts tourists' BIs to travel to Southeast Asia.
H4: FACR negatively impacts tourists' BIs to travel to Southeast Asia.
H5: PSYR negatively impacts tourists' BIs to travel to Southeast Asia.
H6: FUNR negatively impacts tourists' BIs to travel to Southeast Asia.

RESEARCH METHODOLOGY

Questionnaire Design and Distribution

Based on our theoretical framework, a self-administered questionnaire was developed for this study to evaluate the impact of six RP dimensions on Chinese tourists' TIs to Southeast Asia. The questionnaire was divided into three sections.

The first section gathered respondents' demographic information, including gender, age, education level, monthly income, and frequency of international travel. The second section contained the RP scale, which addressed six dimensions: SOCR, FINR, PHYR, FACR, PSYR, and FUNR, each with at least four items. Social risk (SOCR) items were derived from Bai (2019); FINR items from Yao and Hou (2019), Maulana et al. (2022), and Zhu and Deng (2020); PHYR items from Yao and Hou (2019) and She et al. (2019); FACR items from Yao and Hou (2019), Xu et al. (2013), and Zhu and Deng (2020); PSYR items from Yao and Hou (2019); and FUNR items from Xu et al. (2013) and Zhu and Deng (2020). The third section comprised the BI scale, incorporating four items sourced from Irfan et al. (2021) and Yeh et al. (2021).

Respondents were selected on the criteria that they were at least 18 years old and had prior international travel experience. These criteria ensured that participants had relevant experiences and insights regarding RPs and TIs. The questionnaire was distributed via the Questionnaire Star online survey platform on social media platforms such as WeChat, Moments, QQ, and TikTok from 6-19 May 2024. Of 531 distributed questionnaires, 418 valid responses were obtained after removing duplicates and responses from individuals without international travel experience to ensure data integrity.

Data Analysis Methods

Structural equation modelling (SEM) was employed to analyse the data, using IBM® Statistical Package for Social Sciences (SPSS®) 25.0 for descriptive statistics, reliability analysis, and exploratory factor analysis, and IBM® SPSS® Amos 24.0 for confirmatory factor analysis and structural model testing. Structural equation modelling (SEM) is a robust statistical technique that examines complex relationships among variables while accounting for measurement errors (Dang, 2022). The SEM results are presented and discussed in detail in the following sections.

ANALYSIS AND RESULTS

Sample Characteristics

The sample included 418 respondents with a relatively balanced gender ratio (48% female, 52% male). The majority were aged between 26-35 (36.4%), followed by 18-25 (22.2%), 36-45 (26.1%), 46-60 (12%), and >60 (3.3%). Monthly income varied, with 158 respondents earning >RMB8000, 154 earning RMB4001-8000, 101 earning RMB1001-4000, and five earning <RMB1000. Most respondents had an undergraduate degree (n=162), followed by junior college education (n=125), postgraduate education and above (n=79), and high school education or below (n=52). International travel frequency ranged from once (n=79) to ≥5 (n=88) (see Table 1).

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Table 1: Sample Characteristics

Sample characteristics (n=418)	Number	Percentage (%)	Sample Characteristics (n=418)	Number	Percentage (%)
Gender			**Education level**		
Male	199	47.6	High school or below	52	12.4
Female	219	52.4	Junior college	125	29.9
Age			Undergraduate	162	38.8
18-25	93	22.2	Postgraduate and above	79	18.9
26-35	152	36.4	**Times of Overseas Travel**		
36-45	109	26.1	1	79	18.9
46-60	50	12.0	2	81	19.4
Above 60	14	3.3	3	87	20.8
Monthly Income			4	83	19.9
Below 1000RMB	5	1.2	5 and above	88	21.1
1001-4000RMB	101	24.2			
4001-8000RMB	154	36.8			
Above 8001RMB	158	37.8			

The average RP scores were medium-high for all dimensions, with PHYR having the highest (3.648), followed by SOCR (3.605) and FINR (3.518). Key concerns included safety (PHY5=3.88), violent events (PHY3=3.83), and social security differences (SOC3=3.75). The BI score averaged 2.345, indicating a medium-low willingness to travel to Southeast Asia.

Exploratory Factor Analysis (EFA)

The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity were used to assess data adequacy for exploratory factor analysis. The KMO score was 0.956, significantly exceeding the acceptable threshold of 0.6. Bartlett's test produced a chi-square value of 9478.573 (df=528, $p<0.001$), confirming the data's suitability for factor analysis. Using principal component analysis and varimax rotation in IBM® SPSS® 25.0, seven factors were extracted with eigenvalues >1, explaining 71.625% of the total variance. These factors aligned well with the hypothesised model, indicating strong structural validity.

Reliability and Validity Testing

The reliability of the questionnaire was evaluated using Cronbach's alpha (α). The overall scale reliability was excellent (0.931). The Cronbach's α values for SOCR, FINR, PHYR, FACR, PSYR, FUNR, and BI were all >0.85, demonstrating strong internal consistency and stability across all dimensions.

Confirmatory factor analysis (CFA)

Confirmatory factor analysis (CFA) was conducted to verify the measurement model's validity. Model fit indices were assessed to determine the alignment between the theoretical model and actual data. The results indicate a satisfactory model fit, with $X^2/df=1.903$ ($X^2=901.799$, df=474, p=0.000), RMSEA=0.047, CFI=0.954, GFI=0.881, AGFI=0.860, TLI=0.948, and NFI=0.908 (Table 2). These findings affirm the strong structural validity of the measurement model (Irfan et al., 2021).

Convergent and discriminant validity

The composite reliability (CR) was 0.854-0.908, exceeding the acceptable threshold of 0.70 (Hair et al., 2010; Fornell & Larcker, 1981). The average variance extracted (AVE) estimates were >0.5, indicating strong convergent validity (Fornell & Larcker, 1981). Discriminant validity was confirmed using the square root of AVE for each factor exceeding the correlations between factors, demonstrating robust differentiation among constructs.

Structural Equation Modelling (SEM)

After confirming the measurement model's effectiveness, the hypotheses were examined using the structural model. The R^2 was 0.466-0.756, exceeding the minimum threshold of 0.35, indicating good explanatory power (Cohen, 2013). Path analysis revealed significant negative impacts of SOCR (B=-0.265, p=0.001), FINR (B=-0.135, p=0.042), and PHYR (B=-0.203, p=0.038) on BI. However, the effects of FACR (B=-0.128, p=0.131), PSYR (B=0.062, p=0.443), and FUNR (B=-0.024, p=0.689) on BI were insignificant. Therefore, Hypotheses (H) 1, 2, and 3 were accepted, while H4, 5, and 6 were rejected. Table 3 summarises the results of hypothesis testing.

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Table 2: The Results of the Assessment of the Measurement Model

Dimension	CR	AVE	FUNR	PSYR	FACR	PHYR	FINR	SOCR	BI
FUNR	0.891	0.672	**0.820**						
PSYR	0.854	0.594	0.688	**0.771**					
FACR	0.908	0.622	0.708	0.596	**0.788**				
PHYR	0.894	0.586	0.697	0.716	0.728	**0.766**			
FINR	0.903	0.651	0.637	0.725	0.594	0.725	**0.807**		
SOCR	0.855	0.596	0.647	0.638	0.7	0.651	0.535	**0.772**	
BI	0.897	0.686	-0.491	-0.46	-0.538	-0.556	-0.497	-0.549	**0.828**

Notes: Goodness-of-fit statistics for the measurement model: $\chi 2=901.799$, $df=474$, $p<0.001$, $\chi 2/df=1.903$, RMSEA=0.047, CFI=0.954, GFI=0.881, AGFI=0.860, TLI=0.948, and NFI=0.908. Diagonal values represent the root square of AVEs. CR=composite reliability, AVE=average variance extracted.

Table 3: The Results of the Hypothesis Testing

Path	Unstd.	S.E.	t-value	P	Std.	Result
SOCR → BI	-0.265	0.082	-3.249	0.001***	-0.264	Accepted
FINR →BI	-0.135	0.066	-2.036	0.042*	-0.166	Accepted
PHYR →BI	-0.203	0.098	-2.077	0.038*	-0.197	Accepted
FACR →BI	-0.128	0.085	-1.512	0.131	-0.13	Rejected
PSYR →BI	0.062	0.081	0.767	0.443	0.07	Rejected
FUNR →BI	-0.024	0.059	-0.4	0.689	-0.033	Rejected

*Notes: Unstd. = unstandardised coefficient, Std.= standardised coefficient. ***p <0.001, *p <0.05*

A standardised path coefficient diagram was obtained after coefficient standardisation. Of the three latent variables of SOCR, FINR, and PHYR, SOCR had the greatest impact on BI (β SOCR→BI=-0.265, p=0.001), followed by PHYR (β PHYR→BI=-0.203, p<0.05), and, lastly, FINR (β FINR→BI=-0.135, p<0.05) (Figure 1). Therefore, SOCR factors are indicated as the primary obstacles hindering potential Chinese tourists from travelling to Southeast Asia.

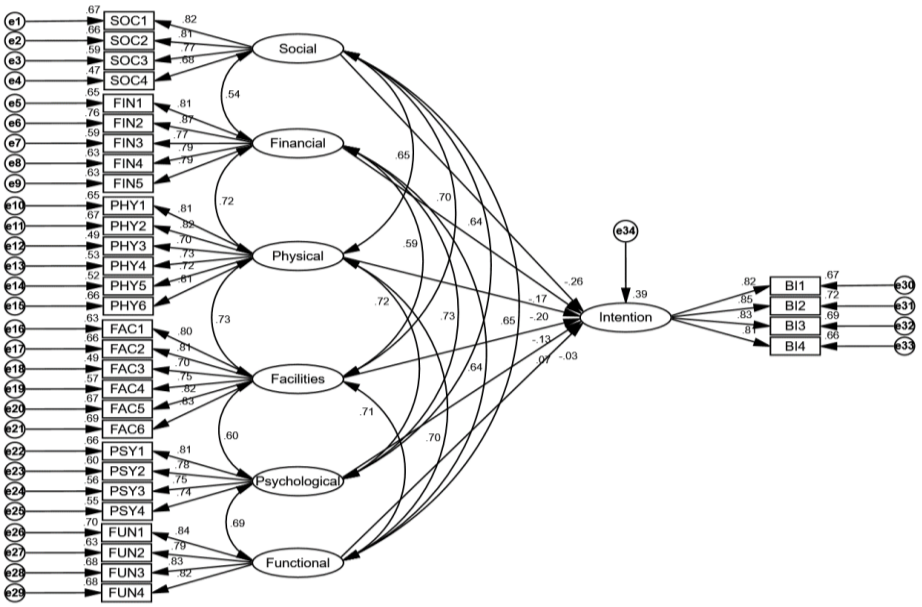


Figure 1: The Result of the Standardised Path Coefficient

DISCUSSION AND CONCLUSIONS

Discussion

This study examined the correlation between the RPs and TIs of Chinese tourists to Southeast Asia. By analysing the influence of six distinct types of RPs—SOCR, FINR, PHYR, FACR, PSYR, and FUNR—on TIs, valuable insights have been gleaned regarding travel behaviours. The findings from EFA, CFA, and SEM reveal key insights.

Firstly, tourists demonstrate high RPs coupled with low BI. Respondents generally had moderately high RPs, with PHYR being the most pronounced, particularly concerning destination safety and potential violence during travel. It underscores significant apprehension about safety and security in Southeast Asia. Social risks (SOCR) and FINR followed closely. The heightened RPs among Chinese tourists can be attributed to frequent reports of negative incidents involving Chinese tourists and recent political turmoil and social instability in certain Southeast Asian countries (Global Times, 2024a; BBC, 2023; Anna Plunkett, 2023). Additionally, global events such as contagious diseases (Škare et al., 2021), natural disasters (Liao & Fan, 2017), and cultural differences (Hou, 2020) contribute to elevated RPs. Consequently, the high RP translates into low BIs, particularly regarding tourists' willingness to recommend Southeast Asia to others.

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Secondly, SOCR, FINR, and PHYR significantly and negatively impact Chinese tourists' TIs to Southeast Asia. Among these, SOCR has the most substantial negative impact, followed by PHYR and FINR. Social risks (SOCR) include public safety and religious beliefs that pose potential risks to tourists (Cui et al., 2016). Due to the unique social environment in Southeast Asia, tourists perceive SOCR more acutely, thereby diminishing their TIs. Financial risk (FINR) involves perceptions of potential financial losses and the belief that the price of travel products or services may not align with their values. A heightened perception of FINR negatively influences BIs. Physical risk (PHYR) pertains to potential health threats due to weather, security, and hygiene. Individual differences, such as physical fitness, make tourists more sensitive to PHYR (Yao & Hou, 2019), thereby negatively impacting their TIs.

Thirdly, the impact of FACR, PSYR, and FUNR on Chinese tourists' TIs was insignificant. This may be because, compared to SOCR, FINR, and PHYR, these risks are perceived as more controllable or less likely to result in severely negative outcomes. For instance, Southeast Asia, as a relatively mature and cost-effective travel destination, has well-developed tourism infrastructure and policy framework, minimising the impact of FUNR. The facility risks (FACR) aspect, involving potential failures of facilities, transportation, or equipment, is relatively low due to careful planning and the short-term nature of tourism. Psychological risk (PSYR), related to mental well-being and emotional discomfort, poses a weaker influence on TIs. Moreover, FACR or FUNR can often be mitigated through careful planning and the selection of reputable service providers.

CONCLUSIONS

This study expanded the Perceived Risk Theory by incorporating multiple risk dimensions into the context of international tourism, providing a nuanced understanding of how these risks individually and collectively influence travel behaviours. It demonstrates that not all RPs carry the same weight, enriching the framework of BIs and underscoring the complexity of the travel decision-making process. These findings highlight the importance of addressing these risks to improve TIs. To attract Chinese tourists, Destination Marketing Organisations (DMOs) in Southeast Asia should prioritise mitigating SOCR and personal risks by enhancing security measures, clearly communicating safety protocols, and improving the overall sense of safety. Marketing campaigns should specifically address the concerns of Chinese tourists, emphasising measures taken to ensure safety and security and promoting positive travel experiences. Furthermore, governments of Southeast Asian nations should collaborate with tourism stakeholders to implement policies that bolster visitor safety, including stricter crime regulations, improved emergency response systems, and partnerships with Chinese travel agencies. Continuous improvements in facilities, psychological,

and functional areas can enhance the overall visitor experience, providing high-quality facilities and services to foster positive word-of-mouth. By addressing these key concerns, Southeast Asian destinations can position themselves as safe and attractive options for Chinese tourists, ultimately boosting the region's tourism industry.

LIMITATIONS

The sample in this study is limited to Chinese tourists, which may restrict the generalisability of the findings. Future research should include diverse tourist groups to validate and extend these results. Additionally, RPs are dynamic and influenced by factors like political stability, pandemics, and economic conditions. Longitudinal studies are recommended to capture these fluctuations and their impacts on travel behaviour over time. Lastly, future research should explore additional risk factors, such as environmental risks and geopolitical tensions, for a more comprehensive understanding of influences on TIs.

ETHICAL STATEMENT

All participants voluntarily participated in this study after being informed of its purpose and procedures. Informed consent was obtained, and participants' anonymity and confidentiality were strictly maintained. The data collected were used solely for academic research purposes.

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ARCHITECTURAL HERITAGE CONSERVATION IN A MULTICULTURAL LANDSCAPE: THE CASE OF THE CHAN SHE SHU YUEN CLAN ANCESTRAL HALL IN KUALA LUMPUR, MALAYSIA

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Abstract

Architecture embodies multiculturalism in material form. Since the mid-19th century, Kuala Lumpur has developed a diverse architectural and cultural landscape owing to its complex geography, immigration waves, and inter-ethnic interactions. This study examines the significance of the Chan She Shu Yuen Clan Ancestral Hall as historical architectural heritage, focusing on its architectural form and decorative arts as expressions of the city's multicultural built environment. Using interpretive methods on documentary and field investigations, it analyses the building's historical context, spatial configuration, and decoration. The findings show that Chinese clan buildings in Kuala Lumpur integrate tropical architectural features with the regional characteristics of Chinese clan architecture. This reflects a clear 'origin-and-development' relationship between clan buildings in southern China and Malaysia from 1901 to 2000, highlighting their role in shaping Kuala Lumpur's multicultural urban landscape.

Keywords: Architectural heritage, architectural form and decoration, Chinese clan association building, Chan She Shu Yuen Clan Ancestral Hall, Kuala Lumpur, Malaysia

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INTRODUCTION

Located in the middle of Southeast Asia, Malaysia has long been a centre for the intersection of various cultures (De Witt, 2010). During the 19th century, Western colonial powers encouraged the development of industrial raw material industries in Southeast Asia, which attracted large numbers of labourers from China and India to the Malay Peninsula. While these migrants contributed significantly to the region's economic development, the architectural landscape was shaped primarily by Chinese merchants, clan associations, and temple builders, who constructed buildings reflecting their cultural identity and aspirations (Gibson-Hill, 1952). In this study, the term "clan association building" is used to refer to traditional Chinese huiguan (会馆) structures established by dialect, lineage, or territorial associations within the Chinese community. The interaction between these structures and indigenous Southeast Asian architecture led to the emergence of a rich and diverse architectural culture in Malaysia (Yeang, 1992). Traditional Chinese-style buildings have long been an integral part of Malaysia's multicultural built environment, representing the enduring legacy of Chinese communities.

This study aims to examine the structural features and decorative arts of the Chan She Shu Yuen Clan Ancestral Hall (CSSYKL), a bloodline-based Chinese clan association building located at the end of Petaling Street.As the only surviving example of the traditional Chinese 'Guangfu' style in Kuala Lumpur (Chan, 2020), CSSYKL offers valuable insights into the historical significance of Chinese clan architecture in Malaysia's multicultural urban landscape. The findings of this study contribute to the understanding of Chinese clan buildings, support urban heritage preservation efforts, and promote the sustainable development of Kuala Lumpur's diverse built environment.

LITERATURE REVIEW

Chinese Clan Association Buildings in Malaysia

Historic buildings represent vital components of the world's cultural heritage, embodying the collective memory, identity, and values of human civilisation. Chinese clan association buildings are an essential part of the historic architectural heritage of Southeast Asia and play a significant role in the preservation of its cultural legacy. In contrast to heritage research and conservation in the colonial cities of the Straits, little research has been conducted on the urban heritage of Kuala Lumpur, Malaysia (Saleh, 2023). Malaysian Chinese clan association buildings form part of the "Chinese architectural culture circle," a concept referring to the diffusion and integration of Chinese architectural traditions across Southeast Asia. This cultural circle developed through exchanges among cities along the southeast coast of China, the Malacca Strait, and Southeast Asian countries (Qing, 2005). Chinese clan association

buildings in Malaysia were established based on dialect, clan, lineage, territorial, and occupational affiliations within the Chinese community.

The CSSYKL has successfully inherited the feng shui principles of site selection characteristic of traditional Chinese architecture (Puan, 2008). The Chan Clan Association of Kuala Lumpur briefly introduced the building's historical background and architectural decoration (Guoqing, 2008). Mui examines how immigrant culture and identity are expressed in the roof decorations of Chinese clan association buildings in Malaysia (Mui, 2012). Chan has conducted an in-depth study on the significance of CSSYKL as the architectural heritage of Kuala Lumpur, which has effectively enhanced the urban cultural value of Kuala Lumpur (Chan R. S., 2019). Chan has taken the example of CSSYKL to explore its role as cultural heritage in uniting the Chinese community in Malaysia (Chan, 2020). Building on these prior studies, this research elaborates on the architectural features of CSSYKL from three dimensions—architectural history, spatial configuration, and decorative arts—and explores the multicultural characteristics embedded in traditional bloodline-based Chinese clan association architecture in Malaysia.

RESEARCH METHODOLOGY

This study adopted a qualitative research methodology within an interpretive paradigm to explore the cultural connotations embedded in CSSYKL's architectural spaces and decorative arts (Alharahsheh, 2020). The data were analysed using logical reasoning, symbolic decoding, and historical comparisons to uncover the building's cultural meanings and its role in shaping Malaysia's multicultural urban landscape. The interpretive approach enabled a deeper understanding of how CSSYKL's architectural forms and decorative arts express cultural identity, heritage values, and the consciousness of the immigrant community. This method also positioned the building within its broader socio-political and environmental context, revealing how its design reflects adaptation to local climate and urban conditions. Furthermore, the study highlights CSSYKL's dual role as a functional space for clan worship and community gatherings, as well as a symbolic structure carrying collective memory and identity.

The data for this study consisted of architectural spaces, architectural plans, and associated decorative images. First, site visits were conducted to accurately map the building's layout. Second, detailed photographs were taken to document the fine elements of its architectural decoration. Third, primary data were obtained through the historical exhibition hall of CSSYKL and the Chinese community research centre, enriching the understanding of the building's cultural significance and contemporary relevance. Finally, decorative patterns were compared with traditional Chinese theories of decoration to interpret their

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symbolic meanings. Traditional Chinese totemic culture has been continuously transmitted through immigrant groups, and both architectural and totemic cultures represent positive expressions of these groups' cultural consciousness. This integrated method of data collection and analysis has proven effective in heritage studies (Utaberta, 2023). Through these methods, the significant value of CSSYKL as a historic building can be interpreted as reflecting the growth patterns of Malaysia's multicultural landscape.

ANALYSIS AND DISCUSSION

Historical Background of the Building

The CSSYKL is closely linked to the Chan Lineage Hall in Guangzhou, China. In 1893, members of the Chan clan from across Guangdong Province funded the construction of a joint ancestral hall in Xiguan, Guangzhou, to provide lodging for clan members visiting the provincial capital for Imperial Examinations. Inspired by the Chan Lineage Hall during a visit to Guangzhou, Chan Siew Lin, a prominent leader in Kuala Lumpur's mining industry, discussed with fellow clansmen Chan Chun and Chan Sun Yuet the possibility of constructing a similar building in Kuala Lumpur. By 1896, the Chan clan urgently needed a public space in the city for daily rituals and gatherings (Guoqing, 2008).

At the time, the British colonial government was auctioning land in Malaya. On 15 December 1897, Chan Siew Lin purchased seven adjoining shop lots on Petaling Street for $3,500 and dispatched representatives to Guangzhou to survey the Chan Lineage Hall. The design of CSSYKL was scaled down to match the purchased land. Construction materials—including bricks, tiles, wood pillars, and carved components—were sourced from Guangzhou, while stone columns came from Malacca. The workforce was recruited locally. Given the project's scale, completion took several years and underwent modifications. The government granted extensions, and Chan Jai Tin, another mining leader, later oversaw the project. On 9 February 1906, the clan leaders formalised public trusteeship for the estate (Guoqing, 2008).

In traditional Chinese architecture, site selection is guided by feng shui, which integrates geography, aesthetics, psychology, and human adaptation to nature. The core elements—mountains and water—are symbolic: mountains ("dragon veins") protect against wind and thermal reflection, while water represents wealth and sustainability (Chen, 2004). The CSSYKL conforms to the feng shui requirement of 'back to the mountain and face to the water' for traditional Chinese clan buildings，with its back against Mount Chin Woo and facing the Klang River. In 2007, the Malaysian government listed it as a historical heritage building for conservation under the National Heritage Act 2005 (Malaysia, heritage.gov.my, 2005). For descendants of the Chan clan, CSSYKL represents a spiritual home; for the public, it is a museum of architectural art; and

for the government and scholars, it is a heritage asset that warrants urgent preservation (Figure 1).



Figure 2: Location of Chan She Shu Yuen Clan Ancestral Hall at the End of Petaling Street, Backed by Chinwoo Hill and Facing the Klang River, Kuala Lumpur
Source: Author's compilation based on Google Maps and field survey.

Plan Composition and Spatial Form of the Building

Traditional Chinese clan temples are very elaborate in terms of building location, orientation, and architectural form, and the CSSYKL is a typical Chinese clan temple building. The Chan Lineage Hall in Guangzhou features a square overall layout: the main building is divided into three hallways, with three entrances along each route; the two flanking structures consist of compartmentalised rooms and side halls. Along the depth of the complex, each route is separated by Qingyun Lane (a narrow open-air passage between the main and side halls, serving as a spatial divider, ventilation corridor, and fire buffer typical of Guangdong clan architecture). In terms of width, the front and rear gable porches define the independent parts of the main building. The traditional side corridors are integrated into Qingyun Lane or transformed into front gable corridors of the outward-facing side halls, creating a grid-like connection of courtyards and buildings both longitudinally and transversely.

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CSSYKL occupies a quarter of an acre and is about one-sixth the size of the Chan Lineage Hall in Guangzhou, with adaptations and innovations in the classic 'open three roads' architectural pattern. It comprises a front hall, main hall, left and right compartments, and front compartments. The main entrance connects directly to the side halls rather than passing through Qingyun Lane. The overall structure is composed of brick walls combined with wooden and stone components, arranged in two sets of three-room units symmetrically along the central axis, forming a layout resembling the Chinese character '口' (Figure 2). The layout follows the Qing Dynasty's classic 'open three roads' pattern, with two sides incorporating Qingyun Lane and compartments. However, in CSSYKL, the open-air passageway between the two main halls has been covered with a roof to better accommodate the heavy rainfall typical of Kuala Lumpur's tropical climate.

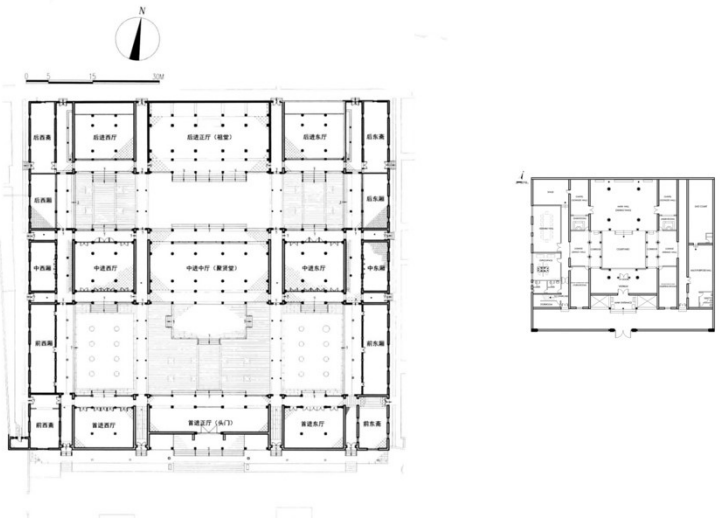


Figure 2: Comparison of Floor Plans: Left – Chan's Lineage Hall, Guangzhou; Right – Chan She Shu Yuen Clan Ancestral Hall, Kuala Lumpur
Source: Left – Guangzhou Folk Art Museum, South China University of Technology, The Chronicle of Chan Clan Ancestral Hall, China Architecture & Building Press, May 2011; Right – Drawn by the author,2024

The central section of the building adopts a spatial pattern characterised by the "Gate Hall", with the traditional chamber function shifted to the side rooms adjacent to the main hall. The left and right sides of the central axis are composed of side halls and compartment rooms, connected to both the side spaces and the rear of the hall. Of the four compartments at the front and rear, those adjacent to

the main entrance include patios that enhance lighting and ventilation, making the hall brighter and more comfortable.

The building demonstrates effective adaptation to the humid, rainy tropical climate. Even on rainy days, the internal passageways are fully covered by a roof, ensuring that pedestrians remain dry. This roofed passageway exemplifies how the architectural design has been modified to suit the tropical environment. While the overall layout inherits the classic forms of Guangfu architecture, it integrates a feng shui-based arrangement that promotes ventilation and facilitates water drainage.

The spatial composition of the building comprises entrance spaces and architectural spaces. The entrance space refers to the external forecourt, while the architectural space encompasses both the sacrificial and ancillary functional areas. The front hall is enclosed by walls and features four celadon brush-shaped decorations on either side of the entrance, symbolising the clan's aspiration for scholarly success across generations and guiding visitors visually into the architectural space. Flanking the front hall are compartments and an open-air patio near the entrance, which provides additional light and ventilation.

The main entrance is screened by two stained-glass doors and windows that form an inner vestibule. Access to the front hall is via the side entrances, and above the central zone is a patio that admits natural light. The side compartments are open spaces without doors or windows, supported by four stone pillars. The left compartment now functions as an office, while the right compartment, known as Lai Jin Hall, is an open structure also supported by four stone pillars. From these side compartments, visitors can enter the side ancestral halls near the front hall's main entrance. The left side currently houses the Historical Memorial Hall (also called the Cultural Relics Hall), while the right side displays exhibits focusing on CSSYKL and prominent members of the Chan clan in Malaysia. These are all ancillary spaces.

The main hall, located at the rear of the central axis, serves as the building's core space and houses the ancestral tablets and statues of the Chen family's forebears. Known variously as the central hall, worship hall, or hall of enjoyment, it forms the essential element of the "three-entry" ancestral hall sequence. The sleeping and central halls are combined to form the back hall, with an open layout supported by pillars.

Compared to the Chan Lineage Hall in Guangzhou, which is a multi-layered complex comprising numerous buildings, CSSYKL presents a simplified, less hierarchical architectural ensemble. Nevertheless, both share a common design approach: using single buildings as basic units, carefully arranged and dispersed to create a cohesive compound with a sense of enclosure. Classical Chinese architecture uses an additive method, combining multiple structures for varied functions to create an organised, layered environment. Each building is

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independent yet complementary, with courtyards serving as collective and dispersive spaces. This design reflects a holistic concept, balancing primary and subordinate spaces, solid and void, and ensuring coherent functional circulation.

Decorative Arts of the Building

Classical Chinese architecture generally features more decorative elements than purely ornamental elements. Many components and structures are not merely added for aesthetic or artistic purposes but instead serve symbolic and cultural functions (Li, 2014). The ancestral hall, initially a family building, gradually evolved into a regional architectural form, and thus best represents regional characteristics in its decorative techniques.

The CSSYKL shares common roots with the Chan Lineage Hall in Guangzhou — from building materials and structural ingenuity to colourful paintings and embellishments, the architectural lineage is evident. The Hall in Kuala Lumpur is enclosed by a glazed brick wall, while traditional grey bricks are used for the building's exterior. When viewed from a distance, the gable walls on both sides of the roof appear to undulate like flowing waves. They are shaped like a golden saddle with a tiger's head or resemble a penstock — architectural features that are collectively known as "Wok Ears", which are a distinctive and iconic characteristic of traditional Guangfu architecture, especially in southern China and its diaspora regions (Figure 3).



Figure 3: Aerial View of Chan She Shu Yuen Clan Shu Ancestral Hall, Kuala Lumpur, Malaysia
Source: Author's Survey, 2024

Decorations on Ridges and Wall Coverings

The ridge ornaments are the most typical decorative elements of the CSSYKL. The two ceramic ridges in front of the hall and the main entrance are especially rich. This decorative technique originated during the late Ming and early Qing dynasties. It flourished during the late Qing Dynasty and was mainly famous in the Lingnan region of China, reflecting southern Guangdong's rich folk architectural decorative style.

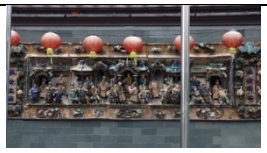
The front hall, main hall, and two side rooms of the CSSYKL are covered with various types of ceramic carvings and decorations along the main roof ridge. Traditionally, ancestral halls in China were only permitted to display fish on roof ridges, as dragons symbolised imperial power. However, the roof of this hall features two dragons playing with a pearl at the centre, flanked by Arowana fish, birds on the left, and animals on the right. The inclusion of dragon sculptures reflects the Malaysian Chinese community's aspiration to break free from the highly centralised feudal rule of the Central Plains, while simultaneously expressing their longing for supreme power through the dragon totem and their hope to gain strength and vitality through unity. The image of the Aoyu conveys a prayer for future generations to "du zhan ao tou" (to attain the top rank in the imperial examination), aligning with the Confucian ideal of "maintaining family harmony and educating future generations" (See Table 1: a, b, c).

Furthermore, lime stucco sculpture (a traditional moulded lime mortar decoration combining sculpting and painting, typical of Guangfu architecture) has been added to parts of the main ridge between the ceramic decorations and tiled roof. These lime stucco sculptures are acid-, alkali-, and heat-resistant, well adapted to the climatic conditions of the tropics. Such lime stucco sculpture is mainly found on the ridges of the front and main halls. For example, the statues of dragons, birds, flowers, pine trees, and immortals on the back of the roof ridge of the front hall are all lime stucco sculptures, mainly decorated with highly saturated colours such as yellow, red, white, blue, and green. Most of these sculptures depict folk customs, using allegory and symbolism to convey messages of enlightenment, guidance, and blessings. In addition to their decorative function, they cleverly incorporate ventilation holes along the roof ridge to mitigate the impact of typhoons on the structure (See Table 1: d, e).

The façade of the Hall is beautifully decorated with green-glazed bricks meticulously arranged like intricate relief murals, themed on traditional Chinese opera. The bricks prominently feature the famous and highly regarded Shiwan ceramic figurines from the Lingnan region, depicted in authentic Ming Dynasty costumes (a metaphor for defying and resisting the Qing dynasty). The lifelike figures were crafted by Wu Qiyu, a renowned master of Shiwan ceramic sculpture in Guangdong, China, and bear inscriptions such as *Guangxu bing-wu* (1906, indicating the exact year of construction) (See Table 1: f).

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Table 1: Decorations on ridges and wall coverings

Building Decorations	Building Decorations
 (a) Dragon-shaped decoration and lime stucco sculpture on the ridge façade of the vestibule	 (b) Dragon-shaped decoration and grey sculpture on the inner side of the roof ridge of the forecourt
 (c) Aoyu decoration on both ends of the roof ridge (*Aoyu*: mythical giant fish placed at ridge ends to protect against fire and bring good fortune)	 (d) Lime stucco sculpture in the shape of a dragon
 (e) Lime stucco sculpture in the shape of flowers and birds	 (f) Ceramic sculptures of traditional Chinese theatre on the facade

Source: Author's Survey, 2024

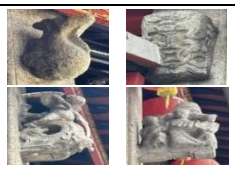
Decoration Made by Carving

The Most of the wood carvings are gilded in gold and black, creating an effect that is both brilliant and solemn. Shallow relief, openwork, and rounded carving techniques are combined to showcase superb craftsmanship.

The wood carvings are primarily found on the doors, windows, and wooden structural components of the buildings, especially on beams, arches, melon tubes, birdbaths, and sealed eaves boards. Most of the wood carvings are gilded in gold and black, creating an effect that is both brilliant and solemn. Shallow relief, openwork, and rounded carving techniques are combined to showcase superb craftsmanship.

Upon entering the front hall through the threshold of the gate, a wood carving of "Kirin Giving Birth" is seen at the lower part of the Yi door (See Table 2: a). Above the door, a richly ornamented structure known as the "Colourful Door" is suspended above the beams, inscribed with the date of creation and the donor's name, indicating that the work was completed during the Guangxu bing-wu year (1906) of the Qing dynasty and donated by the Chan clan (See Table 2: b). The triangular sparrow brace between the central door and the beams is also gilded and coloured, adding splendour to the entrance

Table 2: Decoration made by wood and stone carving

Building Decorations	**Building Decorations**
 (a) Wooden Carving 'Kirin Giving Birth' on the 'Yi door'	 (b) The wood carving above the Yi door is called 'Colourful Door'
 (c)TheBogu beam frame	 (d) The eaves boards
 (e) (Left) drum-shaped bearing stone; (right) foundation of a pillar	 (f) Decorative stone carvings on the upper end of the stone pillars

Source: Author's Survey, 2024

The rest of the wood-carving decorations are concentrated on the wooden frame structure of the front hall, main door, and left and fitting rooms. The main structure of the beam frame of the main door and those of the two sides of the corridor are antique shelf bam frames (See Table 2: c). The beam frames inside and outside the antechamber are carved with various figures, fruits and melons, vessels, flowers, animals and other patterns, and the tracing of gold and application of colours are accurate and flawless. The beams on both sides of the corridor are placed directly on the slope as triangular antique shelf beams carved with plant motifs, animals, and other shapes. The architectural form and decorative content of the two sides are symmetrical. The eaves boards can shield the internal components of the eaves from rainwater erosion and have a decorative function (See Table 2: d). The sealing eaves boards of the Hall's front hall, connecting corridor, and main hall are decorated with exquisite wooden carvings. Gold painted on wood carvings is a perfect combination of mechanics and aesthetics, and the building's wood carvings and decorations are in harmony with the entire building, reflecting the carving artisans' superb skills

The stone carvings of the Hall are based on functional architectural structure decoration, considering the functionality and aesthetic value of architectural components, which mainly include stone pillars, beams, lintels, and

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column bases, which are well-adapted to Malaysia's hot, rainy, and humid climate. The stone pillars on the left and right sides of the eaves of the main entrance of the front hall are each topped by two stone-carved lions, which carry the eaves sealing boards. Not only is the weight of the upper beam transferred to the stone beam, but it also has a decorative function (See Table 2: e).

Stone carvings on either side of the door depict three figures representing "promotion in rank" as a blessing for future generations' success. Inside the front hall, four granite pillars around the courtyard rest on three-layered square bases symbolising "rising step by step." Stone pillars are adorned with carvings such as flying angels holding lamps (symbolising prosperity and offspring), carp (fire prevention), and bat-shaped motifs (good fortune). The main hall's stone pillars feature carvings of an elderly man with a child, symbolising filial piety, love for children, and reverence for ancestors (See Table 2: f).

Other Decorative Arts in the Building

Colourful paintings and couplets are important decorative arts in the Hall. Colourful paintings are mainly painted on the exterior walls, gate posts, beams, and frames. Above the interior walls of the front and main halls are painted traditional Chinese character stories, the main stories of the Twenty-four Filial Piety Characters, and feng shui paintings of mountains and birds, some of which have already peeled off (See Table 3: a). Their use is appropriate and colourful, making the entire architectural style express traditional Chinese characteristics.

Couplets are a unique structure in traditional Chinese architecture that can be used to decorate buildings and give them more cultural colours. The main door of the front hall of the Hall is a transitional space before entering the main building. The doorway of the front hall is inscribed with four prominent characters, 'chan shi shu yuan' in Yan Style, which is simple, solid, and powerful.

The couplets on both sides of the doorway read: "The star of virtue shines far and far, and the flow of the Ying Shui School is long", which tells the story of Chan Shi, the founder of Yingchuan during the Eastern Han Dynasty. The "star of virtue" here refers to the gathering of the stars of virtue, symbolising the story of Chan Shi's father and son. Inside the hall, four large columns support the beams and purlins, with long couplets hanging from the columns. This implies that the descendants will have a long life, cultivate virtue, and teach the clan to pass on the spirit of virtue of the ancestors of the Chan clan (See Table 3: b).

The CSSYKL was started in 1897 and completed in 1907. Although it was modelled directly on Chan Lineage Hall in Guangzhou, new architectural elements were incorporated into the construction and maintenance processes. The exterior walls were decorated with stucco and drawn brick joints, a practice common in Malacca and Penang traditional buildings, reflecting the adaptation of Chinese architecture to the local context (Jiqiang, 2023). To cope with the

humid and rainy climate of Kuala Lumpur, stone was extensively used, and Qingyun Lane was roofed for rain protection. Owing to the lack of burnt bricks, ceramic floral sculptures adorned the walls, adding delicacy to the façade.

Details of this multicultural fusion can also be seen in some architectural decorations of the CSSYKL. For example, Western religious culture influences the stone carvings with angel wings on the front hall's stone pillars. The coloured glass used for decoration in the central door and connecting corridor is taken from the design elements of Western religious architecture (See Table 3: c). Another example is the arched plaster decoration above the passageway of the connecting corridor, which is a Greek architectural element (See Table 3: d). These architectural decoration details can be regarded as examples of the Hall's integration of diverse architectural cultures.

Table 3: Other decorative arts in the building

Building Decorations	**Building Decorations**
 (a)Painting on the inside of the main hall wall	 (b) Couplets in the main hall
 (c) Door decorated with coloured glass	 (d) Door decorated with plasterboard

Source: Author's Survey, 2024

CONCLUSION

This study systematises the value and significance of Chinese clan association architecture as represented by the CSSYKL, in the diverse architectural and cultural landscape of Malaysia. It suggests that the Hall in Kuala Lumpur basically follows the form of traditional Chinese clan architecture in terms of site selection, layout, and spatial combination, but presents new forms in the specific internal spatial structure, such as the design of the connecting corridors and the arrangement of the functional rooms, which are influenced by the local geographic environment and the social and cultural influences of the Malay Peninsula. In the early 20th century, the Chan She Shu Yuen Clan Ancestral Hall emerged as an outstanding example of architecture shaped by the interaction of

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Chinese immigrant culture, colonial influences, and local environment, representing a valuable piece of historic architectural heritage.

This study expands on the symbols of Kuala Lumpur's diverse architectural landscape and culture. As cultural symbols in the development of world history, architecture and culture tend to demonstrate the uniqueness of regional culture and strengthen the identity of historical architectural heritage. The architectural space and decoration of the CSSYKL have both national and international attributes, ranging from traditional Chinese decorative arts that emphasise the "nationalism of style" to a mixture of colonial colours and Western religious ideas, which fits the historical background and development prospects of the multicultural life of the Malay Peninsula. The promotion and preservation of the Chan She Shu Yuen Clan Ancestral Hall's architectural and cultural heritage value is important for enriching Kuala Lumpur's architectural heritage and maintaining the city's sustainable development.

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GOVERNANCE ISSUES IN THE MANAGEMENT OF GOVERNMENT QUARTERS IN MALAYSIA: EVIDENCE FROM AUDITOR GENERAL'S REPORTS (AGR)

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Abstract

Governance determines the utilisation, liveability, and fiscal sustainability of Malaysia's government quarters, yet recurring weaknesses are consistently highlighted in Auditor General's Reports (AGRs). This study assesses governance gaps using systematic audit evidence. A total of 608 AGR findings from 2002–2022 were analysed within a six-dimension framework aligned with national asset management policies: Institutional & Administrative, Allocation & Tenancy, Financial, Maintenance & Procurement, Environment, Safety & Facilities, and Monitoring & Recordkeeping. Maintenance and recordkeeping account for over 40% of all findings, reflecting absent preventive maintenance, fragmented registries, weak enforcement, and mismatched allocations. Temporal analysis shows institutional and safety issues were more prevalent under MPAM, while financial and monitoring gaps intensified during the PSPATA era. The study contributes a longitudinal dataset of audit evidence and a federal–state comparative perspective. Policy recommendations include preventive maintenance regimes, integrated quarters registries, and outcome-linked budgeting to enhance the governance of government quarters as strategic public assets.

Keywords: government quarters; governance; Auditor General's Reports; asset management; Malaysia

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INTRODUCTION

Government quarters are government immovable assets that are provided for civil servants, including healthcare personnel, police officers and teachers. The quarters provision is vital in supporting workforce deployment in both urban and rural areas as well as ensuring the livability and well-being of civil servants. Several key frameworks, including Manual Pengurusan Aset Menyeluruh, MPAM (Urus Setia JPAK, 2021a) and the Pelan Strategi Pengurusan Aset Tak Alih, PSPATA (2021–2030) (Urus Setia JPAK, 2021b), are prepared to enhance the governance of government immovable assets, including government quarters. The frameworks emphasize lifecycle-based asset management, preventive maintenance, transparent allocation, and integrated monitoring systems.

Despite the existence of various frameworks, recurring governance challenges persist in managing government quarters, which include underutilisation and mismatched allocations (Zulkanain et al., 2022), weak enforcement (Shahrul Annuar & Sulaiman, 2019), fragmented data (Jaafar et al., 2025), and inadequate maintenance regimes (Simpeh et al., 2023). The highlighted weaknesses prove the gap between formal frameworks and their actual implementation at both federal and state levels.

Hence, the paper aims to examine governance issues in the management of government quarters in Malaysia through a systematic analysis of Auditor General's Reports (AGR) or Laporan Ketua Audit Negara (LKAN) (2002–2022). The outcome of this paper will assess whether current governance practices are adequate to sustain the utilisation, fiscal efficiency and liveability of government quarters while offering evidence-based insights for planning and asset management reforms.

LITERATURE REVIEW

Governance in Public Sector Housing

Governance in public sector housing involves institutional arrangements, regulatory frameworks, and accountability mechanisms that influence allocation, maintenance, and utilisation outcomes. Strong governance promotes equitable access, financial sustainability, and safe living conditions, whereas weak governance leads to inefficiencies and deterioration (Muhdiarta, 2025). Frameworks such as MPAM and PSPATA in Malaysia outline the emphasis on lifecycle-based management, preventive maintenance, and evidence-driven planning. Nevertheless, AGRs continuously reveal systemic weaknesses, including outdated records, weak enforcement, mismatched allocations, and poor contractor oversight.

Weak structures, limited resources, and unclear responsibilities were identified as the recurring weaknesses under institutional and administrative dimensions (Mohamad Zam et al., 2025). While Malaysian AGRs reported there

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are ongoing issues with enforcement, monitoring, and tenancy management (Bilal et al., 2019), countries with dedicated housing agencies show better results. Aziabah (2018) argues that factors such as adequacy, quality, and affordability are acknowledged as crucial performance indicators. However, issues like fragmented oversight and insufficient accountability are still reported under the governance of various sectors (Shariman et al., 2017).

Singapore's Housing Development Board shows how integrated oversight can be effective, while China's Public Rental Housing reflects the possibilities of governance that brings state, market, and civic actors together (Yan et al., 2020). Meanwhile in Malaysia, AGRs consistently reveal fragmented enforcement and weak tenant management. Learning from other countries is vital, as it helps to address the governance gaps in Malaysia that require systemic reform, particularly in strengthening monitoring, institutional capacity, and stakeholder engagement. In this context, evidence from AGR provides a systematic foundation for advancing reforms in the management of government quarters.

Audit Evidence in Asset Management Research

Mandated under the Audit Act 1957, the Auditor General's Reports (AGR) provide authoritative records of compliance, efficiency and accountability. In comparison to perception-based surveys, AGRs document verifiable governance failures across ministries and states, which make them a powerful and reliable source for longitudinal assessment (Mohamad Azmi & Ismail, 2023). Hence, scholars have progressively used AGRs as an empirical basis to study governance and asset management in Malaysia.

AGRs have been widely employed as evidence to demonstrate recurring governance failures, with several studies concentrating on procurement. For example, Ismail & Md Salleh (2022) on fraud-prone zones, Shariman et al. (2017) on recurring inefficiencies, and Mohamad Azmi & Ismail (2023) on systemic weaknesses and monitoring needs. Beyond procurement, Zahrin & Mohamad (2024) demonstrated how audit certificates and the Financial Management Accountability Index can be used to track accountability trends in local authorities. Collectively, these works underscore the dual role of AGRs, as compliance tools for public accountability and as a critical evidence base for academic inquiry, offering longitudinal insights into systemic governance failures and informing reform agendas in Malaysia's asset management landscape.

Despite the potential in providing systematic evidence on governance gaps across asset lifecycles, AGRs remain underutilised in planning research (Zam et al., 2021). This paper expands the application of audit-based approaches to the governance of government quarters and employs AGR evidence to assess

institutional, operational and policy weaknesses and situates these findings within the national frameworks of MPAM and PSPATA.

Policy and Regulatory Frameworks: MPAM and PSPATA

Malaysia's governance structure for managing immovable assets, including government buildings, is anchored in two key frameworks which are MPAM and PSPATA. PSPATA provides a strategic foundation aimed at professionalising governance through mechanisms such as accrual accounting, value management, and systematic performance measurement. MPAM, on the other hand, introduces the Total Asset Management (TAM) model, which functions as a tactical guide to managing assets across their lifecycle (Urus Setia JPAK, 2021a). Together, these frameworks underscore the importance of sustainability, measurable performance indicators, and lifecycle-based management as essential principles for maximising the value of public assets.

Persistent flaws reveal that these frameworks remain unable to resolve systemic governance challenges. By 2020, nearly one-third of Ministry of Education quarters were either vacant or in deteriorated condition, exposing a stark gap between declared policy objectives and operational realities (Zulkanain et al., 2022). Auditor General's Reports continue to emphasise weak enforcement, disjointed registries, and limited institutional capacity (Mohamed Abu Backer & Wan Yusoff, 2015). Such findings point to structural deficiencies that the framework alone cannot overcome.

The implications for planning are considerable. Vacant units and inadequate upkeep undermine efficient land use, restrict the supply of housing for civil servants, and contribute to less liveable urban environments. Some initiatives, such as adaptive reuse programmes (Jaafar et al., 2025), show a degree of responsiveness. Yet significant structural gaps remain. To ensure that government quarters function as durable and strategically aligned public assets, stronger integration between asset management frameworks and broader planning systems is essential.

Governance Dimensions as an Analytical Framework

Synthesising prior research and AGR evidence, six governance dimensions emerge as critical to understanding weaknesses in the management of government quarters: (i) Allocation & Tenancy, (ii) Environment, Safety & Facilities, (iii) Financial Governance, (iv) Institutional & Administrative Governance, (v) Maintenance & Procurement, and (vi) Monitoring & Recordkeeping. These dimensions reflect the principles embedded in MPAM and PSPATA but remain weakly implemented in practice (Refer to Table 1).

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Table 1: Governance Dimensions, Weaknesses, and Policy Alignment

Governance Dimension	Common Weaknesses (examples)	MPAM (2009, revised in 2021)	PSPATA (2021–2030)
(i)Allocation & Tenancy	Inequitable allocation, weak eligibility checks, poor eviction enforcement	Asset utilisation, minimising vacancy	Demand-based allocation, equity, optimisation
(ii)Environment, Safety & Facilities	Safety hazards, poor sanitation, inadequate communal facilities	Service delivery outcomes, asset performance	Safety compliance, liveability, sustainability
(iii)Financial Governance	Underfunded preventive maintenance, weak rent/utility collection	Asset costing, lifecycle budgeting	Outcome-based budgeting, fiscal sustainability
(iv)Institutional & Administrative	Overlapping responsibilities, unclear roles, weak enforcement	Governance structure, role definition	Role clarity, KPI accountability
(v)Maintenance & Procurement	Reactive maintenance, poor contractor oversight, procurement delays	Preventive maintenance emphasis	Procurement efficiency, contractor performance
(vi)Monitoring & Recordkeeping	Fragmented registries, incomplete logs, poor data integration	Asset registers, documentation systems	Digitalisation, integrated data dashboards

Source: Author's coding of LKAN (2002–2022);
Adapted from MPAM (2009, revised in 2021) and PSPATA 2021–2030

Allocation & Tenancy

This dimension covers eligibility checks, allocation processes, and tenancy enforcement. AGRs highlight weak demand assessments, incomplete eligibility verification, and inequitable distribution of units. These result in both underutilisation and oversubscription, particularly in rural and urban fringe zones (Zulkanain et al., 2022).

Environment, Safety & Facilities

Concerning the quality of living conditions and the provision of basic amenities. Common issues include sanitation problems, inadequate communal facilities, and unresolved safety hazards, which discourage occupancy and reduce staff welfare (Alias & Mohd Noor, 2025).

Financial Governance

Refers to budgeting practices and rental collection systems. Preventive maintenance budgets are frequently inadequate, rental collection is weak, and

spending remains reactive, compromising fiscal sustainability and long-term asset performance (Breesam & Jawad, 2021).

Institutional & Administrative Governance
Covers role clarity, coordination, and enforcement across levels. AGRs report overlapping mandates, unclear responsibilities, and weak enforcement, which delay decision-making and reduce accountability (Tajudin et al., 2022).

Maintenance & Procurement
Relates to upkeep and contractor management. Maintenance remains reactive, contractor oversight is weak, and procurement processes are delayed, contributing to deteriorating living conditions (Simpeh et al., 2023).

Monitoring & Recordkeeping
Covers asset documentation and data systems. Registries are fragmented, logs incomplete, and data integration across agencies remains poor, restricting evidence-based planning and timely interventions (Hauashdh et al., 2020).

Despite the lifecycle, equity, and performance principles expressed in MPAM and PSPATA, AGRs over two decades demonstrate that policy intent has not effectively implemented. For planners and policymakers, these recurring weaknesses threaten the efficiency, occupancy, and liveability of government quarters, underscoring the need for integrated reform that aligns asset management with planning systems.

RESEARCH METHODOLOGY

This study undertakes a qualitative analysis of the Auditor General's Reports (AGR) from 2002 to 2022. Under the Audit Act of 1957, the AGRs are mandated to provide independent evaluations of operational performance, financial management, and compliance across ministries and state agencies. Their accessibility and consistency over the past two decades make them a valuable dataset for examining governance issues in the management of government quarters.

From AGR Series 1, 2, and 3, a total of 608 audit findings were extracted, covering both federal and state levels. The absence of findings in certain years reflects the scope of the audit rather than the absence of governance problems. Each finding was classified into six governance dimensions (refer to Table 1) in line with the principles of MPAM and PSPATA.

The data were analysed using descriptive frequencies and cross-tabulations to illustrate distribution by government level, year, and governance

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dimension. To trace shifts in emphasis over time, comparisons were also drawn across three policy phases: Pre-MPAM, MPAM, and PSPATA (see Table 2).

Table 2: Dataset and Coding Framework

Variable	Description	Categories / Examples
Year	Year of the Auditor General's Report (AGR) in which the issue was recorded	2002–2022 (coverage varies)
Government Level	Government tier where the issue was identified	Federal / State
Governance Dimension	Six categories developed from AGR analysis and mapped to MPAM and PSPATA	Allocation & Tenancy; Environment, Safety & Facilities; Financial; Institutional & Administrative; Maintenance & Procurement; Monitoring & Recordkeeping
Key Issue	Thematic label summarising the specific problem	e.g., Weak traceability, Absent preventive maintenance, Fragmented registries

Source: Author's coding of AGR (2002–2022).

ANALYSIS AND DISCUSSION

Dataset Overview and Governance Distribution

This study analysed 608 audit findings on government quarters from the Auditor General's Reports (2002–2022). Audit coverage was uneven, with some years absent (2003–2005, 2007–2008, 2016, and 2020) due to shifting audit priorities rather than the absence of governance problems (refer to Figure 1). Peaks in reporting, such as 2010, 2014, and 2018, reflect periods when quarters management came under closer scrutiny. By government level, federal agencies accounted for slightly more than half of the findings (56%), while state governments contributed 44%, indicating that weaknesses in quarters governance are systemic rather than confined to one tier.

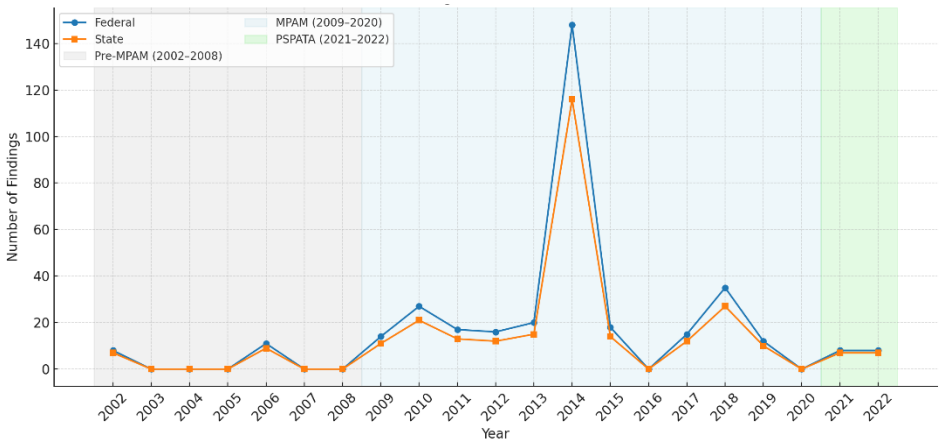


Figure 1: Federal vs State Audit Findings in Government Quarters (2002–2022).
Source: LKAN (2002-2022) & Author's Calculation

As shown in Table 3, governance failures were most concentrated in Maintenance & Procurement and Monitoring & Recordkeeping, which together account for more than 40% of all findings. These reveal persistent reliance on reactive maintenance, weak contractor oversight, and fragmented asset registries. Institutional and Financial Governance issues together form a second tier, about one-third of findings, pointing to structural inefficiencies and fiscal shortfalls. Finally, Allocation & Tenancy and Environment, Safety & Facilities account for smaller shares but remain important, as mismatched allocation and poor living conditions directly undermine occupancy and liveability.

Table 3: Distribution of Governance Issues by Dimension (2002–2022)

Governance Dimension	**F**	**%**	**Key Weaknesses**
Maintenance & Procurement	131	21.5	Absence of preventive maintenance, weak contractor oversight
Monitoring & Recordkeeping	117	19.2	Outdated logs, fragmented registries
Institutional & Administrative	97	16.0	Role ambiguity, weak enforcement
Financial Governance	95	15.6	Inadequate budgets, poor payment systems
Allocation & Tenancy	92	15.1	Mismatched allocation, weak eligibility
Environment, Safety & Facilities	76	12.5	Structural defects, poor sanitation
Total	**608**	**100.0**	

Source: Author's coding of LKAN (2002–2022)

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Collectively, these patterns suggest that technical breakdowns in maintenance and data governance dominate quarters management, while institutional and financial weaknesses hinder long-term sustainability. At the same time, gaps in allocation and environmental quality affect demand, leaving many units underutilised despite acute housing needs.

Temporal Trends and Policy Periods

The analysis of 608 audit findings highlights fluctuations in governance weaknesses across 2002–2022 (refer to Table 4). Audit attention was uneven, with major peaks in 2010, 2014, and 2018, reflecting cycles when quarters management became a focal area of scrutiny. By contrast, several years yielded few findings, indicating variations in audit coverage rather than the absence of governance problems.

Table 4: Distribution of Findings by Year and Governance Dimension (2002–2022)

	Pre-MPAM		**MPAM**										**PSPATA**		
Governance Dimension	2002	2006	2009	2010	2011	2012	2013	2014	2015	2017	2018	2019	2021	2022	Total
Maintenance & Procurement	5	1	5	10	8	5	10	45	7	7	13	15	0	0	**131**
Monitoring & Recordkeeping	3	3	3	8	7	3	3	36	6	9	18	5	4	9	**117**
Institutional & Administrative	1	0	0	10	10	4	1	53	5	5	3	4	1	0	**97**
Financial Governance	2	2	1	8	9	3	0	45	2	2	12	0	4	5	**95**
Allocation & Tenancy	0	6	0	5	4	5	1	42	1	11	11	0	1	5	**92**
Environment, Safety & Facilities	1	0	0	7	7	6	0	43	4	1	5	2	0	0	**76**
Total	**12**	**12**	**9**	**48**	**45**	**26**	**15**	**264**	**25**	**35**	**62**	**26**	**10**	**19**	**608**

Source: LKAN (2002-2022) & Author's Calculation

Aggregating the results into three policy periods (Pre-MPAM, MPAM, and PSPATA) reveals distinct emphases. During the MPAM years (2009–2020), audit findings were disproportionately concentrated in Institutional &

Administrative governance (+2.5) and Environment, Safety & Facilities (+2.4). This pattern suggests that although MPAM sought to institutionalise lifecycle governance, implementation lagged: coordination remained fragmented, and quarters continued to face liveability and safety issues. In effect, MPAM's design addressed "what should be done" but agencies struggled with "how to do it."

By contrast, the PSPATA era (2021–2022) was dominated by Monitoring & Recordkeeping (+3.6) and Financial Governance (+2.3). This shift reflects PSPATA's strategic emphasis on fiscal accountability, digital registries, and performance indicators. However, the over-representation of these categories may indicate that PSPATA is stronger in setting reporting and compliance requirements than in addressing operational realities such as preventive maintenance. The significant under-representation of Maintenance & Procurement (–2.9) is likely due to narrowed audit focus rather than genuine improvement, raising concern that persistent maintenance problems may be under-diagnosed.

Table 5: Distribution of Governance Dimensions Across Policy Periods (Residual Analysis)

Governance Dimension	**Pre-MPAM (2002–2008)**	**MPAM Period (2009–2020)**	**PSPATA Era (2021–2022)**
Allocation & Tenancy Governance	—	—	—
Environment, Safety & Facilities	—	Over-represented (+2.4)	Under-represented (–2.1)
Financial Governance	—	Under-represented (–1.9)	Over-represented (+2.3)
Institutional & Administrative	—	Over-represented (+2.5)	Under-represented (–1.9)
Maintenance & Procurement	—	Slightly over (+1.9)	Under-represented (–2.9)
Monitoring & Recordkeeping	—	Under-represented (–3.2)	Over-represented (+3.6)

Note. Only residuals exceeding ±1.96 are reported. Positive values indicate over-representation relative to expected counts; negative values indicate under-representation. Blank cells (—) indicate no statistically significant deviation. Source: Author's calculation

A chi-square test confirmed a statistically significant association between governance dimension and policy period, $\chi^2(10, N=608) = 35.45$, $p < .001$, with a small-to-moderate effect size (Cramér's $V = 0.171$).

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Table 6: Chi-Square Test of Independence Between Governance Dimension and Policy Period

Test Statistic	Value	df	N	p-value	Effect Size (Cramér's V)
Pearson χ^2	35.45	10	608	< .001	0.171

Note. The chi-square test was significant, indicating that the distribution of governance issues varied across policy periods. Cramér's V = 0.171 suggests a small-to-moderate association. Source: Author's calculation

These temporal shifts suggest that policy frameworks shape the audit lens but have not resolved underlying weaknesses. MPAM-era audits exposed coordination and liveability failures, while PSPATA-era audits highlight fiscal and recordkeeping gaps. Both reflect partial implementation: rules and frameworks evolve, but operational capacity, enforcement, and demand alignment remain unresolved. For planners, this underlines the need for governance reforms that go beyond compliance reporting to ensure sustainable liveability and utilisation of government quarters.

Federal–State Comparisons

At the descriptive level, federal audits accounted for a slightly larger share of governance issues (56%) compared to state audits (44%). Maintenance & Procurement was the most frequent dimension across both tiers, but notable contrasts emerged in other areas. Institutional & Administrative and Environment, Safety & Facilities findings were disproportionately federal, while Monitoring & Recordkeeping was more common in state audits. Allocation & Tenancy was relatively balanced, reflecting persistent mismatches between tenant demand and quarters suitability at both levels.

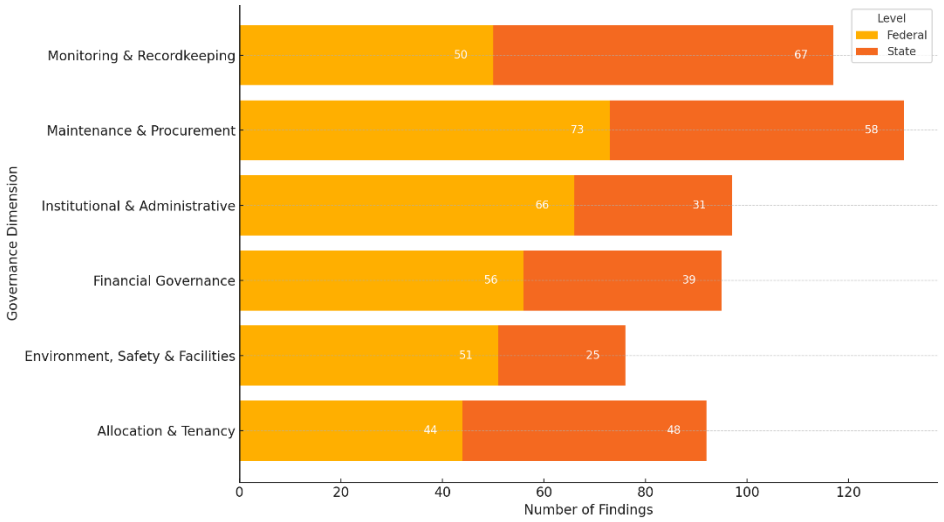


Figure 2: Federal vs State Distribution across Governance Dimensions
Source: LKAN (2002-2022) & Author's Calculation

Inferential analysis confirmed these contrasts ($\chi^2(5, N = 608) = 20.69$, $p < .001$, Cramér's V = 0.184). Monitoring & Recordkeeping was significantly over-represented at the state level, while Institutional & Administrative and Environment, Safety & Facilities were significantly federal-dominant.

Table 7: Chi-Square Test of Independence Between Governance Dimension and Government Level

Test Statistic	Value	df	N	p-value	Effect Size (Cramér's V)
Pearson χ^2	20.69	5	608	< .001	0.184

Source: & Author's Calculation

These patterns reflect structural differences in capacity. At the federal level, coordination failures stem from overlapping mandates, role ambiguity, and weak enforcement mechanisms, which echo broader critiques of Malaysia's administrative fragmentation (Tajudin et al., 2022). Safety-related deficiencies are also more visible at the federal level, where higher-profile agencies and centralised facilities attract greater audit scrutiny. At the state level, monitoring weaknesses are linked to limited technical capacity, fragmented databases, and reliance on manual record-keeping, consistent with earlier findings that subnational agencies struggle with asset registries and data integration (Shariman et al., 2017).

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These results suggest that governance weaknesses are tier specific. Federal agencies require reforms that strengthen compliance, role delineation, and enforcement capacity, while states need investment in ICT systems, digital asset registries, and technical training to improve monitoring. Financial governance weaknesses remain relevant across both tiers, indicating that fiscal sustainability requires coordinated reform. For planners, this highlights that policy solutions cannot be uniform: differentiated strategies are necessary to address the distinct institutional and technical gaps faced at federal and state levels.

Key Issues Across Dimensions

Analysis of issue-level findings reveals that governance weaknesses in government quarters are not evenly distributed but cluster around a narrow set of recurring problems that cut across dimensions. Table 8 highlights that while each governance dimension records deficiencies, most findings are concentrated in monitoring and recordkeeping, maintenance failures, and institutional enforcement

Table 8: Key Governance Issues in Government Quarters Management (2002–2022)

Governance Dimension	Key Issues (KI)	Freq.	%	Total %
Maintenance & Procurement Governance	Absence of preventive maintenance frameworks	51	8.4	21.6
	Deficient maintenance contract oversight & contractor performance	42	6.9	
	Poor maintenance quality	38	6.3	
Monitoring & Recordkeeping	Weak traceability and outdated logs	63	10.4	19.3
	Fragmented registry & asset information systems	54	8.9	
Institutional & Administrative Governance	Lack of policy enforcement and compliance	55	9.0	15.9
	Fragmented oversight, unclear mandates & weak coordination	36	5.9	
	Underqualified staffing and ineligible appointments	6	1.0	
Financial Governance	Ineffective ITP & BSH payment management	42	6.9	15.6
	Inadequate maintenance budgets	33	5.4	
	Inefficient utility bill payment management	20	3.3	

Governance Dimension	Key Issues (KI)	Freq.	%	Total %
Allocation & Tenancy Governance	Mismatch between tenant demand and quarters suitability	32	5.3	15.1
	Insufficient occupancy certification protocols	24	3.9	
	Weak eligibility verification & tenancy approval	22	3.6	
	Poor eviction enforcement	14	2.3	
Environment, Safety & Facilities	Poor building structural integrity, safety, and sanitation conditions	40	6.6	12.5
	Neglected upkeep of site amenities and grounds	36	5.9	
	Total	**608**	**100.0**	**100.0**

Source: LKAN (2002–2022), Author's Calculation

A closer synthesis of these findings indicates that five structural bottlenecks underpin most governance failures:

Data and Monitoring Deficits *(Monitoring & Recordkeeping)*
Weak traceability (10.4%) and fragmented registries (8.9%) form the single largest cluster of issues. These deficiencies undermine evidence-based planning, lifecycle costing, and accountability, reflecting the persistent absence of integrated asset information systems. Internationally, asset management studies stress that without reliable registries, preventive strategies remain ineffective (Aziabah, 2018).

Enforcement and Institutional Weaknesses *(Institutional & Administrative Governance)*
Lack of compliance (9.0%) and fragmented oversight (5.9%) highlight persistent enforcement gaps. These issues point to role ambiguity and overlapping mandates between agencies, consistent with broader literature on institutional fragmentation in public sector housing (Tajudin et al., 2022).

Maintenance Failures *(Maintenance & Procurement Governance)*
Preventive frameworks remain absent (8.4%), contractor performance oversight is weak (6.9%), and maintenance quality is poor (6.3%). This cluster underscores reliance on reactive repairs rather than lifecycle-based maintenance, a pattern widely reported in public housing systems (Simpeh et al., 2023).

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***Financial Inefficiencies** (Financial Governance)*
Ineffective payment systems (6.9%) and inadequate budgets (5.4%) reveal structural fiscal bottlenecks. These constraints limit the ability to plan long-term maintenance and create dependency on complaint-based expenditure. Prior research similarly links underfunding and rigid budgeting to declining stock conditions (Breesam & Jawad, 2021).

***Allocation Mismatches** (Allocation & Tenancy Governance)*
Weak eligibility checks (3.6%) and mismatches between demand and quarters suitability (5.3%) continue to undermine utilisation. Such inefficiencies not only waste resources but also reduce occupancy satisfaction, echoing findings on misaligned allocation mechanisms in civil service housing (Zhang et al., 2022).

These recurrent issues demonstrate that quarters management in Malaysia is undermined not by isolated operational lapses, but by structural governance bottlenecks: unreliable information systems, weak enforcement, reactive maintenance, fiscal mismanagement, and allocation inefficiencies. Addressing these bottlenecks requires integrated reforms that strengthen institutional authority, modernise asset registries, and embed preventive lifecycle practices within financing and maintenance regimes.

Implications for Governance and Asset Management
The concentration of issues across monitoring, maintenance, and institutional enforcement has three major implications for quarters governance:

Planning and Demand Alignment
Persistent mismatches between quarters provision and tenant demand highlight the need for evidence-based planning, a principle embedded in PSPATA's emphasis on demand-based allocation and optimisation. Integrating workforce demographics, civil servants deployment patterns, and regional housing needs into planning cycles would reduce underutilisation and ensure resources are aligned with actual demand.

Policy and Institutional Reforms
The over-representation of institutional weaknesses at the federal level points to gaps in role clarity, compliance, and coordination, which MPAM identifies as core governance functions. Without stronger enforcement mechanisms and clearer delineation of responsibilities across federal, state, and district levels, institutional fragmentation will continue to undermine governance. Aligning these reforms with MPAM's prescribed structures and PSPATA's accountability frameworks would improve oversight and reduce duplication.

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Asset Management Practices

The prevalence of reactive maintenance directly contradicts MPAM and PSPATA's lifecycle-based principles of preventive maintenance and outcome-driven asset management. To operationalise these principles, agencies must move beyond complaint-driven repairs by embedding preventive regimes, linking budgets to performance outcomes, and developing interoperable digital registries. Such steps would fulfil PSPATA's digitalisation agenda and institutionalise MPAM's total asset management approach.

CONCLUSION

This study examined 608 Auditor General's Report (AGR) findings on the management of government quarters in Malaysia between 2002 and 2022. The analysis confirms that weaknesses are systemic and recurring, with monitoring, enforcement, maintenance, and financial governance remaining unresolved despite the adoption of MPAM and PSPATA. Temporal variation showed institutional and safety issues were more prominent during MPAM, while financial and recordkeeping weaknesses have become dominant under PSPATA. Federal–state contrasts further revealed that federal agencies struggle with enforcement and role clarity, whereas state governments face greater difficulties with monitoring and recordkeeping systems.

The results highlight that governance gaps are concentrated in a narrow set of issues: outdated registries, fragmented oversight, absence of preventive maintenance, weak financial systems, and mismatched allocations. These findings suggest that the lifecycle-based and performance-driven principles of MPAM and PSPATA are not yet institutionalised in practice. Strengthening digital asset registries, preventive maintenance regimes, fiscal accountability, and demand-based allocation are therefore essential for improving the liveability and sustainability of government quarters.

As quarters continue to serve as strategic public assets for civil servants, further studies should extend this analysis across other sectors and compare Malaysia's approaches with international models to guide more effective reforms.

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APPENDIX I: Coverage of Auditor General's Reports (2002–2022)

No	Audited Year	AGR/LKAN Report Title
1	2002	Laporan Ketua Audit Negara Negeri Pahang 2002
2	2006	Aktiviti dan Kajian Khas Jabatan/Agensi Negeri Pulau Pinang 2006
3	2009	Aktiviti Kementerian/Jabatan dan Pengurusan Syarikat Kerajaan Persekutuan
4	2010	Aktiviti Kementerian/Jabatan dan Pengurusan Syarikat Kerajaan Persekutuan
5	2010	Aktiviti Jabatan/Agensi dan Pengurusan Syarikat Kerajaan Negeri Sarawak Tahun 2010
6	2010	Aktiviti Jabatan/Agensi dan Pengurusan Syarikat Kerajaan Negeri Terengganu Tahun 2010
7	2011	Aktiviti Kementerian/Jabatan dan Pengurusan Syarikat Kerajaan Persekutuan
8	2012	Aktiviti Jabatan/Agensi dan Pengurusan Syarikat Kerajaan Negeri Pahang Siri 1 2012
9	2013	Aktiviti Jabatan/Agensi dan Pengurusan Syarikat Kerajaan Negeri Sabah Siri 2 2013
10	2014	Aktiviti Kementerian/Jabatan Dan Pengurusan Syarikat Kerajaan Persekutuan Siri 1, 2, 3
11	2014	Aktiviti Jabatan/Agensi dan Pengurusan Syarikat Kerajaan Negeri Perak Siri 3 2014
12	2015	Aktiviti Jabatan/Agensi dan Pengurusan Syarikat Kerajaan Negeri Sarawak Siri 1 2015
13	2017	Pengurusan Aktiviti/Kewangan Jabatan/Agensi dan Pengurusan Syarikat Kerajaan Negeri Pulau Pinang Siri 1 2017
14	2018	Pengurusan Aktiviti Jabatan dan Pengurusan Syarikat Kerajaan Negeri Johor Siri 2 2018
15	2019	Aktiviti Kementerian/Jabatan Kerajaan Persekutuan dan Badan Berkanun Persekutuan Siri 2
16	2021	Pengauditan Pematuhan Kementerian dan Jabatan Persekutuan
17	2022	Penyata Kewangan Kerajaan Negeri dan Agensi Negeri Serta Pengauditan Pematuhan Jabatan/Agensi Negeri Selangor Tahun 2022

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CHALLENGES AND READINESS FOR THE URBAN RENEWAL ACT: PERSPECTIVES OF TOWN PLANNERS IN PENANG

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Abstract

Malaysia's proposed Urban Renewal Act (URA) represents a major policy effort to revitalise ageing urban areas through a unified legal and institutional framework. However, as the Act has not yet been gazetted, questions remain about the readiness of institutions and communities to implement it effectively. This study examines institutional and community preparedness for the URA, focusing on Penang as a case study where urban development intersects with heritage conservation. A qualitative approach was adopted, involving semi-structured interviews with practising town planners from the government and private sectors. Thematic analysis revealed four key challenges, legal uncertainty, fragmented coordination, financial constraints, and low community trust. Institutional readiness was found to be partial, as technical capacity exists, but coordination and procedural clarity are lacking. Community readiness remains weak due to limited awareness and mistrust of redevelopment intentions. Guided by Institutional Readiness Theory, the study concludes that Malaysia exhibits high commitment but low efficacy for implementing the URA. Strengthening inter-agency collaboration, establishing clear procedural frameworks, and enhancing public communication are critical steps toward operational readiness. The findings contribute to understanding how policy innovation in Malaysia's urban governance can evolve from legislative ambition to practical, inclusive reform.

Keywords: Urban renewal, Urban Renewal Act, challenges, readiness and strategies

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INTRODUCTION

Malaysia has undergone rapid urbanisation in recent decades, with more than 76% of its population residing in urban areas compared to 62% in 2000 (DOSM, 2021). This demographic shift has placed increasing pressure on urban infrastructure, housing, and land management systems, particularly in states with high densities such as Penang. Renowned for its strategic economic role and UNESCO World Heritage status, Penang faces a dual challenge: sustaining economic growth while safeguarding its rich cultural heritage and social fabric.

Urban renewal is generally defined as the planned transformation of deteriorated or underutilised urban areas into functional, liveable, and sustainable environments (Roberts & Sykes, 2000; Couch, Sykes & Börstinghaus, 2011). Over time, however, the concept expanded into a multidimensional strategy that integrates physical, social, economic, and environmental objectives. Contemporary interpretations emphasise regeneration, sustainability, and inclusivity, with increasing attention given to governance structures and community participation (Roosli et al., 2019; Shin, 2016). In Malaysia, the Ministry of Housing and Local Government (MHLG) frames urban renewal as a structured intervention designed to revitalise ageing urban areas (Roosli et al., 2019; Soo, 2025). This interpretation highlights the importance of legal clarity, institutional coordination, socio-economic improvement, and the protection of communities directly affected by redevelopment.

Despite these policy intentions, empirical research on the Urban Renewal Act (URA) remains limited, as the Act has yet to be gazetted and, consequently, has not been tested through practical implementation. Existing Malaysian studies primarily examine fragmented redevelopment mechanisms, including the *Strata Titles Act 1985*, urban land readjustment schemes, and heritage conservation initiatives in George Town (Marzukhi et al., 2018; Che Pin et al., 2024). However, there is still insufficient understanding of how planning institutions, practitioners, and local communities are positioned to operationalise the forthcoming Act, particularly within Penang's complex urban–heritage context. This paucity of empirical evidence on institutional capacity and community readiness highlights a critical research gap in the Malaysian urban planning discourse.

Penang presents a distinctive case because it must reconcile urban redevelopment pressures with the protection of George Town's UNESCO World Heritage Site. Renewal projects here are influenced not only by legal and technical considerations but also by socio-cultural sensitivities, ownership disputes, and community trust. These intersecting factors make Penang a meaningful context to examine how readiness for the URA might be shaped by governance, institutional coordination, and heritage-related constraints.

To frame this investigation conceptually, the study applies Institutional Readiness Theory (Weiner, 2009) as its guiding framework. The theory posits

that successful implementation of change depends on two key elements: change commitment (stakeholders' collective determination to pursue reform) and change efficacy (their shared belief in having the capacity and coordination to achieve it). Within the Malaysian context, this theoretical lens provides a structured way to interpret how planning institutions, government agencies, and local communities perceive their preparedness for the URA, both administratively and socially. It also allows the study to move beyond descriptive policy discussions and towards an analytical understanding of the behavioural, institutional, and contextual factors that influence readiness. Accordingly, this study pursues three objectives:

1. To identify the key challenges faced by town planners in implementing urban renewal initiatives;
2. To examine their perceptions of institutional and community readiness for the URA; and
3. To explore strategies proposed to strengthen readiness for successful implementation.

LITERATURE REVIEW

Evolution of Urban Renewal Concepts

Historically, urban renewal focused on the physical reorganisation of declining city areas. During the post-war period, Europe and the United States promoted large-scale redevelopment as a primary strategy for economic revival and modernisation. Urban renewal, as described by Roberts and Sykes (2011), is an encompassing framework that seeks to alleviate urban challenges while simultaneously improving the economy, physical landscape, social structure, and overall environment of cities. Early renewal models, however, were widely criticised for being overly top-down and for prioritising demolition and reconstruction while neglecting the social and cultural dimensions of urban life.

By the 1990s, the academic and policy focus had shifted to urban regeneration, incorporating social equity, cultural vibrancy, and economic viability within physical redevelopment (Roberts & Sykes, 2008). More recent frameworks emphasise participatory planning, inclusion, and heritage protection as fundamental elements of renewal (Wu et al., 2020). These developments mirror broader shifts toward urban governance theory, which views urban transformation as a collaborative process involving state, market, and community actors. Thus, modern renewal practice recognises that sustainable redevelopment requires institutional coordination, adaptive policymaking, and active citizen participation. This is particularly relevant in Malaysia, where conservation, heritage, and community livelihoods, especially in heritage cities such as Penang are deeply interconnected.

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International Experiences in Urban Renewal

Urban renewal practices vary across countries, shaped by governance models and institutional capacity. In European cities, renewal prioritises participatory planning and collaboration between public and private sectors. While this fosters social inclusion, it often leads to protracted project timelines (Roberts & Sykes, 2008). Singapore, by contrast, applies a centralised, state-led model under the Urban Redevelopment Authority, allowing rapid redevelopment through strong legal powers but with limited community involvement (Dobs & Loh, 2021). China's evolving approach illustrates a move toward "micro-renewal," which promotes incremental, community-sensitive improvements rather than large-scale clearance (Ye et al., 2021). Hong Kong's Urban Renewal Authority demonstrates a hybrid form that delivers physical transformation but has been criticised for triggering gentrification and displacement (Yung & Chan, 2011).

Together, these cases illustrate that no single governance model guarantees success. Outcomes depend on how governments balance efficiency, equity, and participation within their institutional frameworks. This insight aligns with institutional change theory, which stresses that effective policy innovation requires adaptive institutions capable of coordinating across agencies, reforming rigid systems, and fostering trust among stakeholders (Patterson & Huitema, 2018). Equally, participatory planning theory highlights that social legitimacy and trust are built through inclusive engagement, particularly in contexts where heritage and displacement concerns are prominent (Roberts & Sykes, 2008; Yung & Chan, 2011).

Urban Renewal in Malaysia

Malaysia's existing legal landscape provides a fragmented yet interdependent foundation for urban renewal. The *Town and Country Planning Act 1976 (Act 172)* and the *Local Government Act 1976 (Act 171)* establish the statutory framework for spatial planning and local administration, defining how land use, zoning, and development approvals are managed within municipal jurisdictions. However, these Acts were initially designed to regulate growth and control development rather than to facilitate large-scale regeneration. Similarly, the *Strata Titles Act 1985 (Act 318)* governs collective property ownership but requires unanimous consent for redevelopment, creating procedural bottlenecks in ageing high-density housing areas (Marzukhi et al., 2018). The *National Land Code 1965* further constrains renewal by prescribing rigid processes for land amalgamation and conversion of tenure, while technical compliance is governed by the *Street, Drainage and Building Act 1974*.

Although these instruments collectively regulate urban form, they function in isolation, with overlapping jurisdictions and limited mechanisms for inter-agency coordination. To bridge these legal and administrative silos, PLANMalaysia under the Ministry of Housing and Local Government

introduced the *Garis Panduan Pelaksanaan Pembaharuan Semula Bandar* (2018), outlining voluntary principles for phased development, one-to-one housing replacement, and heritage conservation. Yet, as a non-statutory document, its enforcement remains discretionary. The forthcoming *Urban Renewal Act (URA)*, or *Akta Pembaharuan Semula Bandar (PSB)*, is thus conceived as a harmonising statute that consolidates these fragmented provisions into a coherent framework. It seeks to integrate planning, property, and institutional mechanisms under a single legislative umbrella, ensuring legal clarity, procedural consistency, and protection of ownership rights as guaranteed under Article 13 of the Federal Constitution.

The proposed URA still under review and not yet gazetted aims to unify fragmented policies and establish a consistent process for renewal implementation. Nevertheless, institutional and legal challenges persist. Land matters fall under state jurisdiction, leading to overlapping responsibilities among federal, state, and local agencies (Roosli et al., 2019). Strengthening urban governance is therefore essential to coordinate actors, clarify responsibilities, and ensure transparent decision-making.

Equally critical is the participation gap. Although the Town and Country Planning Act 1976 provides a mechanism for public involvement, participation often remains procedural rather than substantive. Research in Penang shows that affected communities especially within George Town's heritage areas are frequently excluded from meaningful dialogue, resulting in mistrust and resistance (Morshidi, 2014; Eni et al., 2025). This highlights the need for more inclusive, participatory governance models that align physical redevelopment with social and cultural sustainability.

Synthesis: Contextualising International Insights in the Malaysian Setting

Comparatively, Malaysia's governance structure differs from both the centralised models of Singapore and Hong Kong and the decentralised participatory frameworks of Europe. Land is constitutionally a state matter, and urban planning operates within a federal–state–local hierarchy, often resulting in administrative silos and limited coordination (Roosli et al., 2019). These institutional characteristics constrain Malaysia's ability to implement urban renewal efficiently and equitably.

Drawing lessons from international experiences, Malaysia requires a hybrid approach that merges the procedural clarity of centralised systems with the inclusiveness of participatory governance. The forthcoming URA thus represents both a policy innovation and a test of institutional adaptability. Its implementation, particularly in Penang, where renewal intersects with UNESCO World Heritage obligations, requires careful negotiation between efficiency, equity, and preservation.

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This study conceptualises these challenges through Institutional Readiness Theory (Weiner, 2009). The theory emphasises that the success of change initiatives depends on stakeholders' change commitment (their shared determination to pursue reform) and change efficacy (their collective belief in having the capacity and coordination to execute it). In the Malaysian context, readiness for the URA hinges on the ability of institutions and communities to cooperate, align their objectives, and manage socio-cultural sensitivities. Integrating perspectives from urban governance, institutional change, and participatory planning, this theoretical lens provides a coherent framework to analyse how planners in Penang interpret institutional and community preparedness for implementing the Urban Renewal Act.

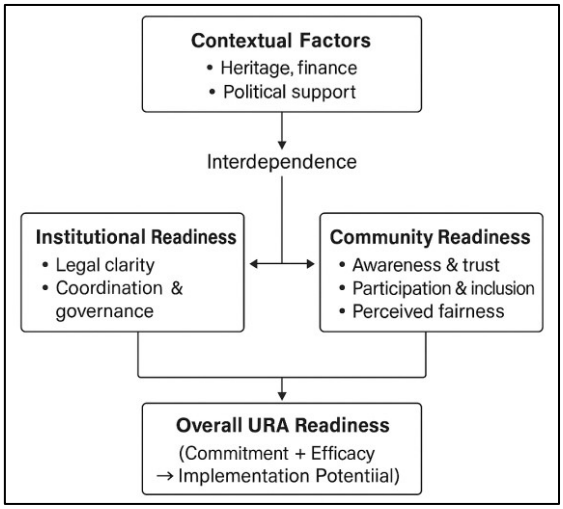


Figure 1: Conceptual Framework

The conceptual framework in Figure 1 integrates Institutional Readiness Theory (Weiner, 2009) with Malaysia's urban governance structure to conceptualise readiness for URA. The framework posits that readiness is a multidimensional construct comprising institutional, community, and contextual dimensions, all of which collectively influence the potential for effective policy implementation. At the core, readiness depends on two interrelated components: change commitment and change efficacy, which reflect the collective willingness and perceived ability of institutions and stakeholders to implement reform.

- Contextual Dimension: This accounts for heritage governance, financial incentives, and political support. These external factors shape both institutional and community readiness by influencing how renewal policies are perceived and operationalised.

- Institutional Dimension: This includes legal clarity, coordination mechanisms, and resource capacity. It reflects how well inter-agency structures (MHLG, PLANMalaysia, and local authorities) align in terms of policy coherence, technical expertise, and administrative collaboration.
- Community Dimension: This covers trust, awareness, and participation. Community readiness is defined by how informed and confident residents are about renewal processes, particularly in sensitive areas like Penang's heritage zones where social identity and property rights are intertwined.

The interaction between these dimensions determines the level of overall URA readiness, represented by three outcomes:

- Strong institutional coordination, inclusive participation, and adequate resources.
- Partial policy alignment with limited coordination or social trust.
- Policy uncertainty, weak communication, and resistance at the community level.

This framework situates readiness not merely as administrative preparedness but as a dynamic governance process linking institutional behaviour, stakeholder engagement, and contextual constraints. It emphasises that for the URA to move from proposal to practice, readiness must evolve concurrently across policy, institutional, and societal levels.

METHODOLOGY

Research Design and Case Study

This study employed a qualitative case study design to explore the challenges and institutional readiness surrounding the implementation of the Urban Renewal Act (URA), with a particular focus on the experiences and viewpoints of practising town planners in Penang. A qualitative approach was deemed most appropriate, as the research sought to delve into professional interpretations, lived realities, and organisational contexts dimensions that cannot be meaningfully understood through numerical data or statistical models alone (Creswell & Poth, 2018).

Penang was chosen as the case study for three reasons. First, it is among Malaysia's most densely populated states, where rapid urbanisation continues to strain infrastructure and land resources. Second, George Town's recognition as a UNESCO World Heritage Site in 2008 creates additional challenges, requiring planners to balance conservation with development pressures. Third, Penang has become a focal point in national discussions on renewal, making it a timely and relevant setting to explore the feasibility of the URA.

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Sampling, Instrument and Data Collection

Purposive and snowball sampling were used to identify a group of planners with direct involvement in urban renewal. The final sample consisted of six senior professionals, each with over ten years of experience in development control, policy formulation, or project renewal. Respondents were drawn from the Majlis Bandaraya Pulau Pinang (MBPP), PLANMalaysia@Pulau Pinang, and private consultancy firms. This selection ensured that both institutional and private-sector viewpoints were represented, allowing for a more comprehensive understanding of renewal challenges and readiness from different organisational positions.

Although the number of participants is relatively small, it is appropriate for an in-depth qualitative case study focusing on a specialised expert group (Hennink & Kaiser, 2021; Guest et al., 2020). In line with the principle of data saturation, interviews continued until no substantially new themes emerged from the data. By the sixth interview, responses largely reinforced existing patterns rather than introducing novel categories, indicating that saturation had been reached for the study's scope (Weller et al., 2018).

An interview guide was developed based on the three main research objectives and informed by key constructs from Institutional Readiness Theory (Weiner, 2009), particularly change commitment and change efficacy. Questions were designed to probe perceptions of legal and institutional barriers, governance coordination, and community acceptance in relation to the URA. Data were collected through semi-structured interviews held between March and June 2025. Each session lasted 45–60 minutes and took place either face-to-face or online, depending on availability. Interviews were conducted in English or Malay, recorded with informed consent, and transcribed verbatim for analysis.

Data Analysis

Thematic analysis was undertaken to interpret the data, drawing on Braun and Clarke's (2006) six-phase framework. This entailed immersion in the transcripts, systematic coding, theme development, iterative reviewing, and the final articulation of findings. Coding was performed manually in the first instance, with codes organised around both inductive patterns emerging from the data and deductive categories informed by Institutional Readiness Theory. Emerging themes were then corroborated with secondary materials, such as policy documents (e.g., *Garis Panduan Pelaksanaan Pembaharuan Semula Bandar*) and relevant legislative texts, to strengthen the interpretive depth.

To enhance the validity and reliability of the thematic analysis, several measures were incorporated. First, coding reliability was addressed by having a second researcher independently review a subset of transcripts and preliminary codes. Differences in interpretation were discussed until consensus was reached,

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supporting consistency in theme development. Second, member checking was conducted by sharing summaries of key themes with selected participants to confirm that the interpretations accurately reflected their views. Third, triangulation was employed by comparing interview data with multiple documentary sources, including policy guidelines, legislative provisions, and publicly available statements on the URA, to corroborate and refine the themes.

In addition, an audit trail of analytic decisions was maintained, including notes on code refinement and theme consolidation, to ensure transparency in the analytical process. Reflexive notes were also kept throughout the study to acknowledge the researchers' positionality and minimise interpretive bias. Collectively, these strategies strengthened the credibility, dependability, and confirmability of the findings derived from the thematic analysis.

FINDINGS

The summary illustrates how each research objective was addressed through themes, codes, and supporting evidence. Town planners identified key challenges such as consent thresholds, distrust, financial feasibility, and displacement risks; noted uneven readiness, with institutions showing partial capacity but communities remaining unprepared; and proposed strategies including legal harmonisation, clear SOPs, engagement, incentives, and safeguards. Together, these insights emphasise that effective implementation of the Urban Renewal Act requires both institutional integration and stronger community trust.

Table 1: Summary of Mapping Themes, Codes, Quotes and Supporting Literature

Research Objective	Themes	Codes	Illustrative Quotes	Supporting Literature
RO1: To determine the Challenges Faced by Town Planners in Implementing Urban Renewal	Theme 1: consent thresholds and ownership disputes	"100% agreement impossible"; "deadlock"; "constitutional issues"	*"Even if 99 owners agree, just one refusal will stop the whole project."* (R2) *"The proposed 75% consent may look good, but can it stand in court?"* (R4)	Marzukhi et al. (2018); Eni et al. (2025); Yung & Chan (2011)
	Theme 2: Political and Social Distrust	"mistrust"; "fear of eviction"; "misinformation"	*"People think renewal means demolition. They don't believe promises about fair compensation or rehousing."* (R1) *"Residents hear rumours on social media and immediately take them as fact."* (R6)	Eni et al. (2025); Roberts & Sykes (2008); Yung & Chan (2011)
	Theme 3: Financial Feasibility	"temporary housing"; "compensation burden"; "low-return areas"	*"Unless renewal is made financially attractive, the private sector will stay away."* (R3)	Eni et al. (2025); Kundu (2014); Yuen (2011)
	Theme 4: Risks of Gentrification	"loss of community"; "poor replaced by rich";	*"Renewal must not mean pushing out poor families… Otherwise Penang will lose its soul."* (R6) *"George Town is*	Davidson & Lees (2005); UNESCO

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Research Objective	Themes	Codes	Illustrative Quotes	Supporting Literature
		"heritage under threat"	*unique not just because of the shophouses but because of the community life."* (R2)	(2011); Roberts & Sykes (2008)
RO2: To explore the readiness for implementation of the URA.	Theme 1: Institutional Readiness	"administrative but fragmented"; "silo work"	*"Institutions are ready in principle, but in practice, coordination is fragmented."* (R2)	Weiner (2009); Marzukhi et al. (2018); Eni et al. (2025)
	Theme 2: Framework Gaps	"no clear guidelines"; "procedures unclear"	*"The Bill gives broad ideas, but the procedures are unclear. Without step-by-step rules, every local authority will interpret it differently."* (R1)	Ye et al., (2021); Dobs & Loh (2021)
	Theme 3: Community Readiness	"low awareness"; "fear of displacement"; "lack of participation"	*"Most residents don't know what renewal means. They are easily influenced by rumours."* (R4)	Eni et al. (2025); Yung & Chan (2011); Roberts & Sykes (2008)
RO3: To examine potential strategies and recommendations for the readiness of the URA.	Theme 1: Legal and Policy Harmonisation	"overlapping laws"; "conflict between acts"; "need for integration"	*"If the Urban Renewal Bill is not aligned with the Strata Titles Act, we will face legal conflicts."* (R4)	Eni et al. (2025); Dobs & Loh (2021); Yung & Chan (2011)
	Theme 2: Clear Procedural Frameworks	"need SOPs"; "step-by-step guidelines"; "avoid confusion"	*"We need SOPs that are clear, detailed, and consistent across states."* (R1)	Ye et al., (2021); Dobs & Loh (2021)
	Theme 3: Community Engagement and Education	"continuous engagement"; "awareness campaigns"; "building trust"	*"We need continuous engagement, not just one-off meetings. Trust is built over time."* (R3)	Roberts & Sykes (2008); Morshidi (2014)
	Theme 4: Developer Incentives	"tax relief"; "expedited approvals"; "financial subsidies"	*"If developers get tax relief or faster approvals, they will be more willing to take the risk."* (R5)	Eni et al. (2025); Shin (2016)

Objective 1: Challenges Faced by Town Planners in Implementing Urban Renewal

The findings indicate that while the proposed URA has the potential to streamline redevelopment, its implementation in Penang is hindered by four recurring challenges: (i) consent thresholds and ownership disputes, (ii) political and social distrust, (iii) financial feasibility, and (iv) risks of gentrification and displacement. These barriers reflect structural, institutional, and social complexities that mirror experiences elsewhere but are intensified by Penang's unique urban and heritage context.

Theme 1: Consent Threshold and Ownership Disputes

One of the most critical barriers is the requirement for unanimous owner consent under the Strata Titles Act 1985. Respondents consistently highlighted this requirement as impractical, noting that it frequently results in project stalemates. One planner remarked:

"Even with 99 owners consenting, a single objection can bring the entire project to a halt. This creates a deadlock and frustrates any renewal effort." (R2)

Planners also expressed concern about the URA's proposal to reduce the threshold to 75% consent, noting that although it may facilitate implementation, it could trigger legal and constitutional disputes:

"The proposed Urban Renewal Act suggests a lower threshold of 75%. While this looks good on paper, we worry about whether it will stand up in court." (R4)

Overall, planners perceived legal uncertainty around consent and ownership as the most pressing obstacle to renewal.

Theme 2: Political and Social Distrust

Beyond legal hurdles, mistrust between communities, developers, and government agencies emerged as a decisive barrier. Respondents noted that many residents equate "renewal" with eviction and demolition, generating strong resistance:

"People think renewal means demolition. They don't believe promises about fair compensation or rehousing." (R1)

Misinformation further fuels distrust:

"Residents hear from a neighbour or on social media that they will lose their homes, and immediately the rumour becomes fact." (R6)

Planners reported that in Penang's heritage areas, where community identity is deeply rooted, such distrust is particularly intense and difficult to overcome.

Theme 3: Financial Feasibility

Financial viability represents another critical challenge. Developers are expected to cover costs for relocation, temporary housing, and compensation, which often outweigh potential returns. As one respondent noted:

"Developers must pay for relocation, temporary housing, and compensation. In low-return areas, it's just not worth the investment." (R5)

Another emphasised that without incentives, private sector participation will remain limited:

"Unless renewal is made financially attractive, the private sector will stay away." (R3)

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Planners therefore regard financial feasibility as central to whether renewal projects will proceed in practice, particularly in Penang, where competition from greenfield development is strong.

Theme 4: Risks of Gentrification and Displacement

Perhaps the most sensitive issue raised by planners concerns the social consequences of renewal. Respondents mentioned that renewal could accelerate gentrification, displace low-income households and erode cultural identity.

"Renewal must not mean pushing out poor families and replacing them with the wealthy. Otherwise, Penang will lose its soul." (R6)

They also emphasised that George Town's value lies not only in its physical shophouses but also in the communities that inhabit them:

"George Town is unique not just because of the shophouses but because of the community life within them. Renewal should preserve that, not destroy it." (R2).

These concerns highlight the need to consider social and cultural dimensions alongside physical redevelopment when planning renewal in Penang. Taken together, these four themes illustrate the multidimensional challenges of implementing the URA in Penang. Legal and financial barriers constrain feasibility, while political distrust and gentrification risks threaten legitimacy and inclusivity. Renewal is therefore not merely a technical process but a contested socio-legal undertaking that demands careful balancing of rights, interests, and values.

Objective 2: Readiness of Institutions and Communities for the URA

The second objective was to examine the extent to which Penang's institutions and communities are prepared for the implementation of the URA. The findings reveal three major themes: (i) institutional readiness, (ii) gaps in procedural frameworks, and (iii) community readiness. Collectively, these themes show that while administrative preparedness exists at the institutional level, critical weaknesses in inter-agency coordination, procedural clarity, and community acceptance pose significant risks to implementation.

Theme 1: Institutional Readiness

Respondents acknowledged that Penang's planning institutions such as Majlis Bandaraya Pulau Pinang (MBPP) and PLANMalaysia@Pulau Pinang possess technical expertise and administrative structures to support renewal. However, this readiness was described as fragmented rather than integrated:

"Institutions are ready in principle, but in practice, coordination is fragmented. Each agency works in silos." (R2)

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Planners agreed that without stronger coordination mechanisms across departments and levels of government, institutional readiness for implementing the URA will remain limited.

Theme 2: Framework Gaps

Another key finding was the absence of clear procedural frameworks to operationalise the URA. Respondents stressed that while the Act provides broad principles, it does not yet specify detailed procedures, creating risks of inconsistent interpretation across states:

"The Bill gives broad ideas, but the procedures are unclear. Without step-by-step rules, every local authority will interpret it differently." (R1)

Planners were concerned that this ambiguity could lead to inconsistent implementation between states and local authorities, undermining legal certainty and complicating decision-making. They stressed that unless detailed guidelines and enforcement mechanisms support the URA, institutional readiness will remain superficial, and renewal will continue to face procedural bottlenecks.

Theme 3: Community Readiness

The most significant gap lies in community awareness and trust. Respondents consistently reported that residents have a limited understanding of urban renewal, often associating it with displacement and demolition:

"Most residents don't know what renewal actually means. They are easily influenced by rumours and prefer to resist." (R4)

Fear of losing homes, livelihoods, and cultural ties contributes to low community readiness. Planners observed that without sustained communication and engagement, public resistance is likely to persist even if institutional mechanisms are improved.

Overall, the findings under Objective 2 suggest that while Penang's institutions show technical preparedness, weak inter-agency coordination and limited community trust hinder effective implementation of the URA.

Objective 3: Strategies for Strengthening Implementation of the URA

The third objective explored planners' perspectives on strategies to strengthen readiness for the effective implementation of the URA. The findings indicate that the Act is viewed as a necessary foundation but that complementary measures are required to address existing gaps. Five main strategies were identified: legal and policy harmonisation, clear procedural frameworks, community engagement and education, developer incentives, and social and cultural safeguards.

Theme 1: Legal and Policy Harmonisation

Respondents emphasised the need to align the URA with existing legislation, particularly the Strata Titles Act 1985, to avoid conflicts and legal disputes:

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"If the Urban Renewal Bill is not aligned with the Strata Titles Act, we will face legal conflicts." (R4)

They argued that harmonisation is essential to protect property rights, clarify compensation procedures, and ensure transparency. Without such alignment, the URA risks generating further ambiguity rather than resolving existing uncertainties.

Theme 2: Clear Procedural Frameworks

Respondents consistently highlighted the need for standard operating procedures (SOPs) to ensure consistency across local authorities:

"*We need standard operating procedures that are clear, detailed, and consistent across states."* (R1)

Planners proposed that these SOPs should include processes for stakeholder engagement, consent, compensation, relocation, and monitoring, so that all parties understand their roles and rights throughout the renewal process. For Penang, respondents recommended state-wide procedural guidelines supported by monitoring and enforcement mechanisms to minimise ambiguity and ensure equitable application of the URA.

Theme 3: Community Engagement and Education

Continuous engagement was seen as essential to building trust and countering misinformation:

"We need continuous engagement, not just one-off meetings. Trust is built over time, and without education, rumours will dominate." (R3)

Planners stressed that one-way communication strategies are insufficient. Instead, they called for long-term participatory mechanisms such as town-hall meetings, workshops, and targeted awareness campaigns to ensure residents are informed and have opportunities to voice their concerns and preferences.

Theme 4: Developer Incentives

Respondents highlighted that private sector participation depends on appropriate financial incentives:

"If developers get tax relief, faster approvals, or subsidies, they will be more willing to take the risk." (R5)

They proposed measures such as tax relief, expedited approvals, targeted subsidies, and soft loans. Without such mechanisms, developers are likely to favour more lucrative greenfield projects over complex renewal schemes. Addressing financial feasibility therefore emerges as a central pillar of readiness for the URA.

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Theme 5: Social and Cultural Safeguards

Respondents strongly emphasised that renewal should protect, rather than displace, local communities and cultural heritage:

"These assessments must be compulsory. Renewal should not destroy communities or erase heritage. It must protect people first." (R6)

They proposed making Social Impact Assessments (SIA) and Cultural Impact Assessments (CIA) mandatory components of renewal projects, particularly in heritage areas such as George Town. This was seen as crucial for ensuring that redevelopment respects existing communities and maintains Penang's cultural identity.

In summary, the findings demonstrate that challenges, readiness, and strategies for the URA are deeply interconnected. Legal, financial, and institutional issues shape what is administratively possible, while trust, awareness, and social safeguards determine whether renewal will be accepted by communities on the ground.

DISCUSSION

This discussion interprets the findings through *Institutional Readiness Theory* (Weiner, 2009) and related frameworks of urban governance, institutional change, and participatory planning. As the URA has not yet been gazetted, the discussion examines anticipated readiness rather than post-implementation outcomes. The findings reveal that while Malaysian planners express strong conceptual support for the URA, institutional, procedural, and social preconditions for effective enforcement remain weak.

Weiner (2009) defines readiness for change as a combination of change commitment and change efficacy. In Malaysia, planners demonstrate a strong commitment to the URA's aims of unifying fragmented legislation and modernising governance. However, efficacy remains low because administrative structures and enforcement mechanisms are not yet formalised. This suggests readiness exists at a rhetorical level but not yet at an operational one. This reflects Vangen et al. (2015) argument that hierarchical governance systems struggle to achieve cross-agency collaboration. In Penang, local authorities exhibit policy enthusiasm but lack the necessary procedural instruments, indicating a gap between their beliefs and capacity.

The introduction of the URA aims to integrate these fragmented legal instruments into a cohesive and operational framework that promotes coordinated, inclusive, and sustainable urban development. Conceptually, the URA functions as an enabling legislation that consolidates the planning authority of the Town and Country Planning Act 1976, the administrative mandates of the Local Government Act 1976, and the ownership mechanisms of the Strata Titles Act 1985 within a single governance architecture. By establishing joint executive committees at the federal and state levels, the Act aims to institutionalise vertical

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coordination between ministries, state authorities, and local governments addressing the long-standing governance gap in inter-agency decision-making. In doing so, it introduces procedural mechanisms such as consent thresholds, negotiated compensation, and phased redevelopment strategies that balance the rights of property owners with collective urban interests. More importantly, the URA marks a paradigm shift from a regulatory system centred on control and compliance to one oriented towards regeneration, adaptability, and stakeholder collaboration, reflecting Malaysia's transition toward a more integrative model of urban governance. Such inertia limits innovation and prevents institutions from developing the procedural agility required once the URA becomes law. In effect, the readiness gap is not only procedural, but also behavioural, as institutions are waiting for legal certainty before acting, instead of using the interim period to build capacity and pilot coordinated approaches to renewal.

The persistent fear of eviction and displacement among communities reflects low psychological readiness for change. According to Weiner (2009), efficacy depends not only on institutional capacity but also on shared confidence in the reform's fairness. In Penang, communities often equate "renewal" with loss rather than improvement, revealing a gap between policy communication and public understanding. Despite planners' intentions to promote inclusive development, participation remains largely procedural, limited to brief consultations rather than sustained dialogue. Without institutionalised channels for continuous engagement, such as community liaison units or mandated social impact assessments, public resistance will likely persist. Strengthening participatory readiness, therefore, requires rebuilding trust through transparency, early involvement, and clear assurance that renewal will protect, not displace, existing communities.

Readiness also depends on financial capacity. Planners' calls for tax relief, subsidies, and joint-venture mechanisms underscore the importance of fiscal instruments in fostering institutional confidence. Patterson and Huitema (2018) argue that policy innovation succeeds when legal, financial, and social systems align. Currently, financial uncertainty constrains institutional readiness and deters private investment, suggesting that reform must extend beyond legislation to include sustainable funding models.

Penang's heritage status adds another layer of complexity to its readiness for renewal. Planners are expected to reconcile the preservation of George Town's cultural fabric with pressures for redevelopment and modern infrastructure. While the proposed URA is anticipated to provide a legal framework, its absence has left planners dependent on non-statutory instruments such as the *Garis Panduan Pembaharuan Semula Bandar* and local heritage bylaws, which have limited enforcement strength. This uncertainty discourages proactive planning and creates tension between conservation and redevelopment priorities. Embedding Social and Cultural Impact Assessments within the URA

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would enable a more balanced approach, ensuring that renewal supports heritage protection, community continuity, and long-term urban resilience in Penang.

Policy Implications

The findings demonstrate that institutional and community readiness for the URA cannot be achieved solely through legislation. Effective implementation will depend on proactive coordination, capacity-building, and trust-building efforts led by the MHLG, PLANMalaysia, and local authorities before the Act is gazetted.

At the national level, MHLG must act as the central coordinating body to align federal, state, and local responsibilities. Without such a framework, policy intentions risk fragmentation once the URA comes into force. A national coordination mechanism would help ensure that renewal operates under consistent principles and avoids the procedural confusion that currently characterises redevelopment under separate laws. Critically, MHLG should view readiness not as mere administrative compliance, but as an institutional transformation that requires inter-agency collaboration, clear accountability, and long-term monitoring.

PLANMalaysia, as the technical lead agency, has a pivotal role in translating legislative intent into operational clarity. It should develop detailed implementation guidelines and readiness assessment tools that bridge legal concepts with day-to-day planning practice. This includes standard procedures for consent, compensation, and community engagement, ensuring that local authorities can apply the URA uniformly across different contexts. Strengthening technical guidance will reduce dependency on fragmented state interpretations and promote procedural confidence among practitioners.

For local authorities, especially those managing heritage environments such as Penang's George Town, readiness requires striking a balance between urban growth and cultural continuity. Councils like MBPP must establish renewal units capable of coordinating planning, land, and heritage functions within one governance structure. They should also institutionalise ongoing community engagement rather than treating participation as a one-off requirement. This approach will address local distrust and ensure that renewal decisions are both socially legitimate and technically sound.

Financial readiness remains an underlying condition for success. Incentives such as tax relief, soft loans, and risk-sharing partnerships should be developed jointly by MHLG and PLANMalaysia to encourage private-sector participation. Without these instruments, urban renewal may remain conceptually desirable but practically unviable. At the same time, embedding SIA and CIA within renewal processes will ensure that economic viability does not come at the expense of social equity and heritage values.

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In essence, the policy implications underscore that readiness is a process of governance reform, not merely a matter of policy preparation. By coordinating institutional roles, clarifying procedures, and fostering public legitimacy before the URA is enacted, Malaysia can transform a legislative aspiration into a credible framework for inclusive and sustainable urban regeneration.

CONCLUSION

Malaysia remains in the pre-gazettement phase of the URA, offering a crucial window to strengthen readiness before formal implementation. The findings indicate that, while there is a strong normative commitment to the URA's objectives, operational efficacy remains limited by fragmented governance, procedural ambiguity, and low community trust. In Penang, these challenges are compounded by the dual imperatives of heritage conservation and urban development.

The study concludes that readiness must be cultivated ahead of gazettement through practical measures such as pilot projects, inter-agency taskforces, and structured public engagement programmes. Strengthening institutional capacity, procedural clarity, and public confidence at this stage will be crucial to ensure that, once gazetted, the URA can transition from legislative ambition to become an effective tool for equitable and sustainable urban regeneration.

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COMMUNITY-CENTRIC APPROACHES TO TOURISM DEVELOPMENT AND PLANNING

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Abstract

Rural tourism has emerged as a key driver for sustainable development, particularly when rooted in community participation and local empowerment. This study explores the sustainable development of tourism in Lembanna Village, Bontobahari District with a focus on community empowerment and participatory planning through the lens of Organisational capacity theory, highlighting the influence of systemic, organisational, and individual capacities. Conducted between 2022 and 2023, the research employed a qualitative approach through in-depth interviews with 20 informants, including members of the Tourism Awareness Group (Pokdarwis), village government officials, tourism stakeholders at the provincial level, and planning consultants. The findings reveal that meaningful community engagement supported using local labour, materials, and culturally responsive design emphasises a significant role in advancing sustainable tourism initiatives. Educational programs that raise awareness of tourism's economic potential have been instrumental in enhancing local support and active involvement. The integration of community knowledge in all stages of development, particularly in the planning and implementation of the Detail Engineering Design (DED), reinforces a bottom-up governance model that aligns with the village's socio-cultural identity and environmental values. This study highlights the importance of multi-stakeholder collaboration, equitable benefit-sharing, and inclusive policy frameworks to strengthen community resilience and ensure long-term tourism sustainability.

Keywords: Tourist Village, Community Empowerment, Sustainable Tourism, Planning, Lembanna Village

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INTRODUCTION

In Bontobahari District, Indonesia's South Sulawesi, the coastal and marine assets present significant opportunities for tourism growth. However, as emphasised by Azwar et al. (2023) and Rami et al. (2023), the success of tourism initiatives depends largely on the active involvement of local communities. Such participation not only amplifies economic benefits but also enhances social cohesion and strengthens community ownership of tourism initiatives (Joshi & Sadhale, 2022). Lembanna Village, situated in the Bontobahari District, offers a compelling example of spatially driven, community-based tourism development. This study investigates how local participation shapes tourism planning and implementation in Lembanna, emphasising spatial characteristics that promote sustainable outcomes. The village's development model includes collaboration between residents and professional designers, ensuring that infrastructure meets both sustainability and aesthetic standards (Khan et al., 2021; Roxas et al., 2020).

This study adopts an institutional capacity (Hall, 1999) to assess Lembanna's governance capability in tourism and explore how decision-making and resource control shape community involvement which is suggested by Karim and Mandala (2024). Organisational capacity theory offers a useful framework for analysing the multi-level capacities required for sustainable community-based tourism. These capacities operate at the systemic, organisational, and individual levels (Domorenok et al., 2021). In the context of Lembanna Village, this framework enables a deeper understanding of how external policies, institutional structures, and individual competencies collectively shape tourism development outcomes. A core feature of Lembanna's approach is the strategic planning of tourism sites, particularly in less-developed areas, to minimise site competition and improve equitable benefit distribution (Polontalo et al., 2023). This reflects the importance of aligning tourism policies with regional development objectives that preserve cultural and natural assets while promoting economic growth. Leadership by the Village Head and the Tourism Awareness Group (*Pokdarwis*), along with active resident involvement, has improved inclusive tourism governance and strengthened local social capital (Han et al., 2023; Li et al., 2020). These participatory processes align with the South Sulawesi Tourism Office's vision of harmonising economic development with heritage conservation.

LITERATURE REVIEW

Tourism Planning and Development

Tourism planning plays a significant role in aligning development with the sustainable use of natural and cultural resources while improving inclusive community participation. It acts as a strategic framework that guides tourism growth without compromising environmental integrity or cultural authenticity. According to Tehseen et al. (2024), comprehensive planning enhances visitor

experiences and mitigates adverse effects such as overcrowding, environmental degradation, and socio-cultural displacement. Sustainable tourism rests on three equally important pillars: economic development, environmental conservation, and cultural preservation (Okrožnik et al., 2024). A failure to integrate these pillars risks short-term gains at the expense of long-term community wellbeing.
A systemic and holistic approach to tourism planning must account for long-term impacts on both ecosystems and communities. Community involvement is central to this process, as integrating local knowledge fosters culturally sensitive and socially sustainable outcomes (Tabatabaei et al., 2024). Participatory planning promotes trust, shared ownership, and alignment of stakeholder goals (Zachrisson et al., 2021; Suno Wu et al., 2021). Strategic marketing and place-making rooted in local heritage enhance destination competitiveness and prevent cultural homogenisation (Ruiz-Real et al., 2020; Richards, 2020). Embedding emotional meaning through place-making strengthens authenticity (Singh et al., 2023).

Community Based Tourism (CBT)

Community-based tourism (CBT) is widely recognised as a sustainable and inclusive development strategy, particularly in rural and coastal regions. It promotes local participation throughout tourism processes, including planning, decision-making, and management (Esichaikul & Chansawang, 2022; Paladan, 2020). Active involvement fosters ownership and empowerment, reducing resistance to tourism development while ensuring fairer benefit distribution through employment and income generation (Tjilen et al., 2021; Llupart, 2022; Ruiz-Ballesteros, 2023). CBT challenges the extractive tendencies of top-down models, strengthening local economies and amplifying community voices. It allows communities to shape tourism narratives authentically, preserving traditions rather than catering solely to external market demands (Miller & Torres-Delgado, 2023; Sosa, 2022; Zielinski et al., 2021). In places like Lembanna, where culture and ecosystems are central to tourism, CBT fosters pride and deeper visitor engagement (Azwar et al., 2023). Moreover, communities contribute vital ecological knowledge, enhancing environmental stewardship and resilience (Buitrago & Yñiguez, 2021; Pahrudin et al., 2022).

UNDERPINNING THEORY

Organisational Capacity Concept

Organisational capacity offers a valuable framework for examining how institutions and communities design, implement, and sustain strategies such as tourism development (Hall, 1999; Lusthaus et al., 2002). This theory identifies capacity as operating across three interconnected levels: systemic, organisational, and individual (Karim & Mandala, 2024). At the systemic level, broader institutional and policy environments influence the effectiveness of organisations

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and communities, encompassing legal frameworks, governance structures, and policy mandates that either facilitate or constrain local initiatives (Blomkamp, 2022). Within tourism, systemic capacity shapes local autonomy, resource distribution, and the degree to which national or regional policies support community-based efforts. Strong systemic capacity ensures a stable, supportive environment through coherent regulations, policy alignment, and institutional support mechanisms (Mirzoev et al., 2022). At the organisational level, capacity relates to the structures, resources, leadership, and governance of organisations such as local tourism groups or village committees (Nurhasanah & Van den Broeck, 2022). This level determines how effectively organisations mobilise resources, coordinate actions, and fulfil strategic goals. The individual level focuses on the skills, knowledge, motivation, and leadership of key actors whose expertise and informal networks shape organisational performance (Schiuma et al., 2024). Collectively, these levels determine the success of sustainable tourism initiatives (Lusthaus et al., 2002).

RESEARCH METHODOLOGY

This study adopted a qualitative case study approach to examine community-based coastal tourism development in Lembanna Village, Bontobahari District (See Figure 1). Data was collected from October 2022 to October 2023 through interviews with 20 informants, including *Pokdarwis* members, village officials, provincial tourism stakeholders, and consultants. Field observations and suitability mapping complemented the interviews to identify tourism potential based on Lembanna's natural assets, such as coral reefs and coastal landscapes. Thematic and narrative analyses were conducted using NVivo, guided by Braun and Clarke (2006) and Mayring (2015), with transcripts verified and translated for accuracy (Loubere, 2017; Nowell et al., 2017). Credibility, transferability, dependability, and confirmability were ensured through triangulation, expert review, and reflexivity (Lemon & Hayes, 2020).

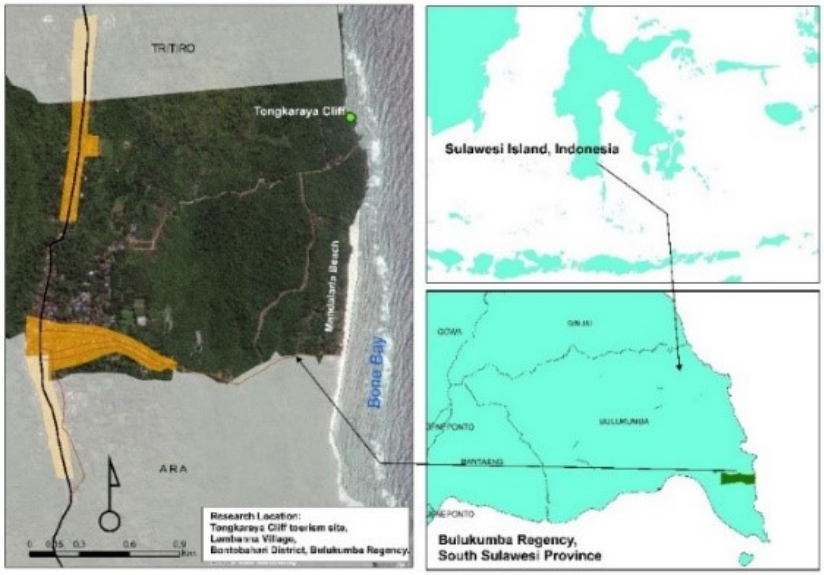


Figure 1: Map of the study area
Sources: Masri Ridwan (2024)

FINDINGS

Community-Led Environmental Governance in Tourism Development

Tourism development in Lembanna Village is driven by collaboration between the village government, *Pokdarwis*, and the community. Village Head *Aspar* and *Pokdarwis* Chairman Abdul Gaffar lead initiatives such as road upgrades and site planning to boost accessibility and highlight tourism potential. The Village Consultative Body (BPD) supports this through land grant documentation. Community engagement in clean-ups, training, and discussions around Detail Engineering Design (DED) will ensure that infrastructure reflects local needs while promoting sustainable tourism and economic development (Azwar et al., 2023).

The findings show that, a communal cleanup, led by the village head and PKK members, targeted areas vulnerable to illegal dumping and emphasised proper waste disposal using designated bins. This reflects more than environmental maintenance, it signifies a cultural shift where sustainability and tourism are seen as shared community responsibilities (Azwar et al., 2023). The consistent application of *Sapta Pesona* values, particularly *kebersihan* (cleanliness) and *ketertiban* (order), has become embedded in everyday practices, enhancing not just a cleaner village but a collective sense of pride and ownership.

These initiatives serve as a grassroots model of environmental governance, driven by collaboration between local authorities and civil society, particularly women's groups. This approach aligns with the principles of CBT,

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where resident participation and environmental protection are critical for long-term success (Dangi & Petrick, 2021). By embedding sustainability into daily life, Lembanna not only enhances its appeal to tourists but also strengthens internal community bonds, demonstrating how tourism development can influence civic behaviour and reinforce local identity through inclusive, values-based action. Lembanna Village actively integrates environmental cleanliness into its tourism development through community-driven initiatives aligned program objectives (See Figure 2).



Figure 2: Community Engaging in Environmental Cleanup:
A Collective Effort "*Gotong Royong*"
Source: Masri Ridwan (2024)

Apart from that, P3MD coordination meeting in Lembanna Village has been held, emphasising multi-stakeholder collaboration in community-based tourism which symbolises tourism's central role in development (as shown in Figure 3). The Village Head, *Pokdarwis*, BPD, and local officials discussed governance, security, and planning alignment. These regular dialogues promote transparency, trust, and shared decision-making. Reflecting participatory governance, such collaboration ensures tourism supports community values while preventing conflict and empowering local actors for sustainable, inclusive development (Astawa et al., 2024).



Figure 3: Community Dialogue on Sustainable Tourism Initiatives at Lembanna Village; Musrenbang Session: Engaging *Pokdarwis* in Village Tourism Development
Source:Pokdarwis Andalan (2024)

On another note, the findings also found participatory mapping process in Lembanna Village, involving residents, village officials, and *Pokdarwis* in defining territorial boundaries for the Grant Certificate (See Figure 4). This inclusive approach ensures transparency, reduces land disputes, and strengthens stakeholder trust. By validating local land rights, it empowers communities and aligns with sustainable land management practices that prioritise local knowledge (Pereira et al., 2021). The process builds spatial clarity, improve sense of ownership, and lays the groundwork for socially cohesive, conflict-free, and sustainable tourism infrastructure development.



Figure 4: Participatory Mapping of Location Boundaries for Determining Planning Areas as the Basis for the Grant Certificate
Source:Masri Ridwan (2023)

During the interview, community members contributed feedback on the design of viewing platforms and beach access, while the local government proposed a food court to support culinary tourism and empower local SMEs. The Detailed Engineering Design (DED) for Tongkaraya Cliff in Lembanna Village, reflecting a participatory approach in sustainable tourism planning. DED includes vital infrastructure such as a multipurpose hall, public restrooms, a pier, beach stairs, and a water tower to enhance visitor comfort. This collaborative planning

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process demonstrates how aligning infrastructure with local input fosters a sense of ownership and long-term support. The inclusion of a food court creates economic opportunities for small-scale entrepreneurs and promotes place-based development through culinary tourism. As Cvijanović et al. (2025) emphasise tourism development should extend beyond physical attractions to encompass local livelihoods and economic resilience. Hence, the DED ensures that Tongkaraya Cliff is positioned as both a tourist destination and a community-driven economic asset.

Findings also highlight Lembanna Village's participatory governance in tourism, with the Village Head institutionalizing *Pokdarwis* via Decree No. 23b/KPTS/1/2022 to lead grassroots initiatives. Land management, shared with the BPD, includes allocating a 10-hectare site at Tongkaraya Cliff. Inclusive planning through mapping and design which involves village leaders and consultants, ensuring transparency. Community engagement in clean-up and safety reflects the community value which Azwar et al. (2023) agreed that reinforcing a sustainable tourism model grounded in empowerment, collaboration, and cultural ownership.

Community Participation in DED Design: Conditions of Tourist Facility Development in Lembanna Village

The development of tourism facilities in Lembanna Village showcases a participatory and inclusive approach, involving collaboration between the government, private sector, and local community members. The Detail Engineering Design (DED) process integrates community feedback to ensure that planned infrastructure reflects local values and needs, enhancing both functionality and cultural relevance (Pelden et al., 2025; Wondirad & Ewnetu, 2019). Communities are actively encouraged to contribute ideas, participate in construction, and oversee implementation, enhancing a strong sense of ownership and long-term sustainability. As emphasised by the Chairman of *Pokdarwis;*

"We aim to participate in every stage, and using locally sourced timber will boost our economy".

This highlights that the project also supports local livelihoods and resource-based microenterprises. This approach not only strengthens community empowerment and economic inclusion but also demonstrates how tourism development can align with grassroots aspirations and sustainable practices. The development of Mandalaria Beach demonstrates a collaborative and community-based approach to sustainable tourism. PT. *Delapan Sepuluh Sebelas*, a consultant recommended by *Pokdarwis* "Andalan," led the DED process, integrating cultural elements and local needs into the design (see Figure 5). The

use of traditional wood and stone enhances place identity and authenticity, aligning with sustainable practices and reflecting the community's cultural values (Richards, 2020). Around 20 local workers from Lembanna and nearby villages participated in the construction phase, ensuring that economic benefits remain within the community while promoting skills development and social cohesion. Village Head *Aspar* emphasised:

"Community involvement is vital".

Respondents highlighted the importance of bottom-up development, whereas local input shapes outcomes. This participatory model exemplifies CBT principles, where equitable development is achieved through inclusive governance and grassroots engagement (Agustang et al., 2021; Zachrisson et al., 2021).

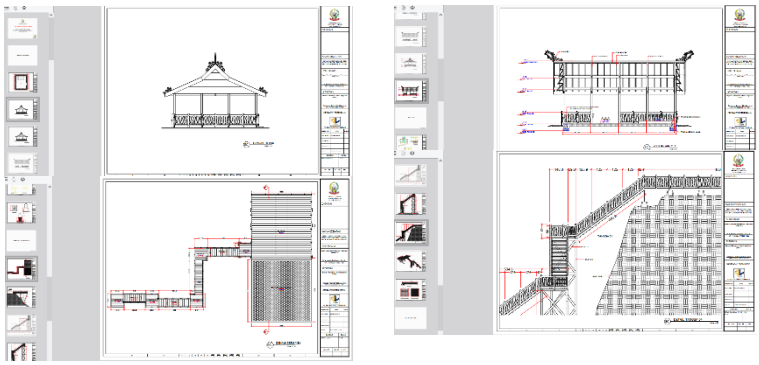


Figure 5: Platform Design through DED Process
Source: Authors' Proposition

Findings also outlines the participatory process in Lembanna Village's tourism facility planning, from identifying needs to maintenance. Community members provide input, select local materials, and collaborate with *Pokdarwis* and consultants to ensure cultural alignment in the DED. They also participate as labourers, instilling ownership and skill-building. During construction, the community helps monitor progress to uphold cultural values. After completion, residents manage facility upkeep, reflecting a sustainable, community-led model of tourism development rooted in local identity and empowerment.

DISCUSSION

Rural tourism plays a significant impact in revitalising communities and driving economic development, particularly when grounded in inclusive participation and local empowerment (Junaid et al., 2023). In this context, Lembanna Village

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stands out as a compelling case of how tourism can be strategically developed to serve community interests. Genuine empowerment in tourism extends beyond mere participation; it necessitates institutional mechanisms that safeguard local rights, provide vocational training, and ensure equitable income distribution (Eyisi et al., 2021). In Lembanna, establishing structures that promote community ownership over tourism initiatives is essential to prevent external dependency and ensure sustainability. Oh and Lee (2021) emphasise that such empowerment improves resilience, enabling communities to adapt to external pressures while maintaining socio-cultural integrity. Moreover, sustainable tourism in heritage-rich areas requires strong government oversight to protect cultural resources while encouraging bottom-up development approaches (Hu et al., 2022). This balance ensures that tourism development is both community-led and context-sensitive.

Stakeholder engagement is essential to sustainable tourism in Lembanna, particularly through inclusive governance and local participation. Addressing power imbalances and ensuring fair representation strengthens long-term success (Okonkwo et al., 2023). Empowerment mediates between governance and grassroots participation, shaping support for tourism (Cardoso et al., 2023; Nugroho & Numata, 2020). Strengthening emotional ties to place while reducing perceived tourism costs encourages stewardship. Educational initiatives on rights and tourism's value enhance participation (Rami et al., 2023). Transparent engagement frameworks and policies promoting local culture are key to achieving sustainable, community-based rural tourism (Qu & Zollet, 2023).

The findings reveal that tourism development in Lembanna Village is shaped by local involvement across the systemic, organisational, and individual levels of organisational capacity. At the systemic level, frameworks such as the formal establishment of Pokdarwis reflect the Village Head's authority in directing tourism governance, illustrating how policy environments shape or constrain local autonomy (Asmorowati et al., 2022; Domorenok et al., 2021). Similar trends are noted in ASEAN contexts like Thailand and Indonesia, where village tourism bodies rely on top-down systems (Kontogeorgopoulos et al., 2014). Organisationally, while Pokdarwis mobilises participation, decision-making is centralised within village leadership, mirroring Vietnam's CBT experience (Giampiccoli & Mtapuri, 2021). At the individual level, leaders leverage personal networks, while residents participate in operational roles, reflecting global CBT critiques on elite capture and power asymmetries (Zielinski et al., 2021). Lembanna's case demonstrates how capacity shape community tourism governance. Hence, a conceptual framework is suggested as below:

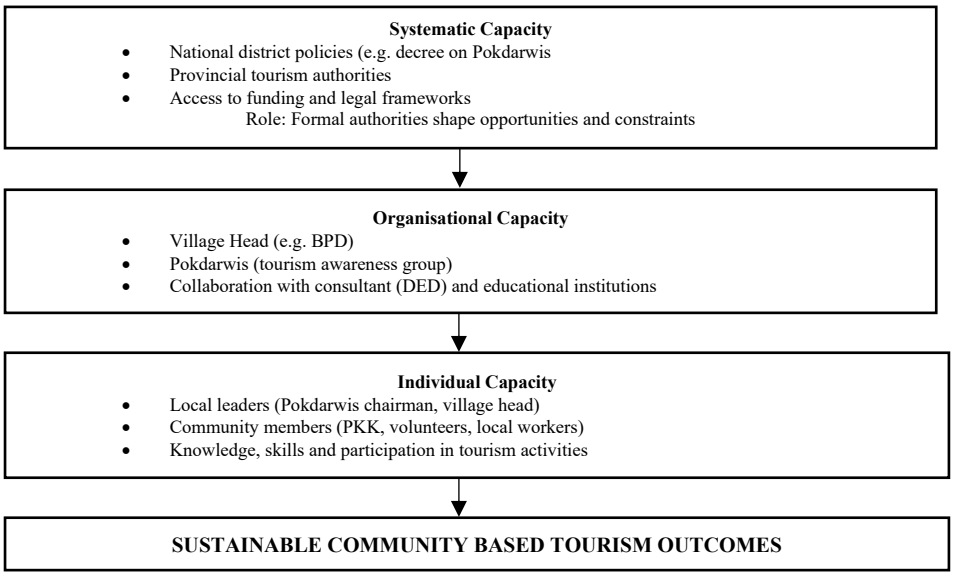


Figure 6: Conceptual Framework of Organisational Capacity Sustainable Community - Based Tourism Development
Source: Authors' Proposition

CONCLUSION

The sustainable tourism development in Lembanna Village depends on strong community empowerment, emphasising local labour, regional materials, and increased awareness. Utilising local resources and workforce ensures that economic benefits remain within the community while improving a sense of ownership and responsibility. Educational initiatives that highlight tourism's economic value and cultural significance are essential to encourage participation and collaboration in planning and implementation. Integrating community knowledge throughout planning, Detail Engineering Design (DED), and oversight stages supports a sustainable tourism framework. Collaboration between local government, stakeholders, and residents through clear communication and targeted training can enhance local capacity in managing tourism sustainably through the lens of organisational capacity and community power. While this study highlights key strategies for inclusive development, it is limited in its exploration of tourist satisfaction and the broader economic impacts on the community. Future research should investigate visitor experiences, community well-being, and economic outcomes. Comparative studies with other rural destinations could offer valuable insights into scalable models of sustainable tourism. Moreover, this study is limited in scope as it does not incorporate the perspectives of visitors regarding satisfaction or expectations, nor does it evaluate

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the economic performance of tourism facilities. Future research should employ mixed method approaches to capture tourist perceptions and quantify tourism's economic contributions to local livelihoods.

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THE IMPACTS OF ELECTRONIC DISTRIBUTION CHANNELS AND INFORMATION TECHNOLOGY ON THE TRAVEL AGENCIES SECTOR

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Abstract

This study endeavors to explore the resilience of travel agencies in the Digital Age, addressing the phenomenon of disintermediation. It examines the ramifications and challenges posed by e-commerce and the efficacy of internet technology on traditional travel agencies. The research is grounded in data collected from Bukit Mertajam and Seberang Perai, utilizing judgment sampling to select respondents and qualitative data derived from 15 semi-structured interviews with travel agents. Findings from the interviews revealed that the current strategies and policies employed to fortify travel agencies encompass (1) the roles and functions of electronic distribution channels, (2) supportive strategies within tourism policies and the government's role in tourism policy-making concerning travel agencies, and (3) the advantages of electronic distribution channels, alongside the challenges and adverse effects associated with these channels, as well as the perceptions of travel agencies regarding electronic distribution channels, all of which are pivotal in determining the survival of travel agencies. The conclusion drawn indicates that internet technology and tourism policies serve as significant indicators of success.

Keywords: Benefits, Challenges, Impact, Travel Agency, Surviving, Internet Era.

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INTRODUCTION

The internet affords unparalleled access to the travel industry across all destinations. Travel agencies must navigate these conditions and devise an optimal marketing distribution mix to minimize costs, strategically allocate their marketing resources, and monitor their efforts to cultivate incremental revenues. Traditionally, distribution in the tourism sector has been characterized by intermediaries such as tour operators and travel agencies. As intermediaries, travel agencies must leverage the internet and concentrate on their business strategies to sustain competitiveness and avert obsolescence. The corporate travel sector has already begun to undergo transformation due to the emergence of electronic commerce as a revolutionary technology (Tsaur, Liang, & Hsiao, 2006). To curtail expenses, travelers are now empowered to arrange their own travel itineraries, booking flights and accommodations directly online, which poses a significant threat to travel agencies within their operational milieu, consequently diminishing market share and revenue levels. In contemporary times, most travel agencies and operators have evolved into 'brick-and-click' organizations, as traditional operators expand into the realm of e-commerce, now termed cybermediaries. Suppliers are harnessing internet technology as a means to promote their products and services directly to consumers, effectively circumventing travel intermediaries.

The novel and innovative nature of internet technologies enhances the dissemination of information for every traveler, thereby diminishing the significance of intermediaries. The emergence of new internet technologies has transformed the landscape of travel agencies, as the process of booking is increasingly streamlined, with commercial transactions being channeled predominantly through websites that serve as primary conduits to connect directly with consumers (Rigas Doganis, 2006). It becomes exceedingly challenging to justify the utilization of traditional travel agencies when one recognizes the simplicity and convenience of using the internet (Clarke & Doherty, 2004). The advancements in internet technology have profoundly impacted the realms of networking and the automation of distribution channels within the travel and tourism industries.

From the travel and tourism sector, the evolution of Information and Communication Technology (ICT) has elicited a myriad of responses among travel agencies, ranging from reactive survival strategies to a more static approach. However, to date, research concerning the utilization of ICT by travel agencies and its ramifications on their business operations remains scant and limited. The present proposed study endeavors to address these issues by concentrating on effective distribution strategies for tourism products, complemented by an examination of tourism policies that bolster the survival strategies of travel agencies, thereby mitigating the prospective risks faced by traditional travel agents. The following research questions guided this inquiry:

1. What constitutes an effective distribution strategy for tourism products within travel agencies?
2. How supportive are tourism policies in relation to the survival strategies of travel agencies?
3. What are the future risks confronting traditional travel agents in their interactions with suppliers and travelers following the advent of the internet?

In addressing the pivotal research questions delineated above, it is imperative to adopt a robust research approach that facilitates meticulous data collection, analysis, and interpretation of findings for the benefit of the researcher. Consequently, all researchers embarked upon the study with a comprehensive literature review to furnish a profound understanding of effective distribution strategies for tourism products employed by travel agencies, the supportive role of tourism policy in enhancing survival strategies of travel agencies, and the prospective risks faced by traditional travel agents amidst the evolving dynamics between suppliers and travelers introduced by the internet.

The internet serves not merely as an advantageous tool for travel agencies but also as a formidable challenge to traditional distribution methods. Conversely, the internet facilitates cost-effective advertising and promotional strategies while acting as a pivotal communication channel to generate supplementary sales. It has fundamentally transformed the conventional role of travel agencies as intermediaries within the distribution channels for tourism products and services. Booking processes are progressively being streamlined, with commercial transactions increasingly conducted through websites. This shift has intensified pressure on service providers, resulting in reduced distribution costs and diminished commissions.

Tourism plays a crucial role in sustainable development, and organizations such as the UN and WTO endeavor to align policies with principles of sustainability. It is imperative for governments to comprehend market trends, consumer travel behaviors, and prevailing conditions to ensure the attractiveness of destinations, safety, and the provision of quality information for travelers. The public sector should actively support environmental quality and amenities. Malaysia's tourism policy emphasizes education and training for travel agents, ensuring they are well-versed in planning, marketing techniques, and tourism impact analysis. Governments establish specialized training institutions and offer incentives for enterprises. Travel agencies provide essential tourist information services, while the National Tourism Policy advocates for the development of innovative tourism products, including riverine tourism, culture and heritage-based tourism, agrotourism, ecotourism, and MICE.

Online shopping has gained significant traction among travelers, offering readily accessible information, prompt responses, and competitive pricing. Approximately 20% of individuals utilize social media for vacation

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planning, compelling the airline and travel sectors to persist in their competitive endeavors. Travel agencies should reposition themselves as consultants in travel process management, leveraging internet technologies such as Computer Reservation Systems and Global Distribution Systems to facilitate the booking of air tickets and accommodations. Given demographic considerations, cultivating online trust is paramount for leisure travel.

The internet has significantly impacted tourism marketing, offering opportunities and increasing consumer choices. It has transformed distribution channels, becoming a virtual market with specific communication strategies. Central governments shape tourism policies using institutional mechanisms. The internet has also transformed organizational value chains, allowing producers to bypass traditional market intermediaries. However, it also poses threats like disintermediation and traditional roles of travel agents. Travel agencies should continue embracing technology, developing informational websites, and increasing e-commerce usage to strengthen their performance and merge with new internet technology called cybermediaries.

More research is needed to understand how to successfully integrate online and offline channels, compare the effects of specific technologies on various agency types, and better understand the digital skills gap and how it affects agency survival. Although the issue of disintermediation has been studied, little is known about long-term survival and re-intermediation tactics, especially for small and medium-sized organizations.

This study is instrumental in enhancing our comprehension of the capabilities and reliability of the internet as a distribution channel when integrated into the tourism industry. In terms of research context, it is anticipated that this study will contribute to the implementation of innovative internet technology approaches in tourism planning and management for travel products and services, particularly for traditional travel agencies and travelers, thereby fostering improvements in business performance.

LITERATURE REVIEW

The ascendancy of the internet has fundamentally transformed the conventional distribution paradigms of tourism services and products. A strategic shift has emerged, enabling tourism enterprises to generate value through adept management of information and communication technology (ICT) (Amit & Zott, 2001). The tourism sector is undergoing a revolution characterized by the proliferation of online channels, which alter the structural dynamics and influence the behavior of agents within the industry. Agile network organizations are increasingly attuned to market opportunities, representing a novel approach to the specialization of tourism intermediaries, and possess the capacity to deliver more efficient outcomes (Isabel, 2012).

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The past decade has witnessed the advent of the internet and the rise of novel travel eMediaries, which have emerged as an increasingly pivotal distribution channel within the tourism sector, as articulated by Kalodikis and Yannakopoulos (2003). The deployment of sophisticated Computerized Reservation Systems (CRSs) is propelling a significant surge in tourism demand among travelers. The tourism industry has experienced a paradigm shift towards intermediation, with traditional travel agents now engaging directly with consumers via search engines such as Google. This evolution has engendered a new distribution framework that encompasses consumers, technologically adept corporate travel agents, online tour operators, and various search engines. Consequently, this transformation has redefined the conventional retail agent model, enabling suppliers to forge direct connections with consumers and adapt to the dynamic landscape of the industry. Online travel agencies and travel aggregators have become popular platforms for travelers to compare prices, read reviews, and book flights, accommodations, and other services (Mayhew, 2018). Digitalization has also enabled cost reduction by comparing prices across multiple platforms, allowing customers to book flights, accommodations, and activities at competitive rates without additional fees (Mohapatra, Mohapatra, & Dubey, 2022). This has eliminated the need for traditional travel agencies, allowing customers to access a wide range of options and make direct bookings (Dhanabagiyam, 2020).

According to Haxton (2015), the internet's influence on the conventional operations of travel agencies is characterized by the tourism policy's co-existence and attempts at coherence within the overarching government approaches, as well as policy complementarity that generates synergies, thereby enhancing the well-being of each sector both collectively and individually. Effective policies are essential for fostering tourism growth and optimizing the strategic trajectory of travel and tourism development. This can be achieved by implementing frameworks that enhance information intensity, promote awareness and coordination, eliminate obstacles, ensure safety and security, and mitigate burdensome taxation on consumers across various governmental tiers and between governmental entities. Such measures are crucial for fortifying and cultivating a supportive and collaborative policy environment for Travel and Tourism, as they significantly impact competitiveness and sustainability, thereby propelling tourism growth. Second, in order to balance the requirement to boost tourism's contribution to the local and national economies with the preservation of natural functions, government support policies are required (Andriansyah et al., 2019).

Tourism can serve a pivotal role in advancing sustainable development. The United Nations Environment Programme (UNEP) and the World Tourism Organization (WTO) mandate that all nations ensure their policies and actions for development and management are fully aligned with the principles of

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sustainability. The tourism policy must encompass a thorough understanding of consumer travel patterns, customer demands, and the evolving trends within market conditions. The execution of these policies should focus on preserving the appeal of destinations, safeguarding the safety and security of travelers, and fostering a more supportive and cooperative policy environment for tourism. Ensuring the safety and security of tourists while implementing judicious taxation across a broad spectrum of policy domains will significantly influence individuals' decisions to travel.

The conventional travel agencies are experiencing significant pressure from the airline industry, which is adept at directing customers straight to their own services, thereby instigating a highly competitive landscape and extensive consolidation within the travel agency sector. Conversely, the advent of the internet presents substantial opportunities for the acquisition of travel-related information (Bloch & Segev, 1997).

The traditional roles of travel agencies—serving as information sources, specialists, and mediators—have been fundamentally challenged by emerging internet technologies. The integration of online technology into traditional travel agencies heralded the onset of the internet era. Ultimately, traditional travel agencies must not only embrace internet technology but also concentrate on niche markets. According to Buhalis and Law (2008), travel agencies can leverage e-business technologies to enhance the value of their services. The internet serves as both a formidable challenge and a remarkable boon for numerous stakeholders, facilitating greater computer literacy among consumers, while simultaneously threatening to diminish the distribution channels of traditional travel agencies unless they can offer value-added services that fulfill customer needs.

To provide travelers with the best possible service, Rosario and Raimundo (2021) have proposed that traditional and e-commerce distribution channels can be used in conjunction with social networking to better understand customer wants, facilitate consumer marketing strategies, and exchange creative ideas. Travel agency enterprises must prioritize exceptional service, product quality, and competitive pricing in their initial phases. They utilize mobile booking platforms and online portals to connect buyers with suppliers and sustain their operational frameworks. Travel agents meticulously gather information regarding executives' destinations, travel preferences, and itineraries, linking them with multiple agencies. Online travel services are revolutionizing the industry by providing unparalleled convenience and value. Travel agencies can harness information technology to navigate the marketplace, manage operational costs, and adhere to corporate policies. Nonetheless, competition between the travel and airline sectors is poised to persist, with smaller agencies increasingly focusing on alternative revenue streams beyond airline services. Trust in the internet remains paramount for leisure travel.

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RESEARCH METHODOLOGY

To obtain precise and comprehensive data for this study, it was conceived as a qualitative investigation employing a case study strategy and semi-structured interviews as the research technique. A total of 15 respondents were meticulously selected from pertinent travel agencies in Bukit Mertajam and Seberang Perai, Penang, Malaysia, encompassing branch managers, assistant managers, tour representatives, sales coordinators, and tour executives. An interview schedule was meticulously crafted to ensure that data collection was conducted in a structured manner, aligning with the study's objectives. In this research, judgment sampling was employed to facilitate the acquisition of more nuanced data and intricate details. Figure 1 delineates the research process.

To ascertain the worthiness of the research topic, it is imperative to delve into the research problems that will facilitate the researcher's comprehension of issues pertaining to travel agencies. The research objectives and inquiries serve a pivotal function in guiding and supporting the researcher in the examination of the targeted subjects. Subsequently, a literature review is conducted to engage with pertinent topics that are essential for this investigation.

Upon gathering information from the literature review, a research design can be meticulously crafted. Two research methodologies will be employed: "extensive" and "intensive" research designs, as delineated by Andrew Sayer (2003). According to Maxwell (2012), intensive interviews afford researchers the opportunity to probe into public perspectives. The researcher then opted for an intensive approach, concentrating on qualitative techniques through interactive interviews. For instance, judgment sampling was utilized to discern respondents in the data collection process.

Longhurst (2003) emphasizes the critical importance of participant selection in the conduct of semi-structured interviews. This study adopts an inductive approach, as it generates results, strategies, and theories that are both comprehensible and experientially credible to both the broader audience and the subjects under investigation (S. Bolster Arthur, 1983). Specific data will be gathered through qualitative interviews with representatives from travel agencies, including branch managers, tour representatives, sales coordinators, and tour executives. This approach will facilitate the identification of additional pertinent interviewees, leveraging the researcher's professional acumen and judgment. Such a strategy is instrumental in obtaining intricate insights into the topic while remaining aligned with the research objectives.

The reliability and validity of qualitative research are crucial factors for researchers to consider when designing, analyzing, and judging the quality of their findings. Reliability refers to the consistency of tools, precisions, accuracy, stability, homogeneity, and equivalence, while validity includes quality, rigor, or trustworthiness generated by the researchers themselves. Triangulation is an appropriate strategy to test the validity and reliability of research findings, using

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methods such as methodological, investigator, theoretical, analysis, and data triangulation. In this research, data triangulation was used as data resources triangulation, representing the use of multiple data sources in the same study for validation purposes. The robustness of data can vary based on time, space, and setting.

Research ethics involve ensuring participants are aware of the research background and objectives before conducting interviews. Dilmi Aluwihare-Samaranayake (2012) emphasizes the importance of informed consent and confidentiality. Interviewees are not named and presented with a corresponding number, such as R1, R2, or R3. Confidentiality is a crucial ethical issue, and each interview data is transcribed and sent back for confirmation to ensure it does not differ from its meaning. Confidentiality is a crucial ethical issue in research.

Upon completion of data collection, the researcher will advance to the subsequent phase, which involves employing framework analysis to scrutinize the data, thereby addressing the research questions. The findings will be meticulously analyzed and documented in the final report.

The semi-structured interviews were recorded and will be examined using framework techniques. To yield analyses with the potential for actionable outcomes, the framework was conceived within an applied research context as a systematic methodology for managing qualitative data, as articulated by Ritchie and Spencer (1994). The framework technique encompasses a methodical process comprising five stages of data analysis.

1) Familiarisation

Initially, the process of familiarization will commence the data analysis. Following the transcription of the recorded interviews and their subsequent storage in electronic files, the researcher will enumerate salient ideas and recurring themes. According to Lacey and Anne (2001) and Luff (2001), prior to the formal initiation of the analysis, the researcher should attentively listen to the recordings, meticulously read and re-read the data, and compile comprehensive summaries.

2) Identifying a thematic framework

During the familiarization phase, a thematic framework was meticulously constructed from the transcriptions and textual data. Ritchie and Spencer (1994) referred to this as the preliminary iteration of the indexing process, wherein all themes emerge from both pre-existing and newly identified issues articulated by the respondents. This process necessitates a synthesis of intuitive and analytical reasoning, alongside the exercise of discernment regarding the significance, relevance, and implications of various issues, as well as the latent connections among ideas (Ritchie & Spencer, 1994). This stage is crucial to ensure

comprehensive engagement with the research questions posed (Ritchie & Spencer, 1994).

3) Indexing

At the indexing stage, the application of the thematic framework to the data process involves the identification of specific data elements that correspond to various themes, a practice commonly referred to as coding in other qualitative analytical methodologies (Lacey, Anne; Luff, 2001). Although this approach can be employed on any textual material, it has predominantly been utilized for transcriptions of individual interviews (Ritchie J. & Spencer, 1994).

4) Charting

The analyst must construct a comprehensive understanding of the data by implementing a thematic framework to individual transcripts and meticulously examining the spectrum of attitudes and experiences pertinent to each issue or thematic perspective (Ritchie J. & Spencer, 1994). Each theme, as articulated by all respondents, is thematically represented through charts, or conversely, each respondent's insights are categorized across all themes by case (Lacey, Anne; Luff, 2001). In this study, the thematic approach will be embraced. When adopting a thematic methodology, for each critical subject area, charts are meticulously compiled, with entries documented for multiple respondents on each chart (Ritchie J. & Spencer, 1994).

5) Mapping and Interpretation

The analyst commences the process of synthesizing the fundamental characteristics of the data, undertaking a comprehensive mapping and interpretation of the dataset as an integrated whole, once all the data have been categorized according to core themes (Ritchie, J. & Spencer, 1994). During this phase, Ritchie and Spencer (1994) posited that the qualitative analyst should endeavor to (1) delineate concepts, (2) chart the spectrum and nature of phenomena, (3) formulate typologies, (4) identify associations within the data, and (5) offer explanations or devise strategies.

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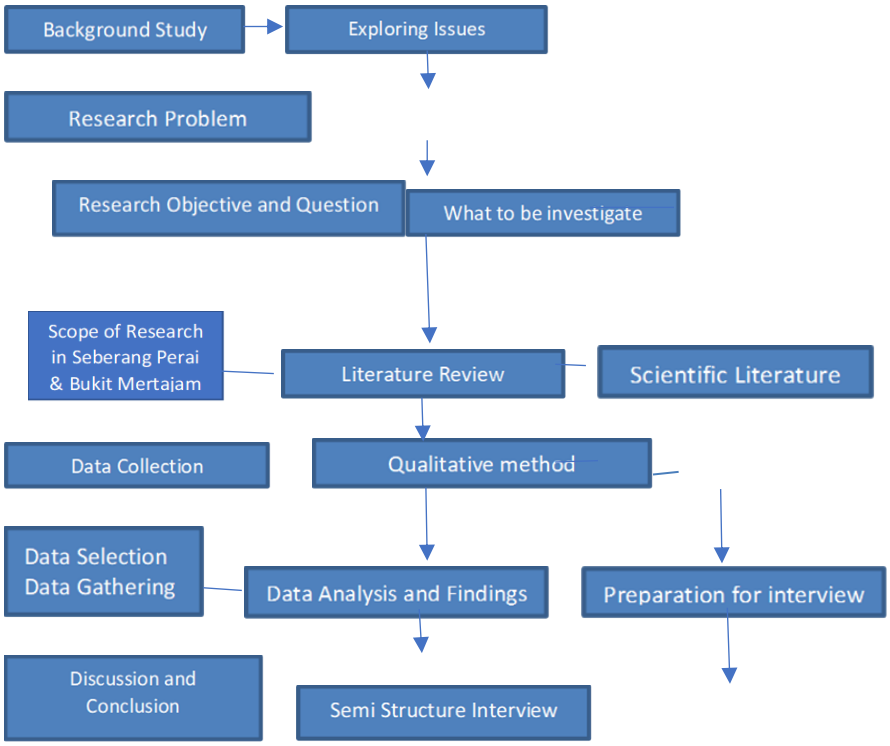


Figure 1: Research Process

RESULTS AND ANALYSIS OF FINDINGS

After the pertinent data have been meticulously compiled and analyzed, this chapter elucidates the discussion of the findings, encompassing the functions and contributions of electronic distribution channels (Table 1), the supportive strategies inherent in tourism policies, and the pivotal roles of government in the formulation of tourism policy-making (Table 2). Additionally, it examines the advantages (Table 3), challenges and adverse impacts (Table 4), as well as the perceptions regarding travel agents (Table 5).

Table 1: *Roles and Parts of Electronic Distribution Channels*

Roles and components of electronic distribution channels.	*Respondent Interview Transcript*
(a) Facilitate the development of distribution strategies and models, leveraging the advantages of internet technology to enhance the careers of travel agencies.	*R4: "We are adept at facilitating the promotion within the target market or clientele and marketing tourism products and services through advertising on the company website and communications via email, as well as through*

Roles and components of electronic distribution channels.	*Respondent Interview Transcript*
	the travel agency's personnel Facebook accounts." *R14: "Technology enhances the design process and provides effective distribution planning for the travel agency, thereby attracting customers to procure travel products and services through an informative website."*
(b) Mixing distribution channels as a pivotal component yields a favorable impact on traditional travel agencies, enabling them to thrive in a competitive landscape.	*R12: "Internet technology exerts a beneficial influence on traditional travel agencies by serving as an instrumental tool for the marketing and promotion of tourism products and services. Furthermore, it offers a diverse array of holiday packages, thereby enabling these agencies to gain a competitive edge over their rivals."* *R10: "The internet distribution channel within the traditional travel agency framework facilitates the establishment of robust relationships between customers and travel agents, ensuring the continuity and sustainability of the tourism business."*
(c) ***Partnerships serve as a pivotal mechanism through which tourism products are disseminated via cutting-edge internet technologies.***	*R13: "Internet technology has main function of distribution as extending the sales and business, which services are performed and products are delivery as involving in the tourism promotion as a supporting tool for the traditional travel agency."* *R3: "Technology create design process and provide good distribution planning for the travel agency to attract the customers to purchase the travel products and services through the informative website."*
Summary	*The results showed that electronic distribution channels play important roles which include widening the distribution system for promotion tourism products, improving the management and development of the travel agency, providing business opportunities for the sustainable of the travel agency company.*

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Table 2: *Strategies of Supportiveness of Tourism Policy and Roles of Government in Tourism Policymaking*

Strategies of supportiveness of tourism policy guidance of government.	*Respondent Interview Transcript*
(a) Comprehensive policy to solve tourism issues	*R3: "Tourism policy concerns about tourism related sectors such as economy, trade the travel products and services to the travellers and consumers and for tourism growth."* *R8: "Governments' tourism policymaking is helping to generate new issue of the new opening of the travel destination as becoming a part of the schedules and itinerary of the travelling packages and advertising through the website."*
(b) Effectiveness of governments' role in tourism policy-making toward travel agency.	*R3: "Tourism policies include tourism regulation and facilitating tourism such as information technologies and innovation promotion and programme campaign for the travel agency organization."* *R13: "Governments are ensuring the availability date of the price and ticketing as for visiting the local attraction and updated in the website or apps so the customers will know the tickets' prices in advance."*
(c) Government's role in tourism policy-making towards sustainable of travel agency	*R7: "Tourism policies are endeavoring to export tourism products both domestically and internationally, thereby augmenting opportunities for travel agencies to market their diverse offerings, including inbound, outbound, and domestic holiday packages."* *R5: "Governments are facilitating traditional travel agencies in the development and establishment of innovative promotional strategies and campaigns for travel destinations aimed at enticing travelers."*
(d) Tourism Policy as a Constructive Instrument	*R1: "The governments' formulation of tourism policies has facilitated the integration of database marketing as a promotional instrument to effectively market and promote both domestic and international travel packages."* *R6: "Governments have increasingly assumed the responsibility of overseeing the marketing and promotion of tourism products and*

Strategies of supportiveness of tourism policy guidance of government.	*Respondent Interview Transcript*
	services, aimed at enticing consumers to purchase trips or select destination packages."
(e) Tourism policy-making undertaken by governments is integral to the management and strategic planning of the tourism sector.	*R15: "Tourism policy serves to direct the execution of marketing and promotional strategies for products, taking into account market trends, community concerns, and environmental considerations on the travel agency's website."* *R12: "Governments are facilitating travel agencies in discerning tourist behaviors and preferences, enabling them to effectively target customers. Consequently, travel agents will possess insights into what should be marketed, the variety of trip packages available, and specialized holiday options that will be offered to clients."*
Summary	*Governments have been collaborating with pertinent stakeholders, including Penang Tourism and Penang Global Tourism, to implement tourism policies that encompass supportive strategies. These initiatives involve the development of tools for travel agencies to enhance management and planning capabilities, as well as efforts to promote the tourism products and services of the destination, all aimed at fostering a sustainable tourism industry.*

Table 3: *Benefits of the Electronic Distribution Channels*

Benefits of the Electronic Distribution Channels	*Respondent Interview Transcript*
(a) An innovative electronic distribution system enhances the advantages afforded to traditional travel agencies.	*R4: "Leveraging internet services in conjunction with advanced computer technology will enhance the networking capabilities of traditional travel agencies, fostering partnerships with outbound travel agencies in other countries to effectively manage holiday trips post-purchase by customers."* *R10: "The internet provides invaluable information regarding weather conditions, currency exchange rates, and city maps, thereby assisting travel*

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Benefits of the Electronic Distribution Channels	*Respondent Interview Transcript*
	agencies that may lack the time to conduct thorough research, ultimately enhancing customer satisfaction."
(b) Introduction of the electronic distribution system towards the sustainability of traditional travel agencies.	*R13: "By integrating the traditional travel agency model with cost-effective strategies and leveraging innovative internet technologies, we can enhance and expand the distribution system."* *R7: "Electronic commerce has the potential to optimize the profitability of traditional travel agencies by uniting the expertise of specialized travel consultants with cutting-edge technological advancements."*
(c) Effectiveness of the Implementation of Electronic Distribution Systems	*R13: "The internet system facilitates travel agencies in maintaining comprehensive profiles and personal data of customers, enabling agents to effectively target clients based on their interests and behaviors."* *R8: "Customers can effortlessly access information regarding holiday packages through the websites of travel agencies, with the browsing process often occurring during public holidays or weekends."*
Summary	*The efficacy of electronic distribution channels is broadening the scope of distribution networks and enhancing connectivity with outbound travel agencies. Moreover, it accelerates operational systems and streamlines documentation processes, facilitating communication with customers via email. This advancement yields substantial benefits, including increased profitability and an enhanced competitive positioning of travel agencies within the tourism industry.*

Table 4: *Bad Effects and Challenges of the Electronic Distribution Channel*

Bad effects and Challenges of the electronic distribution channel.	*Respondent Interview Transcript*
(a) Negative Impacts of electronic distribution system.	*R14: "Indeed. The introduction of internet technology is revolutionizing the operational procedures of hotels and airlines, as customers are increasingly encouraged to procure rooms or tickets directly through their websites, thereby reducing operating costs and commissions traditionally associated with travel agencies."* *R3: "The internet serves as a formidable tool, enabling direct marketing, distribution, and communication with customers, circumventing the conventional methods employed by travel agencies."*
(b) Constraints on Traditional Travel Agents in Tourism Development	*R7: "Indeed. The conventional model of travel agencies is poised to wane, as third-party intermediaries will significantly diminish the fees imposed on clients, including operational and transactional charges typically associated with traditional travel agencies."* *R13: "Certainly. Customers can effortlessly access and obtain information regarding travel package options via online platforms, eliminating the need for in-person visits or telephonic conversations with travel agents."*
(c) The conventional distribution systems prevalent in today's market.	*R2: "The utilization of traditional travel agencies as intermediaries has diminished, as internet technology offers comparable information at a significantly reduced cost in contrast to conventional methods."* *R3: "In contemporary times, consumers are increasingly eschewing traditional travel agencies, discovering that online platforms present analogous products and services to those offered by conventional agencies."*

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Bad effects and Challenges of the electronic distribution channel.	*Respondent Interview Transcript*
(d) ***Challenges of Internet technology in traditional travel agency****.*	*R6: "Many consumers believe they can orchestrate their travel arrangements independently, eschewing the assistance of travel agencies, as they are able to procure comparable products and services at more competitive prices."* *R14: "A significant portion of the populace is inclined to embrace internet technology, which is capable of delivering services and products of equivalent quality while minimizing communication, operational, and transactional costs."*
Summary	*There will be a constrained capacity for traditional travel agencies to seize business opportunities as internet technology has supplanted the status and roles of travel agents. Their services, characterized by hospitality and the expertise of specialized travel consultants, now face formidable competition from online platforms offering an array of tourism products.*

Table 5: *Perceptions of Travel Agency towards Electronic Distribution Channels*

Perceptions of travel agency towards electronic distribution channels.	*Respondent Interview Transcript*
(a) Views of the travel agents regarding the traditional distribution system in the internet era moving forward.	*R11: "Some travelers experience challenges when orchestrating trips that encompass multiple destinations, as they still rely on travel agencies due to the extensive networks that these agents possess in outbound countries."* *R12: "Certain customers prefer to navigate their destinations independently, expressing a reluctance for travel agents to meticulously plan and arrange every aspect of their journey."*
(b) Maintaining traditional practice in travel agency.	*R9: "Traditional travel agencies offer expert tour consultation, specializing in personalized services and possessing extensive networks with outbound tour companies, thereby facilitating the*

Perceptions of travel agency towards electronic distribution channels.	*Respondent Interview Transcript*
	meticulous planning and arrangement of trips for their clientele." *R8: "Continue to concentrate on the functionality and operational mechanisms of traditional travel agencies to thrive in the digital age."*
(c) Improvement of travel agency.	*R3: "Utilizing the internet as a sophisticated computerized system serves as a pivotal tool for professional agencies, enabling them to enhance and elevate the quality of their services, thereby securing a competitive advantage in the marketplace."* *R13: "The advancement of traditional travel agencies has been significantly propelled by the groundbreaking innovation of computerized reservation systems."*
Summary	*No matter the circumstances, traditional travel agencies must integrate internet technology to enhance their management, development, and operational systems. Additionally, it is essential to preserve the conventional practices that enable them to thrive and endure in the competitive landscape of the tourism industry.*

DISCUSSION

The electronic distribution channels play pivotal roles, encompassing the expansion of the distribution framework for the promotion of tourism products, the enhancement of management and development within travel agencies, and the provision of business opportunities for the sustainability of travel agency enterprises, as noted by Laverty S. (2018). "Travel agencies are leveraging internet technology as a distribution channel, functioning as a conduit for tourism information, amalgamated with travel arrangement services and a suite of tourism products, while establishing effective mechanisms," (Respondent 13). "The electronic service information section of the website encompasses travel agencies in promoting and marketing products and services, utilizing online platforms, mailing systems, and personal information storage," (Respondent 14). Respondent 3 elucidated that "E-commerce technology integrates with traditional travel agencies in accordance with customer needs and demands, aiming to achieve customer satisfaction." Respondent 4 articulated that the application of

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the internet, which is increasingly utilized by a broader audience to seek travel information, enhances market value and fortifies a robust market position, thereby ensuring the sustainability of travel agencies.

Overall, governments have been collaborating with relevant stakeholders, including Penang Tourism and Penang Global Tourism, to implement tourism policies as supportive strategies. These strategies involve developing tools for travel agency management and planning, as well as promoting tourism products and services pertinent to travel destinations, thus fostering a sustainable tourism industry. Respondent 3 remarked that "Tourism policies encompass regulatory frameworks and facilitate tourism through information technologies, innovation promotion, and campaign programs for travel agency organizations." Respondent 6 elaborated that "Effective policies for tourism growth entail the implementation of arrangements to enhance updated information and facilitate awareness-sharing among travel agencies." Respondent 12 indicated that "Tourism policies contribute to the enhancement of knowledge and skills among staff regarding the utilization of new internet technologies, such as computerized reservations, networking management, telecommunications, and the creation of company websites as distribution strategies for travel agencies." Conversely, Respondent 8 noted that "Travel and Tourism governing bodies are poised to export economic activities such as travel, shopping, events, and accommodation, thereby supporting traditional travel agencies in conducting trade for buyers and customers." Governments strive to diversify travel products and services to align with traveler demands and interests, while also implementing the development and promotion of travel products that focus on customer satisfaction (Pejabat Perdana Menteri Malaysia, 2012).

In acknowledging the advantages of electronic distribution channel strategies for traditional travel agencies, this paradigm has significantly facilitated the engagement of travel agents in tourism-related activities. Respondent 8 elucidated, "Travel agencies are harnessing the innovations of internet technology to streamline management processes, assist in organizing travel itineraries, offer expert advice, and provide specialized information about various destinations." For instance, "With the aid of technology, traditional travel agents are equipped to deliver enhanced services and a broader selection of products at reduced operational costs tailored to the customers' profiles," (Respondent 5). "The internet serves as a device and communication tool within travel agency operations, offering a diverse array of options that enable them to secure and sustain competitive advantages," (Respondent 7). Respondent 1 articulated, "Internet websites collaborate with traditional travel agencies, ensuring customers can safely purchase holiday packages online while simultaneously receiving guidance from travel agents, thus preserving the commissions for traditional travel agencies." The findings indicate that to deliver superior value-added services and to redefine the value propositions of travel

agencies, it is imperative to adopt new marketing strategies and integrate internet technologies, as noted by Dilts and Prough (2002).

However, the electronic distribution channel has constrained the capacity of traditional travel agencies to exploit business opportunities, as internet technology has supplanted the status and roles of travel agents with services such as specialized hospitality and the expertise of knowledgeable travel consultants who offer tourism products. "As the internet provides rich, detailed, and comprehensive information, reliance on professional specialized travel agents is diminishing," (Respondent 5). "The advent of internet technology facilitates 24-hour operations, allowing customers to independently plan their trips or holidays, which adversely affects sales turnover for traditional travel agencies," (Respondent 8). Respondent 4 stated, "The majority of individuals are now capable of independently planning and organizing their trips, preferring to book tickets and accommodations directly through websites, thereby avoiding additional commissions to travel agents." Respondent 15 remarked, "Within the tourism sector, traditional travel agencies have come under considerable pressure from internet technology, as a substantial population opts for online systems to arrange their travel through applications such as Expedia, Hotelcombine, and Skyscanner." The proliferation of online technologies has exerted substantial pressure toward disintermediation within the tourism industry, as discussed by Law et al. (2004) and Lawton and Weaver (2009).

Some travelers find that sourcing travel information can be quite challenging when it comes to planning their trips, and they often prefer the expertise of specialized travel agents to orchestrate the entirety of their journey. Respondent 5 articulated, "Some customers perceive online booking as cumbersome, and they still require travel agencies since the agents possess extensive experience and knowledge; booking, planning, and arranging trips for customers is their profession." Respondent 9 noted, "Certain customers believe that online booking systems are inconvenient, as they must handle ticket processing, accommodation bookings, and insurance independently, thereby favoring the services of a travel agency." The findings indicate that travel agencies have developed a distribution channel mix that effectively constitutes a comprehensive portfolio by determining marketing activity patterns, enhancing tangibility, identifying target markets, and fostering trust among travelers. Traditional travel agencies must maintain their cadre of specialized consultants; their experience and knowledge remain indispensable in the tourism industry, enabling them to compete effectively in an environment where they cannot be easily supplanted by internet technology in the future. Respondent 14 elucidated, "Many individuals still prefer consulting travel agents, as they trust the agents' expertise to resolve any issues customers may encounter, and they appreciate receiving guidance before making decisions regarding travel package purchases." Respondent 1 stated, "Some of the populace continues to rely on traditional

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methods, as travel agents will prepare everything that meets the customers' requirements, and they are more likely to receive personalized service." According to Hatton (2004), regardless of the changes and developments in the business operating environment, traditional travel agencies remain the most efficient distribution system. Conversely, some individuals prefer to plan their trips independently, often comparing prices between websites and travel agencies. Respondent 10 remarked, "Some travelers feel uncomfortable or distrustful, believing that many travel agents tend to mislead them into more expensive deals."

The information available on internet websites complements the expertise and knowledge possessed by travel agents, thereby enabling them to provide superior services to customers, as both avenues mutually reinforce one another. "The extensive implementation of internet technology will enhance the viability of traditional travel agencies, elevate their corporate reputation, and enable them to thrive in a competitive landscape," stated Respondent 14. Respondent 13 mentioned, "By integrating the cost-effectiveness of traditional travel agencies with innovative and efficient internet technologies, we can enhance and broaden the distribution system." Traditional travel agencies and online technologies serve to complement one another, effectively catering to customer satisfaction, as articulated by Law et al. (2004).

CONCLUSION

From the vantage point of travel agencies, we recognize the strategic initiatives formulated to enhance the management and development of tourism products and services, including electronic distribution channels and strategic models. A pivotal instrument for the management and advancement of travel agencies is the distribution channel mix, encompassing websites, email, and telecommunications within the agency's operational framework, which will enable traditional travel agencies to thrive in the future. Concurrently, travel agents, as specialized consultants, must deliver superior personal service to clientele to ensure their return to the agency.

Undoubtedly, travel agencies must continue to cultivate a cadre of professional travel agents and specialized tour consultants endowed with managerial and entrepreneurial acumen to elevate the productivity of their tourism offerings. The government should take into consideration the perspectives of travel agencies when formulating enhanced tourism policies, as well as investing in essential physical infrastructure and facilities. Furthermore, establishing regulations to conserve and manage environmental resources is fundamental in assisting travel agencies in creating superior tourism products.

To mitigate adverse impacts, traditional and digital technologies should complement one another, forging partnerships as a mechanism for the distribution channels of travel products and services proffered by travel agencies. Indeed,

traditional travel agencies necessitate a workforce that is not only professional but also adept in computer literacy, equipped with the managerial and entrepreneurial skills required to amplify productivity in tourism product development.

Digitalization has significantly impacted the travel agency industry, driven by customer demand, the sharing economy, social media, and virtual reality. Organization readiness and control effect readiness are crucial for successful digitalization strategies. Organizations must be prepared to implement changes and manage risks associated with digitalization. Training plans for employees with new digital skills are essential for success. Businesses must re-think and possibly reinvent their business models to remain competitive in the digital age.

The study emphasizes the significance of direct interaction and quality customer service in the travel agency sector to retain customers and compete with online travel agencies. It suggests that travel agency managers need to adapt their business models and incorporate e-commerce processes for competitiveness. The study also calls for ongoing research to identify solutions and adapt to new tourism trends and future consumers.

RESEARCH CONTRIBUTION

In the context of research, this study aspires to contribute to the implementation of innovative internet technology approaches in tourism planning and management concerning travel products and services, particularly for traditional travel agencies and travelers. This study serves as a pivotal instrument in enhancing our comprehension of the capabilities and reliability of internet technology as a distribution channel when integrated into the tourism sector. When travel agencies recognize the significance of internet technology as an effective distribution strategy, they will engage with and incorporate it into their management practices, thereby enhancing business opportunities and performance. To expand the existing corpus of knowledge within tourism studies, this research also aims to assist related stakeholders in managing tour and travel companies by elucidating the perceptions and opinions of local traditional travel agencies regarding current distribution strategies. These contributions are elaborated upon in the following paragraph:

CONTRIBUTION TO THE BODY OF KNOWLEDGE

This research provides a foundational framework for future scholars examining the survival of travel agencies in the digital age. This study has delineated an effective distribution strategy for tourism products employed by travel agencies, aimed at assisting stakeholders in the administration and management of tour and travel enterprises concerning tourism products and services. Furthermore, it

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elucidates the supportive role of Tourism Policy in fostering the survival strategies of travel agencies as endorsed by governmental bodies.

CONTRIBUTION TO THE TRAVEL AGENCY AND TRAVELERS

The investigation into efficacious distribution strategies for tourism products employed by travel agencies underscores the paramount significance of these strategies for sustainable tourism development. It elucidates the potential perils of disintermediation precipitated by advancements in internet technology and advocates for a synergistic integration of traditional methods with digital innovations to enhance the operational framework of travel companies. The research aspires to equip travel agents with a comprehensive understanding of the critical roles that internet technology plays within their strategic paradigms, as it possesses the capacity to profoundly influence their future trajectories. Furthermore, the study accentuates the advantages of juxtaposing travel packages via the agency's website.

CONTRIBUTION TO THE COUNTRY ECONOMIC

Tourism development can serve as a long-term source of revenue for a country, enhancing its image and reputation through tourism products that attract a continuous influx of visitors. This fosters trust and reliability among consumers. Consequently, it will elevate the number of travelers visiting various tourist destinations. Innovative distribution strategies have expanded the avenues for promoting and marketing travel products and services, enabling travelers from diverse countries to easily search for and explore websites that compellingly showcase well-prepared tourist destinations.

CONTRIBUTION TO THE TOURISM INDUSTRY

Online reservations, mobile applications, and virtual reality have made travel planning more accessible and personalized. Customers are more flexible in searching for information, expect personalized, emotional, and engaging travel experiences, and have increased demand for tourism and competition in the tourism market. The integration of electronic distribution channels and information technology has transformed travel agencies from face-to-face to digital platforms, increasing operational efficiency, global reach, and empowering travelers, changing consumer behaviour, thereby contributing to the growth, accessibility, and innovation of the tourism industry.

RESEARCH IMPLICATION

Technology has fundamentally transformed travel planning, rendering it more accessible and tailored to individual preferences. The amalgamation of sales, marketing, distribution, and logistics processes enhances adaptability while harmonizing product demand with inventory levels. Nevertheless, this evolution

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has also diminished the prominence of travel agents and wholesalers, empowering consumers to book directly with airlines or service providers. Travel agencies, however, can still deliver bespoke services and optimize costs by leveraging advanced information technology. The incorporation of electronic distribution channels and information technology has transformed conventional travel agency models while simultaneously creating fresh opportunities for innovation, expansion and efficiency. Ultimately, the shift presents not just challenge and survive, well-positioned to thrive in a rapidly changing industry, but a strategic opportunity for growth, dynamic and competitive advantage in the digital era.

STUDY LIMITATIONS

The limitations encountered by this study include temporal constraints that hindered comprehensive research into areas such as Penang Island. Future investigations could delve deeper into these findings by incorporating diverse insights from a broader spectrum of travel and tour agencies, thereby extending the scope of the inquiry to gather more substantial information regarding the resilience of travel agencies in the digital era across the entirety of Penang state.

CONCLUDING REMARKS

This research conducted in Bukit Mertajam and Seberang Perai has elucidated the effective distribution strategies for tourism products aimed at engaging travel agencies. From the perspective of the travel agency, we gain insights into the initiatives formulated to facilitate management and development related to tourism products and services, including electronic distribution channels and strategic models.

A pivotal instrument for the management and evolution of travel agencies is the mix of distribution channels, which encompasses websites, email communications, and telecommunication systems within the agency's operational framework. This integration is crucial for ensuring the survival of traditional travel agencies in the future. Travel agencies must adeptly harness internet technology to sustain their relevance and prevent marginalization in the global marketplace. Concurrently, travel agents, as specialized consultants, must provide exemplary personal service to customers, thereby encouraging repeat business. Furthermore, they require robust support from tourism policies that bolster the distribution strategies implemented by the government.

Undoubtedly, travel agencies must continue to cultivate a cadre of professional travel agents, as well as specialists in travel and tourism, who possess managerial and entrepreneurial acumen to enhance the productivity of their offerings. Findings also revealed that all respondents concurred that governments have been collaborating with relevant entities, such as Penang Tourism and Penang Global Tourism, to operationalize tourism policies as

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supportive measures. These initiatives include equipping travel agencies with essential tools for management and planning, alongside promoting tourism-related products and services at destinations, thereby advancing a sustainable tourism sector.

Conversely, as highlighted in the research findings, despite the availability of distribution channel strategies, travel agencies continue to confront prospective risks and adverse impacts. The roles of travel agents have been undermined, leading to disintermediation and a transformation of selling and marketing functions directly to consumers. This shift results in diminished distribution costs, such as the elimination of commission payments to suppliers. For instance, the airline industry has become increasingly profitable by incentivizing customers to book tickets directly through their websites, thereby bypassing travel agencies and resulting in zero commissions for them.

To mitigate these adverse effects, traditional and internet technologies should complement one another and forge partnerships as a mechanism for distribution channels of travel products and services. Moreover, nurturing partnerships can safeguard traditional travel agencies from obsolescence in contemporary markets. Consequently, efforts to integrate and collaborate between traditional and internet technologies will be vital for sustaining travel agencies and fostering competitiveness within the tourism industry. It is imperative that traditional travel agencies recruit more professionals with advanced computer skills, equipped with managerial and entrepreneurial expertise, to enhance productivity in tourism product development.

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THE IMPACT OF TANGIBLE HERITAGE TOWARDS HISTORIC BUILDING USAGES IN THE GEORGE TOWN UNESCO WORLD HERITAGE SITE IN PENANG, MALAYSIA

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Abstract

This study endeavors to explore the economic significance of tangible heritage treasures, examining their positive and negative ramifications, as well as their conservation and preservation for sustainable development. A framework analysis was employed to gather data from both local and international traders. Findings derived from qualitative methods revealed that the economic value of tangible heritage treasures, as manifestations of living cultural heritage, is particularly evident within the George Town UNESCO World Heritage Site, which functions as a specialized market treated as a monetary asset. This dynamic engenders both advantageous and detrimental financial effects on the utilization of historical buildings in George Town, highlighting the unique architectural heritage as a valuable asset for residential and commercial purposes. The potential for adaptive reuse for business ventures necessitates ongoing maintenance as a critical aspect, while challenges such as gentrification, which displaces long-standing residents in favor of wealthier individuals, underscore the importance of preserving built heritage. Moreover, the imperative to conserve and protect these assets for sustainability is evident, with the enhancement and upkeep of built heritage being essential for both survival and the viability of sustainable enterprises. The results illuminate the perspectives of the local community and foreign visitors, offering constructive suggestions for improvement and insights into the future of heritage sites, particularly in light of the impacts of Covid-19 and the strategies for overcoming these challenges in the George Town World Heritage Site.

Keywords: Economic Value, Tangible Heritage treasures, Historical Building Usages, Sustain, Cultural Heritage, George Town UNESCO World Heritage Site Penang, Malaysia

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INTRODUCTION

The UNESCO World Heritage Site designation has significantly propelled the tourism industry in Malacca and George Town, particularly emphasizing cultural tourism. The unique amalgamation of historical townscapes, living heritage, and multiculturalism that distinguishes Malacca and George Town is noteworthy. In 2008, the UNESCO World Heritage Committee conferred upon George Town the prestigious title of World Heritage Site in the Cultural Heritage category following multiple nominations. According to George Town World Heritage Incorporated (2016), the "historic cities of the Strait of Malacca" were collectively acknowledged as multicultural heritage communities and architectural masterpieces.

The UNESCO nomination as a World Heritage Site has engendered abundant opportunities for the enrichment of George Town's cultural heritage. The harmonious fusion of multiculturalism, living heritage, and historical townscapes is what uniquely characterizes Malacca and George Town. These three salient elements epitomize the peaceful coexistence of diverse religions and places of worship, a synthesis of Asian and colonial multicultural heritage, and architectural forms that reflect the lives, daily rituals, trades, and culinary traditions of the inner city community (Farahani et al., 2012).

The historic city of George Town encompasses a diverse array of architecturally significant structures, showcasing various styles. These include churches, mosques, and Chinese and Indian temples, as well as Indo-Malay Palladian structures, Early Shop Houses, Anglo-Indian Bungalows, Early Eclecticism Shop Houses, Early Traditional Style, Sino-Anglo Bungalows, Art Deco Style, Neo-Classical Style, Early Modern Style, Late Modern Style, and an assortment of religious architectural heritage. The deterioration of George Town's streetscapes stands as a testament to the evolution of this once rustic port city.

George Town, a city center in Penang, faces threats to its cultural, location-specific, local knowledge, and traditional trades. To preserve the culture, the public should consider George Town as a Cultural Capital and harness its economic resources to provide employment opportunities and generate revenue for the local community. Since 2008, George Town has been designated a World Heritage Site, leading to increased land and property values, job opportunities, and rental costs within the heritage zone.

Generation has led to the displacement of traditional business owners and increased rents, which have compelled the displacement of traditional business owners. Urban regeneration, or gentrification, involves reinvesting in inner cities that are deteriorating due to neglect and abandonment, resulting in long-lasting economic and physical improvements.

The prices of heritage properties in the buffer and core zones have risen by an additional 300 percent since 2008, driven by limited availability of falls

within the heritage zone for sale and strong demand from foreign and domestic shareholders or investors. Rental rates for heritage properties that have not been renovated or are still in their original condition are still low, with yields typically below 2 percent.

UNESCO World Heritage Sites aims to conserve and preserve the culture in George Town by promoting the recognition, preservation, and protection of the heritage site as a site of exceptional value to humanity. However, researchers need to elaborate on the limitations of cultural tourism's economic impact and conduct a comprehensive study to identify the values of tangible heritage treasures in the city.

LITERATURE REVIEW

Penang, established in 1786 by the British East India Company, emerged as a pivotal shipping and trading nexus along the Straits of Malacca. The principal town, George Town, was aptly named in honor of King George III. In response to a labor shortage during the 19th century, Penang experienced a significant influx of Chinese and Indian immigrants. The majority of Malay inhabitants, however, remained ensconced in rural locales and largely abstained from the urban development of the town. By the early 19th century, the urban landscape was characterized by the dominance of shophouses and terrace houses adorned with tiled roofs and robust brick constructions. The allure and distinctive character of the city center stem from the plethora of historically significant monuments and the rich tapestry of cultural and architectural elements, particularly evident along King Street. Penang's traditional edifices, shaped by local customs and the tropical climate, continue to serve commercial purposes, as a substantial portion of trade is still conducted within these vibrant Southeast Asian structures (Hailane et al., 2013). The most iconic formation within the inner city comprises shophouses, featuring two or three stories that provide covered walkways and open arcades extending five feet both in front and behind. An abundance of food vendors, bustling markets, quaint shops, and artisanal workshops contribute to a lively street scene where stores and cafés overflow with patrons.

Nur Alia Mohamad Omar and Sharifah Fairuz Syed Fadzil (2011) observe that the original identity of the shop houses has evolved into that of boutique hotels and retail establishments. This transformation is the result of a serene and harmonious amalgamation of cultures that have coexisted in George Town, occupying various types or categories of buildings to facilitate their livelihoods. According to Zwain and Bahauddin (2019), one such structure, the shop house, boasts a history spanning at least 200 years and exemplifies a unique architectural style distinctive to George Town. Traditionally, it has fulfilled dual purposes, with the ground floor dedicated to commercial activities and the first

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floor serving as a residence. On the other hand, the George Town World Heritage Site in Penang has seen the emergence of creative tourism as a result of these business and cultural activities, as well as the need for development, which has transformed numerous historic buildings with heritage status into boutique hotels and commercial spaces (Mohd Abdullah et al., 2020).These edifices represent a living, tangible heritage of the past—showcasing the built environment, traditional artisans, and trades that continue to thrive and operate as they have for generations in Georgetown.

The 2008 designation as a UNESCO World Heritage Site significantly influenced the affordability of housing and accommodations within the inner city of George Town, recognized as a world heritage site. Consequently, George Town's dynamic voluntary and discretionary sectors have cultivated a discourse surrounding heritage, wherein the inhabitants, the spaces they occupy, and the edifices they have constructed are perceived as focal points for conservation (Cheng et al., 2014). This phenomenon has emerged as a consequence of a secondary wave of outward migration, supplanted by practitioners and investors. Amidst the pressures of economic expansion, social transformation, and the commodification of cultural heritage attractions, George Town has been acknowledged as possessing Outstanding Universal Value (OUV), with its cultural resources facing significant threats. Consequently, the development process may result in heritage buildings acquiring designations and classifications that are ill-suited for restoration.

(Mohamed et al., 2015) posits that, in accordance with other historical or heritage sites, escalating real estate prices can lead to exorbitant rental costs for proprietors, the emergence of boutique hotels, upscale dining establishments, and a burgeoning hospitality sector. As noted by (Y. Lee et al., 2017), rental fees for commercial spaces within public heritage zones have surged dramatically by 500 percent. This troubling trend places George Town at risk, eroding the intrinsic allure of its living cultural heritage. It is imperative that greater public engagement and consideration for community welfare be integrated into the strategies for gentrification and redevelopment in George Town. Concurrently, more comprehensive research dedicated to the preservation of culture and history should prioritize conservation efforts over capitalist ambitions. The collapse of local cultural identities has been directly impacted by the transition of conventional enterprises, as citizens and long-standing firms are being forced to relocate and foreigners are acquiring more city assets (Connolly, 2021).

Penang's shophouse culture transcends mere architecture and construction; its preservation necessitates a commitment that surpasses conventional practices associated with building conservation (Wagner, 2017). The Act on Tourist Boards states that the common goal is the consciousness’s development about the importance and economic, social and other effects and

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influence of tourism; about the importance and need to improve and preserve all the elements of the tourist product of a certain area, and especially the protection of the environment and the safeguarding of cultural heritage and natural according to the development sustainability (Petti et al., 2020).The government must engage with a diverse array of stakeholders, as pursuing these processes in isolation is neither viable nor advisable. Being recognized globally as a UNESCO World Heritage Site entails a profound sense of accountability on an international scale. Consequently, for a site to be included in the esteemed roster of World Heritage Sites, it must uphold its remarkable universal value, alongside the criteria of authenticity and integrity at the moment of its nomination and declaration. Failing to meet these standards jeopardizes its status on the list, resulting in the forfeiture of its significance (Mohd-Isa et al., 2011).

These initiatives can generate revenue for the residents while safeguarding traditional enterprises. Engaging stakeholders in tourism management, coupled with training and fostering innovation, can substantially enrich visitor experiences. Dedicating human capital and resources towards conservation efforts can yield financial advantages for the local community. By recognizing cultural diversity and actively participating in conservation programs, it is feasible to achieve economic viability and stave off deterioration. Conversely, George Town encountered severe repercussions from the COVID-19 pandemic, which precipitated a surge in cultural tourism yet simultaneously imposed travel restrictions and controls that complicated mobility. Although the pandemic's impact on the travel industry was devastating and overwhelming, the city also witnessed the resilience exhibited by certain enduring business vendors and operators, who adeptly navigated the transition back to regular business operations through the implementation of Movement Control Orders (MCO), Standard Operating Procedures (SOP), the availability of vaccinations, and the maintenance of local product capabilities, supplemented by financial assistance from the local government. Incentives designed to invigorate and stimulate the tourism sector must adhere to rigorous assessment and evaluation rather than merely conforming to regional norms and best practices (Dewan, 2020). Penang aspires to revitalize the tourism industry and rebound from these challenges.

RESEARCH METHODOLOGY

This study was meticulously designed as a qualitative research endeavor, employing a case study as the overarching research strategy and semi-structured interviews as the primary research method. A cohort of 21 respondents was judiciously selected from both local and international traders, as well as associated traditional businesses engaged in economic activities within the cultural heritage context of George Town, specifically in the buffer and core zones. Open-ended questions can provide qualitative information that can be

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analyzed with qualitative methodology (Robyn Longhurst, 2010). This approach facilitated the collection of comprehensive and precise data. An interview schedule was meticulously crafted to ensure that data collection occurred in a structured manner, aligning with the study's objectives. Judgment sampling was employed to elicit more profound insights and intricate details within this inquiry.

The research focuses on the economic impacts of cultural tourism development in George Town, Penang. It involves exploring research problems, determining research objectives, conducting a literature review, and constructing a research design using "intensive and extensive" approaches. The research uses intensive interviews, focusing on qualitative techniques like interactive interviews, to explore public views and understand the economic impacts of cultural tourism development in the area.

Data was garnered through in-depth interviews conducted from October to December 2021, with each open-ended interview allotted between 45 and 55 minutes. These sessions were recorded using audio tapes and supplemented with detailed notes. Arrangements were established prior to the actual meetings, with interviews taking place in the interviewees' offices, although some participants were interviewed at their shophouses.

Prior to initiating the interview process, the researcher prepared a comprehensive list of questions tailored for the targeted participants. Longhurst (2013) emphasizes the importance of participant selection in semi-structured interviews. The resultant strategies and theories generated from this research are both intelligible and experientially credible to the subjects being studied, as well as to others, thereby establishing the inductive approach in practice (S. Bolster Arthur, 1983). By employing this strategy, the researcher aims to fulfill the research objectives through the acquisition of in-depth information regarding the subject matter. The researcher will subsequently proceed to the final stages, which entail analyzing the data through framework analysis, thus facilitating the answering of the research questions. The findings will be thoroughly discussed and analyzed in the final report.

The framework methods will be utilized to systematically analyze the recorded semi-structured interviews. Developed by Ritchie J. and Spencer, the framework represents a methodical procedure for managing qualitative data within an applied research context, thereby yielding analyses with the "potential for actionable outcomes." The framework technique encompasses five distinct stages of data analysis, executed in a systematic manner.

1. Familiarisation

Initially, the familiarization process will initiate the data analysis procedure. Once the recorded interviews are transcribed and securely stored in electronic files, the researcher will delineate key concepts and recurring themes. According to Anne

Lacey (2001), prior to commencing the formal analysis, the researcher should attentively listen to the recordings, thoroughly examine the data, and compile comprehensive summaries.

2. Identifying a thematic framework
During the familiarization phase, the thematic framework was meticulously crafted from the transcription and textual analysis. Ritchie & Spencer (2002) refer to this as the preliminary iteration of the indexing process, wherein all themes emerge from both preconceived notions and novel issues articulated by respondents. This methodology encompasses 'both intuitive and logical reasoning, alongside discerning the significance, relevance, and implications of various issues, as well as the latent connections between concepts' (Ritchie & Spencer, 2002). This stage is imperative to ensure that the research inquiries are comprehensively addressed (Ritchie & Spencer, 2002).

3. Indexing
At the indexing stage, the application of the thematic framework to the data process entails identifying specific data segments that align with various themes through the utilization of numerical or textual codes, a practice commonly referred to as coding in other qualitative analysis methodologies (Anne Lacey, 2001). Although this method can be employed to index any textual material, it has predominantly been utilized for transcriptions of individual interviews (Ritchie & Spencer, 2002).

4. Charting
The analyst is tasked with constructing a comprehensive understanding of the data by employing the thematic framework to individual transcripts and meticulously examining the spectrum of attitudes and experiences associated with each issue or thematic perspective (Ritchie & Spencer, 2002). Each theme, as represented across all respondents, is rendered thematic through charts, or conversely, each respondent is analyzed across all themes by case (Anne Lacey, 2001). In this study, the thematic approach will be embraced. Upon the adoption of a thematic approach, for each pivotal subject area, charts are meticulously created, with entries recorded for multiple respondents (Ritchie & Spencer, 2002).

5. Mapping and Interpretation
The analyst commences the process of synthesizing key characteristics of the data, subsequently mapping and interpreting the dataset in its entirety once all the data have been organized according to fundamental themes (Ritchie & Spencer, 2002). During this phase, Ritchie & Spencer (2002) posited that the qualitative

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analyst should endeavor to (1) delineate concepts, (2) chart the spectrum and nature of phenomena, (3) construct typologies, (4) uncover associations within the data, and (5) offer explanations or formulate strategies.

Research ethics involve ensuring participants are aware of the research background and objectives before conducting interviews. Dilmi Aluwihare-Samaranayake (2012) emphasizes the importance of informed consent and confidentiality. Interviewees are not named and presented with a corresponding number, such as R1, R2, or R3. Confidentiality is a crucial ethical issue, and each interview data is transcribed and sent back for confirmation to ensure it does not differ from its meaning. Confidentiality is a crucial ethical issue in research.

The researcher ensured the validity and reliability of the research findings through careful recording and listening to interviews. Reliability measures the scope without bias and ensures compatible measurement across time. In qualitative research, reliability is defined as consistency, precision, stability, homogeneity, equivalence, and accuracy. Validity involves rigor, trustworthiness, and quality generated by the researchers themselves. Triangulation is a valuable strategy for testing reliability and validity, used in gathering data about unitary matter and examining policy documents and interview results. There are five types of triangulation: investigator, methodological, theoretical, data, and analysis. However, triangulation raises methodological issues in naturalistic and qualitative approaches to control bias and establish valid propositions. Therefore, triangulation is the best instrument for achieving analysis findings' validity and reliability.

RESULT AND DISCUSSION OF FINDINGS

Akram Zwain (2019b) observes that Georgetown, Penang, stands as the sole complete and final surviving center of the historic city along the Straits of Malacca. The architectural edifices and cultural heritage of Penang have emerged as some of the most esteemed products and assets within Malaysia. Furthermore, it boasts a rich tapestry of multi-cultural and ethnic heritage stemming from the trade routes and pathways connecting the Indian subcontinent, the Malay Archipelago, China, Europe, and Great Britain. For instance, as articulated by respondent 13: *"I embarked on my early-stage songkok enterprise within a traditional shophouse of early Penang style, reflective of structures built between the 1790s and 1850s, featuring five-foot walkways, single-story design, intricate details, lime plaster on structural brick pillars and walls, and square columns supporting slanting beams with overhanging eaves, established by Indian and Malay artisans."*

George Town Heritage City, home to approximately 7,000 traditional shophouses, serves as a testament to Penang's illustrious architectural legacy. Two centuries ago, this city was conceived in a markedly different era (Y. W.

Tan & Studio, 2015). Owing to its distinctive architectural style and cultural milieu, this city in the northern region of Peninsular Malaysia was inscribed on the UNESCO World Heritage Sites list in 2008. The integrated economic and social development of urban and regional planning endeavors ought to take into account the historic urban landscape of George Town. Respondent 9 further remarked, *"As a five-star boutique hotel, complete with a café, fine-dining restaurant, cigar den, and wine lounge, we celebrate Penang's vibrant present and its opulent colonial past. This establishment, known as Gatsby's Mansion, is the first Malaysian member of Design Hotels and is named in honor of the British Governor of Penang, Colonel Norman Macalister, who served from 1808 to 1810."*

The findings elucidate that adaptive reuse constitutes a "successful marriage" of contemporary architectural design and cultural heritage facilities. This concept pertains to the modification and transformation of sites or edifices that are amenable to adaptation or conversion in alignment with modern inclinations and the principles of sustainable and viable development. Such initiatives are capable of stimulating the economy and generating revenue for local stakeholders (Mohd. Shukuri & Awang, 2014). *One of the traditional traders (Respondent 4) remarked, "We have occupied 11 heritage shop houses in Georgetown and require ample time and space for roasting coffee. During the conversion process, we intend to utilize the upper floor as an office while the ground floor will serve both business and production purposes." Another traditional trader (Respondent 7) stated, "The store has also been transformed into a joss stick workshop. We continue to use the ground floor for this workshop, while the upper floor remains designated for housing and shelter during visits."*

The findings elucidate that maintenance encompasses the introduction of novel uses and services while preserving the contextual attributes of the location. This approach facilitates business expansion without compromising the original function and utilization of the buildings, all while safeguarding their architectural integrity and design. Consequently, this enhances their value and economic stature (Wahab et al., 2016). As articulated by respondent 16, "Our café business endures as it has been meticulously preserved and restored in accordance with UNESCO guidelines, facilitated by Intersocietal and Scientific, and inaugurated by the Penang Governor. It embodies a southern Chinese traditional shophouse, adorned with an interior reflective of Penang Peranakan Muslim eclecticism. The establishment is owned by an Indian Muslim coppersmith and brass craftsman, and, as previously, was brought to life by the Al Iman society."

Yee Sing & Yoh (2016) elucidated that maintenance encompassed the introduction and promotion of novel uses and services while preserving the locale conducive to fulfilling the requirements of the desired and sought-after functionality. The construction upheld the contextual integrity of the

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environment, yet adapted to incorporate an entirely new performance and function internally, thereby enabling the continuation and expansion of business operations. *Respondent 3 remarked, "Our traditional building houses have been meticulously preserved and now feature a coffee museum, suites, and an art gallery, creating an eclectic ensemble of a restaurant, all fully equipped for both short and long-term stays, adorned with modern amenities." Respondent 6 observed, "It infuses the street with vibrancy and liveliness, establishing an optimal pathway to explore the intimate side lanes replete with secluded hidden alleys and hawker stalls."*

According to the findings, globalization has profoundly influenced George Town's heritage site, particularly through gentrification propelled by economic interests. Establishments such as cafes, restaurants, hotels, and hostels have experienced a surge in prices due to heightened demand for accommodations, culinary experiences, and entertainment options. The inception of these enterprises in the 1970s was integral to the region's early tourism initiatives. The scarcity of affordable housing coupled with escalating living costs has precipitated the displacement of local communities, an influx of businesses, deteriorating premises, unoccupied constructions, and an increase in low-wage employment (Ley, 2014). Professional roles are now predominantly filled by foreign nationals and investors rather than local or domestic workers, and apprehensions regarding security have intensified in recent times. The restoration of heritage structures is prohibitively expensive for many locals, as they are compelled to adhere to authentic and traditional construction methods and materials.

According to Respondent 1, *"The only hotel in Penang that currently exists has been bestowed a new lease on life within a 130-year-old edifice, dating back to the British colonial era, originally established as a merchant hotel and now functioning as a boutique hotel. However, by 2007, it had fallen into decline due to diminishing demand and the onset of inflation, which rendered it increasingly challenging to preserve the building. Consequently, it remained uninhabited for several years. Only a few years ago, this architectural heritage was granted a second chance at life. After a period of leasing, Mr. Seah, the proprietor of various real estate assets in this city, invested approximately RM 11 million to restore and maintain the original structure, culminating in its current state and operation as a potential new entry into the hospitality industry."*

Referring to the interview with Respondent 3, they stated, *"These shophouses were originally constructed in 1927. At that time, traders resided on the upper floors while conducting their businesses on the ground level. The shophouses are almost entirely adorned with antique oriental-themed furnishings, showcasing exquisite carvings and fine woodwork. The first owner faced business failures and was unable to preserve the integrity of the traditional*

shophouses due to the burgeoning development of cultural tourism following the declaration of George Town, prompting them to vacate and sell their property from this prime location. The premises were left abandoned until they were claimed by a Swiss gentleman, who relocated to Penang as the proprietor of a coffee house and an aficionado of the beverage, establishing a boutique hotel along Stewart Lane. Today, the building houses six suites, the 55 Cafe & Restaurant, and the Kopi Museum, which serves Mediterranean-inspired cuisine, alongside the Gehrig Art Gallery, currently under the stewardship of Gehrig."

In the George Town World Heritage Site, gentrification is conspicuous and has jeopardized the sustainability and livelihoods of its multicultural, ethnic, and historically rich inhabitants (Ferm, 2016). As articulated by respondent 12, *"There are numerous similar competitors, which have rendered our businesses economically unviable due to the exorbitant rental fees on Penang Road. Concurrently, the development of George Town, Penang has precipitated inflation, as the original proprietors could not maintain the structural integrity and deteriorating condition of the shop houses, leading them to divest their properties. These have been acquired by new investors who have subsequently escalated the rental fees to offset the high costs of repairs. Moreover, the price of materials for rattan goods has surged, while the demand for rattan has diminished, as consumers increasingly favor plastic alternatives. Consequently, we experienced a significant loss in business and were compelled to relocate, with the new owners transforming the premises into a café. In response, we have devised plans to innovate new rattan products, such as baskets and handicrafts. Today, there is a growing awareness among people regarding their heritage and culture, fostering an interest in this endangered craft. Ultimately, our shop has gained visibility online. Gradually, fueled by our passion and dedication to crafting with rattan and bamboo, our business has flourished, culminating in the establishment of a shop house on Beach Street."* According to Respondent 13, *"The demand for ready-made songkok has surged, compelling me to cancel orders for tailor-made variants this year. Most consumers opt for factory-made songkok available in malls or supermarkets, despite the superior quality of handmade products. This shift has resulted in a considerable decline in business, necessitating our relocation from the shop house on King Street in George Town due to the untenable rental fees. The landlord's insistence on preserving the traditional architectural features of the shop house, which are vital for economic growth, has compounded our difficulties. The premises have suffered damage from inclement weather, and the preservation of its historical elements has become increasingly costly and time-consuming. Ultimately, the property was relinquished and acquired by a new owner from Singapore, who repurposed it into a restaurant for higher profits. During each George Town festival, I endeavored to set up a stall to promote and sell songkok, which gradually*

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enhanced my reputation and business prospects. I received an order for approximately 100 pieces from a company in Singapore, enabling me to purchase a shop house in Little India and revitalize my business, which continues to thrive to this day."

Kamal et al. (2016) posited that the inflation rate serves as a significant factor and indicator that may precipitate an increase in housing prices. One traditional trader (Respondent 14) lamented, *"We face the same competition as artisans. The inflation of goods has rendered it impossible to procure materials necessary for production, leading to business failures and a diminished capacity to purchase supplies. Ultimately, we are compelled to sell handicraft products at significantly reduced prices, sometimes even at half their original value, resulting in diminished profits and, consequently, the collapse of our enterprises."*

In an interview with Respondent 1, it was noted, *"In light of inflation, a majority of suppliers have escalated the prices of raw materials essential for food preparation, thereby undermining our financial viability. This compels us to raise operating costs, room rates, and the prices of menu items, which we must pass on to our guests in order to secure essential resources and materials. Consequently, many guests engage in comparative analysis to ascertain the best value, gathering information to inform their decisions, which ultimately leads to a loss of business opportunities. If we continue to suffer losses and are unable to sustain ourselves, we risk losing our properties."*

Urban development poses a threat to the architectural integrity of shop houses in Georgetown, Penang, adversely impacting their facades and stylistic elements. The visual aesthetics and delicate features render them susceptible to degradation. Architectural principles must be re-evaluated, with particular features necessitating heightened attention. As articulated by Respondent 8, *"To preserve the authenticity and originality of our hotel building, we require greater financial resources. Additionally, we must restore the facilities of buildings that embody a heritage concept. Failing to retain the original architectural characteristics will not only erode the artistic and cultural significance but also contravene the regulations instituted by the government aimed at preserving pre-war structures."*

Moreover, another traditional trader (Respondent 5) remarked, *"It is imperative that we restore and maintain our shop houses to ensure the survival of all food stall businesses, as numerous family members are reliant on these enterprises for their livelihood. Food stall proprietors are compelled to allocate their income in two directions: towards the renovation of the shop lots and the sustenance of their families. Beyond food quality and service, we must uphold the ambiance, authenticity, and facade of the coffee shop to allure both local and international tourists."*

The evolving values and characteristics of individuals have

fundamentally transformed the consumption of products, particularly heritage items, which necessitate specialized knowledge and skills, thereby influencing the viability of the heritage production model (Ashworth & Larkham, 2013). Grasping the market demand in this contemporary era is imperative, as it significantly influences purchasing behaviors, learning experiences, and engagement with heritage products. Respondent 6 noted, *"The enduring popularity of our restaurant has persisted alongside the burgeoning interest in Indian cuisine over the years, both prior to and following the nomination and the ascent of economic and cultural tourism in George Town, Penang, despite the occurrence of inflation."* Furthermore, Respondent 10 remarked, *"It is fortunate that my establishment is located along Armenian Street, a prominent destination frequented by tourists for sightseeing. Often, they discover my shop upon their return home and share their experiences with relatives and friends. One of the primary reasons for my continued success is the affordability of my offerings, allowing customers to select from an extensive catalogue or print designs that resonate with their events."*

Gentrification is intricately linked to historical patterns of residential segregation, with indigenous communities grappling with threats stemming from white flight and neglect throughout the 1950s to the 1970s (Powell & Spencer, 2002). Strategies devised to counteract gentrification are predominantly centered around residential areas, with the aim of ensuring stability, job equity, and sustainable economic growth. To foster long-term stability and equilibrium, these strategies should garner support from a diverse array of sectors, including municipal, regional, non-profit, private, and philanthropic entities. As articulated by Respondent 3, *"What has transpired is that, as businesses negotiate fair market rents, there has been a leapfrogging effect along the street, resulting in numerous new openings and the closure of several establishments. The well-regarded local specialty shops and coffee houses, still buoyed by the patronage of local customers from both the city and suburbs, continue to thrive in their endeavors." Respondent 19 commented, "Gentrification will inevitably manifest, yielding fortune; however, only 3% to 4% of the shop houses and other properties in the 109.38 zone are owned by foreign entities, thereby controlling and restricting the ownership of heritage properties by outsiders, as stated by the chief minister."*

Said et al. (2013) posited that the proliferation of cultural and heritage tourism, along with its attendant benefits, can facilitate the preservation of heritage and elevate awareness, ultimately yielding financial dividends. The city's affluence and its rich tapestry of historic shophouses and grand edifices encapsulate Penang's cultural essence and depth. Numerous initiatives have been undertaken by individuals and organizations to foster tourism development and enhance heritage appreciation in Penang (Chan et al., 2020). Respondent 9

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articulated, *"It is imperative for the local authority to contribute to the upkeep of historical sites and buildings, as well as to acquire land pertinent to the preservation of these historical structures." Furthermore, another traditional trader (respondent 2) remarked: "As a local resident, it is crucial to engage in the planning of sustainable tourism development, educating both tourists and residents, conserving natural resources, respecting local culture, and actively participating in all practices and initiatives pertaining to sustainable tourism."*

The issue of sustainability assumes particular significance in the context of cultural phenomena that shape and define the fundamental dimensions of cultural tourism development and industry (Abdullah et al., 2019). The assessment of the energetic dynamics of tourist activities and their impact on cultural sites necessitates a more concerted effort for cultural tourism to achieve greater sustainability. As articulated by a traditional trader (respondent 12), *"We cultivate a diverse array of cultural activities within our shop house, enabling us to derive direct benefits from foreign visitors who contribute economically. This, in turn, allows us to sustain our shop house while generating economic advantages for the community and preserving the values inherent in our cultural heritage."*

This finding underscored that the residents recognized the paramount importance of heritage preservation for the benefit of future generations. Generally, the uninformed yet keen community of enterprising and entrepreneurial individuals could derive greater advantage from gaining insight into the diverse interpretations that have emerged in the discourse surrounding heritage, as well as understanding the business models specifically designed to promote the sustainability of cultural tourism (Cw et al., 2021). Furthermore, the enhancement of systemic support and fundamental infrastructure can facilitate collaboration across different generations within the communities of George Town, fostering a collective appreciation and acknowledgment of the area's historical significance and its modest future as a heritage site and cultural nexus (Samat & Mahamud, 2019). In September 2016, the Special Area Plan (SAP) was published for George Town's heritage buildings, providing a more detailed and professional management plan. The plan includes a history, SWOT analysis, conservation strategy, guidance plan development, and guidelines for heritage buildings and conservation areas. According to a traditional trader (respondent 9), *"Conservation areas and Heritage Building Guidelines are intended to manage and regulate land development and consumption, safeguarding not only the heritage structures but also contributing to the integrity of the entire area within the George Town World Heritage Site."* As articulated by respondent 11, *"It is imperative to provide appropriate services and amenities to ensure the comfort and convenience of visitors while exploring the destination, thereby stimulating increased engagement in cultural tourism and attracting a greater*

influx of visitors to the heritage site."

The findings suggest that fortifying the bond between local communities and the city's heritage, while augmenting awareness of its cultural values—encompassing both local significance and Outstanding Universal Value (OUV)—is essential for establishing productive, inclusive, and accountable foundations at every level of residency. This approach aims to facilitate equitable access for all and foster harmonious societies conducive to sustainable development (Khoo Salma Nasution, 2001). Respondent 15 articulated, *"The principal strength will undeniably reside in the inner-city area of George Town, Penang, as a UNESCO World Heritage Site, characterized by its multi-ethnic societies, distinctive architecture, and historic landscapes, which directly engage tourists through vibrant marketplaces and street life, thereby epitomizing the uniqueness of our culture."* Respondent 11 remarked, *"Preserving the pre-war buildings is vital for enhancing the stability and longevity of these structures. Our hotel room business, housed within these shophouses, attracts tourists and travelers seeking a heritage-centric experience. This not only generates benefits through tourist taxes but also underscores local distinctiveness, thereby ensuring the preservation of heritage resources in George Town."*

Timothy Choy Xia Wei and Yeong Pey Jung (2020) emphasize the imperative for the council and government to furnish augmented support, resources, and expertise for tourism development in the wake of the COVID-19 announcement. Local communities must diligently adhere to standard operating procedures (SOP) to mitigate the profound impacts of the pandemic, alongside the phased implementation of the Movement Control Order (MCO) which pertains to regional recognition and identity (Lee Siu Ming, 2020). The efficacy of the recovery across all sectors and the capacity to navigate the public and community health responses to the COVID-19 pandemic will hinge on population immunity and the widespread acceptance of vaccinations (Vaghefi et al., 2021). This initiative is poised to catalyze economic revitalization, instigating transformations within the heritage and industrial sectors. Such progress is untenable without regular discourse among all stakeholders regarding their perspectives and contributions to the management and operation of enhanced adaptable tourism development.

Respondent 4 articulated, *"The pandemic has precipitated business closures, resulting in widespread job losses across various industries, diminished financial prospects, and an inability to procure our products. The loss of business has reached a critical point; if we cannot sustain operations, we will inevitably be compelled to cease our business activities."* Respondent 5 remarked, *"The culinary staff uphold stringent hygiene practices, and patrons diligently adhere to SOP and MCO regulations."* Furthermore, Respondent 14 asserted, *"It is incumbent upon government officials and healthcare professionals to ensure*

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comprehensive awareness of the immunization process for all residents and to facilitate vaccination efforts to restore normalcy in business operations." Respondent 7 conveyed, *"The adoption of innovative applications aimed at enhancing the skills of master craftsmen represents the most effective strategy to preserve our techniques and craftsmanship, thereby ensuring the continuity of our enterprises."* Additionally, Respondent 11 proposed, *"Our government should devise strategies to alleviate electricity costs and tax burdens for the hotel sector in George Town City, thereby reducing the financial strain during the pandemic's cessation."*

CONCLUSION

Georgetown, Penang, stands as the sole, quintessential remnant of the historic city along the Straits of Malacca. The architectural edifices and cultural heritage of Penang have emerged as some of the most esteemed assets in Malaysia. The unparalleled uniqueness, extraordinary architectural designs, historical significance, and distinctive layout of these heritage buildings are pivotal factors in their commodification, as boutique hotels, restaurants, galleries, and various establishments contribute to the local economy. However, with such development and growth, the specter of gentrification looms, wherein the character of historically underserved urban areas is transformed by the influx of wealthier residents, leading to enhancements in housing and the attraction of new businesses, often resulting in the displacement of existing inhabitants during Georgetown's developmental trajectory.

While the preservation of built heritage presents formidable challenges, it is imperative that these treasures be conserved and safeguarded for sustainable advancement. Thus, there exists an urgent need for collaborative input and perspectives from local stakeholders and international partners to effectively manage this heritage site and cultural nexus for a prosperous future. In light of the pandemic, which has posed significant challenges to the site, it is essential to adopt exemplary regional practices to invigorate cultural tourism.

Cultural tourism is expected to become a key part of the travel industry, presenting challenges in managing flows to cultural destinations and sites. It can help revive customs and restore historical landmarks, but unrestrained travel can negatively impact this sector. Sustainable development in cultural heritage tourism should focus on preserving cultural assets, understanding their value, providing genuine guest experiences, and generating revenue from cultural assets. It should also consider the impact of the travel industry on networks and districts, financial and social benefits, insurance, and promotion. Addressing challenges in managing and advancing the social legacy of the travel industry can lead to the growth of the local travel industry.

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The study found that tangible heritage treasures can significantly impact the economic development of cultural tourism in George Town UNESCO Heritage Site, Penang, Malaysia. Future research should compare this with other locations in Malaysia to improve cultural tourism management. Intangible elements should be linked with tangible elements to nurture the state as a tourist attraction and destination. The website promotes various types of tangible heritage, including dwellings, places of worship, human creations, art, architecture, and traditional crafts and arts. As the travel industry rapidly develops, maintaining cultural tourism is crucial. A coordinated, manageable travel industry can attract additional financial support and support the local economy.

The review reveals that George Town lacks complete data on all heritage values, with the lack of a comprehensive list of heritage items being the main reason. Intangible heritage, which is more sustainable, has less protection and conservation policies. The researchers believe that uploading and providing data about intangible information requires agreement from trades owners and key holders, which is time-consuming and requires significant effort. Comparing tangible and intangible heritage is crucial for understanding their conservation and protection.

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REGULATORY GAPS AND GOVERNANCE CHALLENGES IN WAQF HOUSING: STRENGTHENING LEGAL AND INSTITUTIONAL PROTECTION UNDER MALAYSIA'S HOUSING DEVELOPMENT FRAMEWORK

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Abstract

Waqf housing developments offer an alternative mechanism for affordable housing delivery in Malaysia by utilising inalienable waqf land through long-term lease arrangements. However, these schemes do not align neatly with the purchaser–developer model under the Housing Development (Control and Licensing) Act 1966 (HDA), creating uncertainty over whether waqf lessees are entitled to statutory protection and access to the Tribunal for Homebuyer Claims. Using a doctrinal approach, this study analyses statutory provisions, case law, and administrative guidelines to assess the legal standing of waqf lessees, the scope of the Tribunal's jurisdiction, and the adequacy of available remedies. The findings reveal that although waqf lessees may fall within the definition of purchasers under the HDA, the Act's buyer-centric procedures and remedies fail to address the fiduciary and religious dimensions of waqf governance. The paper proposes governance-oriented reforms, including clearer statutory recognition of waqf lease arrangements and stronger coordination between housing regulators and State Islamic Religious Councils to ensure equitable and coherent protection within Malaysia's housing system.

***Keywords**:* Homebuyer protection, Waqf housing, housing governance

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INTRODUCTION

Access to affordable and secure housing remains a persistent challenge in Malaysia despite long-standing government intervention through regulatory reforms and public housing programmes (Daud et al., 2022). The introduction of waqf-based housing has been recognised around the world as an innovative mechanism for social housing delivery, utilising inalienable waqf land to provide long-term residential leases for lower- and middle-income groups (Cania & Juliati, 2024). Such initiatives resonate with the Malaysia MADANI policy's emphasis on inclusivity and social justice, as well as the Sustainable Development Goal (SDG) 11, which calls for sustainable and equitable urban communities.

Nevertheless, integrating waqf land into the mainstream housing market presents complex governance and regulatory challenges. Malaysia's housing system operates within a multi-level governance structure involving federal, state, and local authorities. The Ministry of Local Government Development (KPKT) administers the HDA and the Tribunal for Homebuyer Claims, while land and planning matters fall under the jurisdiction of the respective State Authorities. The additional role of the State Islamic Religious Councils (SIRCs) as trustees of waqf assets introduces another institutional layer. This overlapping jurisdiction often results in regulatory fragmentation, particularly when waqf housing schemes do not fit neatly within the purchaser–developer model envisaged under the HDA.

Within this complex regulatory landscape arises a key question; what extent are the HDA and the Tribunal for Homebuyer Claims adequate in protecting waqf housing lessees within Malaysia's housing governance framework? To address this question, this paper adopts a doctrinal approach to examine the adequacy of Malaysia's housing development framework in protecting waqf housing lessees. It analyses statutory provisions, case law, and administrative guidelines to assess whether waqf lessees fall within the definition of "purchasers" under the HDA and whether the Tribunal for Homebuyer Claims offers suitable remedies. Framing the analysis within Malaysia's housing governance structure, the paper identifies coordination gaps between federal regulators and SIRCs and proposes governance-oriented legal reforms to enhance statutory recognition of waqf leases and strengthen institutional coordination.

LITERATURE REVIEW

Waqf Property and Housing Development in Malaysia

The waqf institution in Malaysia has long been recognised as a vital instrument for socio-economic development. Classical Islamic jurisprudence emphasises the inalienability, perpetuity, and irrevocability of waqf property, positioning it as a unique charitable mechanism distinct from zakat and hibah (Mamat et al., 2025).

In contemporary practice, waqf is increasingly mobilised as a means of addressing pressing social issues such as poverty, housing affordability, and equitable access to property ownership.

Siti Nadiah et. al. examined waqf real estate development as a social welfare alternative, using Penang as a case study. They find that the Penang Islamic Religious Council has successfully implemented housing projects based on the ijarah concept, enabling low- and middle-income groups to access safe and comfortable homes. Their study demonstrates how waqf property, if managed effectively, can address urban housing challenges while adhering to Shariah principles (Ali et al., 2016).

However, the inalienable character of waqf land means that ownership cannot be transferred, sold, or mortgaged. To unlock its socio-economic potential, particularly for housing, waqf land is developed through long-term lease mechanisms (*ijarah*). Under this structure, the SIRC retains legal ownership as trustee, developers construct and market residential units, and occupiers enter into lease agreements that grant rights of use for a fixed term, often 30 to 99 years. This framework ensures the perpetuity of waqf while simultaneously allowing the land to serve pressing community needs (Ali et al., 2016; Hydzulkifli et al., 2013).

Waqf housing therefore provides a viable path to secure housing for low- and middle-income while transforming idle Waqf lands into productive residential assets (Hydzulkifli et al., 2013). These arrangements also generate recurring income for waqf institutions, ensuring the sustainability of waqf property management (Abdullah et al., 2020). Scholars have proposed various innovations to expand to expand this potential. The Waqf Cooperative Housing Model (WCHM) combines cooperative development with waqf-based financing instruments such as cash waqf and waqf sukuk, to overcome funding constraints (Khan et al., 2019). Similarly, collective waqf models integrate governance, financing, and social impact dimensions to improve affordability for disadvantaged groups (Ating & Kamal, 2020).

Taken together, existing studies confirm that lease mechanisms on waqf land are a practical and socially beneficial method of providing housing while preserving the inalienability of waqf. Nevertheless, most of this literature concentrates on development models, financial structures, and institutional governance within Islamic administration. From a broader housing governance perspective, these studies have not addressed whether such lease arrangements provide occupiers with the same legal and regulatory safeguards as conventional homebuyers. Therefore, this unexamined dimension, i.e the adequacy of legal protection for waqf housing lessess under Malaysia's statutory housing framework forms the basis of the present analysis.

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Legal Protection of Homebuyers under the HDA and the Tribunal for Homebuyers' Claims

The HDA was enacted to curb abuses by housing developers and to protect purchasers. The statute prescribes standard-form contracts (Schedules G–J), which are mandatory for both developers and purchasers and are non-negotiable. These contracts stipulate fixed delivery periods, either 24 months for landed property or 36 months for subdivided buildings, where late deliveries would entitle the purchasers to liquidated ascertained damages (LAD) at 10% per annum calculated daily (Amin et al., 2014).Under these prescribed contracts, the purchasers would also benefit from a 24-month defect liability period, during which developers must repair defects at their cost (Hassan et al., 2021). Courts have consistently upheld these statutory rights, treating them as mandatory consumer protections.

The Tribunal for Homebuyers' Claims, introduced through an amendment in the HDA in 2002, reinforces these protections by offering purchasers a fast, low-cost dispute resolution mechanism. Within its first nine years, over 30,000 claims were filed, with 90% concerning LAD for late delivery (Amin et al., 2014). The Tribunal's jurisdiction is, however, carefully prescribed under the HDA. Azlinor Suffian observes that the Tribunal only hears disputes arising from the abovementioned statutory contracts entered into between homebuyers and licensed developers, and its awards are capped at RM50,000 (Sufian, 2011). Due to these limitations, contractors and consultants cannot be brought before the Tribunal, leaving civil courts as the only recourse for the purchasers (Sufian, 2012).

While consumer-friendly in design, the Tribunal faces procedural and enforcement weaknesses. Legal representation is generally barred, with lawyers allowed only in complex cases and upon agreement by both parties. Representative claims are disallowed, requiring multiple buyers in the same project to file individually, creating inefficiency (Sufian, 2011). Remedies are confined to monetary losses flowing directly from SPA breaches; claims for distress, personal injury, or broader tortious remedies fall outside its jurisdiction. Enforcement is also problematic: although Tribunal awards are deemed equivalent to Magistrates' Court judgments, execution must be pursued in civil courts, which undermines efficiency (Sufian, 2011).

The monetary cap of RM50,000 has been criticised as inadequate for many disputes, particularly in urban areas where property values are high. By contrast, Sarawak's tribunal permits claims up to RM80,000 with ministerial approval (Sufian, 2011). These disparities suggest that Peninsular Malaysia's framework remains more restrictive.

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(Abu Bakar et al., 2022) demonstrate that attempts to substitute the mandatory SPA with long-term lease arrangements are considered unlawful deviations under the HDA regulations, which require strict adherence to the prescribed format. Their analysis of private lease schemes highlights how such mechanisms blur the distinction between ownership and tenancy, exposing buyers to legal uncertainty and revealing the statutory rigidity of the HDA. This doctrinal limitation has governance implications: innovative housing models, including waqf-based leases, cannot access statutory protections despite serving similar socio-economic purposes.

The literature therefore presents a clear contrast. On the one hand, the HDA and the Tribunal provide robust safeguards for purchasers under statutory agreements, including fixed delivery timelines, LAD, and accessible dispute resolution mechanisms. On the other, these protections have been examined almost exclusively in the context of conventional purchaser–developer arrangements, with little attention to lease-based schemes. Waqf housing, which operates through long term leases in a tripartite arrangement involving the SIRC and developers, falls outside this framework. Broader housing studies note that Malaysia's affordable-housing governance as fragmented and market-driven, with weak integration between regulatory instruments and social objectives (Daud et al., 2022). This fragmentation extends to waqf housing, where coordination between federal housing regulators and state religious authorities remains limited.

RESEARCH METHODOLOGY

This study adopts a doctrinal legal research methodology, which is primarily qualitative and interpretive in nature. Doctrinal research involves the systematic analysis of legal rules, principles, and concepts, focusing on statutes, case law, and authoritative commentaries to explain, systematise, and evaluate the state of the law (Hutchinson, 2016).

The primary sources examined include the Housing Development (Control and Licensing) Act 1966 (HDA), the Housing Developers (Control and Licensing) Regulations 1989, which prescribe the standard form sale and purchase agreements (Schedules G–J), and the Housing Developers (Tribunal for Homebuyers' Claims) Regulations 2002, which establish the Tribunal and govern its procedures. Together, the provisions govern the purchaser–developer relationship through prescribed sale and purchase agreements (Schedules G–J) found under and establish the jurisdiction, procedures, and powers of the Tribunal for Homebuyers' Claims. Case law is analysed to examine how courts have interpreted the definition of 'purchaser,' the enforceability of statutory sale and purchase agreements, and the legality of alternative arrangements such as lease-based schemes.

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In addition to statutory and judicial sources, the study engages with secondary sources, particularly academic journal articles on waqf administration, housing law and housing governance in Malaysia. These materials are used to contextualise the governance of waqf land within the broader institutional framework of housing development, to explain the contractual structure of lease agreements, and to highlight gaps existing gaps in both legal protection and administrative coordination affecting waqf lessees.

By comparing the contractual structure of waqf leases with the statutory purchaser–developer model under the HDA, this analysis identifies doctrinal gaps in legal protection and explores how these gaps reflect broader governance challenges in ensuring coherent oversight of waqf-based housing schemes.

ANALYSIS AND DISCUSSION

Jurisdiction of the Tribunal in Relation to Waqf Lessees

Under Section 16M(1) of the HDA, the Tribunal for Homebuyer Claims has jurisdiction to determine claims where the total amount sought does not exceed RM 50,000 in respect of each claim. Under section 16L, proceedings before the Tribunal may be commenced by a *homebuyer* through the filing of a prescribed claim form. As Azlinor Suffian observes, locus standi before the Tribunal is restricted exclusively to homebuyers; neither consumer associations nor non-governmental organisations may act on their behalf. (Sufian, 2011).

The statutory definition of *homebuyer* is provided in section 16A, which refers back to the meaning of *purchaser*. Section 3 of the HDA defines a *purchaser* broadly as "any person who purchases housing accommodation" or "any person who has any dealing with a licensed housing developer in respect of the acquisition of housing accommodation." On this basis, the scope of protection under the Act is not limited to outright buyers but may extend to parties who acquire housing accommodation through other dealings, including long-term leases with licensed developers. Accordingly, section 3 is sufficiently clear to accommodate lessees within the definition of purchaser, and by extension, homebuyer under section 16A.

The real issue, therefore, does not lie in the statutory interpretation but in the adequacy of the Tribunal's jurisdiction to address the distinctive features of waqf leases. Unlike ordinary lease arrangements, waqf properties are held in perpetuity for religious and charitable purposes, with the SIRCs serving as sole trustees. Lease agreements involving waqf property thus often involve a tripartite structure between the lessee, the developer, and the SIRC. This triangular relationship raises practical and legal questions about how effectively the Tribunal can extend its protective jurisdiction to waqf lessees, especially where the fiduciary obligations of the SIRCs intersect with the statutory rights of lessees under the HDA (Kader et al., 2018).

Although no case law has directly addressed the position of waqf lessees before the Tribunal, inferences may be drawn from the treatment of private lease schemes. In *Loh Tina & Ors v Kemuning Setia Sdn Bhd & Ors and Another Appeal* [2020] MLJU 635, the Court of Appeal considered a housing development on freehold subdivided land in Penang, where the developer had unilaterally modified the prescribed Schedule G Sale and Purchase Agreement into a "Build and Lease Agreement." Purchasers were granted 99-year leases with an option of renewal, despite the Controller of Housing having rejected approval for such modifications. The appellants insisted on their standing as purchasers under the HDA, seeking declarations that the agreements should conform to Schedule G and that the freehold titles be transferred. It should be noted that the Court consistently referred to the appellants as purchasers, notwithstanding the lease form of the transaction.

The Court ultimately held that although the agreements were framed as long-term leases, the appellants remained purchasers under the HDA and were entitled to all statutory protections, including those conferred by Schedule G. In doing so, it reaffirmed the Federal Court's position in *Ang Ming Lee & Ors v Menteri Kesejahteraan Bandar, Perumahan dan Kerajaan Tempatan & Anor* [2020] 1 MLJ 281 that the HDA is a piece of social legislation, and that the paramount consideration under the Act is the protection of house buyers. Developers cannot, therefore, circumvent statutory obligations by disguising sales as leases.

From *Loh Tina*, it may be inferred that parties who enter into lease arrangements involving waqf properties with developers may still be regarded as purchasers for the purposes of the HDA. By extension, they fall within the definition of homebuyer under section 16A and thus enjoy standing before the Tribunal. The challenge that remains is whether the Tribunal's mechanisms are adequate to safeguard waqf lessees, given the unique role of SIRCs as trustees and the religious character of waqf property.

Cause of Action and Waqf Lease Agreements

Section 16N(2) of the HDA further limits the Tribunal's jurisdiction to claims arising from a cause of action based on the sale and purchase agreement entered into between a homebuyer and a housing developer. This raises a difficulty in cases where purchasers had entered into agreements that were not in the prescribed statutory form, or where the agreements had been varied without proper approval. The question then is whether such purchasers can still rely on the protection of the HDA and bring their claims before the Tribunal.

The courts have long taken the view that statutory protection cannot be ousted by contractual variations. In *SEA Housing Corporation Sdn Bhd v Lee Poh Choo* [1982] 2 MLJ 31, the Federal Court held that clauses in a sale and purchase

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agreement inconsistent with the prescribed Schedule G were void, and that the statutory clauses must prevail. This principle ensures that developers cannot evade their obligations by altering the statutory form.

Later, in *ABT Construction Sdn Bhd & Anor v Tribunal Tuntutan Pembeli Rumah & Ors* [2013] 9 MLJ 193, Varghese George J affirmed that compliance with the statutory form is mandatory but recognised that an exception arises where approval for variation is properly obtained. At that time, such approval was thought to be within the Controller's discretion. However, the Federal Court in *Ang Ming Lee & Ors v Menteri Kesejahteraan Bandar, Perumahan dan Kerajaan Tempatan & Anor* [2020] 1 MLJ 281 clarified that only the Minister, and not the Controller, has the power to approve variations to the prescribed contracts.

Building on these foundations, the Court of Appeal in *Loh Tina* considered a case where a developer had replaced the Schedule G Sale and Purchase Agreement with a "Build and Lease Agreement," despite the Controller having refused approval. The Court held that although the agreements were framed as long-term leases, the purchasers remained purchasers under the HDA and were entitled to the statutory protections. Importantly, the Court emphasised that only the unauthorised variations were void, while the rest of the contract continued to be enforceable in line with Schedule G.

The same approach was followed in cases such as *Wong Hang Foh & Ors v Tropika Istimewa Development Sdn Bhd* (Kuala Lumpur High Court Civil Suit No: WA-22NCVC-120-03/2018) and *Ang Bee Chin & 38 Ors v Kemuning Setia Sdn Bhd & Anor and Other Suits* [2025] MLJU 908. In both cases, the courts confirmed that developers who opted out of the prescribed agreements without ministerial approval had committed an offence under the Act. Nevertheless, the courts upheld the contractual relationship between the parties and required the agreements to be performed as if they were in the prescribed form.

Taken together, these cases establish a coherent line of authority: (i) Schedule G (or the relevant prescribed schedule) is mandatory and prevails over inconsistent contractual terms (*SEA Housing*); (ii) variations are permissible only with ministerial approval (*Ang Ming Lee*); and (iii) where a non-prescribed agreement is used without such approval, the agreement remains enforceable, but only to the extent that it conforms with the statutory contract (*Loh Tina*, *Wong Hang Foh*, *Ang Bee Chin*).

Accordingly, lessees who enter into lease agreements, whether authorised or otherwise, can still be protected under the HDA and bring claims before the Tribunal. The enforceability of such agreements, however, depends on whether the requisite ministerial approval has been obtained and, in its absence, the degree to which the agreement deviates from the statutory form.

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The Nature of Waqf Lease Agreements

Waqf lease agreements differ fundamentally from the statutory sale and purchase agreements prescribed under the HDA. Whereas the statutory contracts in Schedules G and H are structured as bilateral arrangements between a licensed housing developer and a purchaser, waqf leases are by their nature tripartite. The agreement is deliberately drafted to embed the trustee's fiduciary obligations as well as rights within the contract. An example can be observed in the arrangement of Seetee Aisah Wakaf development project in Penang, where a sighting of its lease agreement provides for the requirement of the consent of the SIRC before any sublease, transfer, or alteration can take place and restricts the use of the property to purposes consistent with Islamic law. Financing must be arranged through Shariah-compliant instruments such as *Ijarah*, and succession is managed through the appointment of nominees subject to the SIRC's approval. Even in the governance of the development, the SIRC retains a supervisory role, participating with the developer and lessees in the management corporation to preserve the religious character of the project (Hashim & Rahman, 2012). These provisions highlight that a waqf lease is not merely a commercial agreement, but a trust-based instrument safeguarding the perpetual nature of the waqf.

By contrast, the HDA does not provide space for such a framework. Its statutory forms presume a straightforward relationship between developer and purchaser. The Act however does acknowledge the role of the registered proprietor where the developer and the landowner are not the same. This is seen in *Foong Seong Equipment Sdn Bhd (Receivers and Managers Appointed) v Keris Properties (PK) Sdn Bhd (No 1)* [2009] 5 MLJ 381 and reaffirmed in *Loh Tina*. The courts explained that the prescribed statutory agreement may take either a bipartite form, where the developer is also the proprietor, or a tripartite form, where the developer is separate from the proprietor. In the latter scenario, the registered proprietor of the land must be made a party to the SPA, since without the proprietor's signature the subdivided title cannot be transferred to the purchaser. This demonstrates that the HDA is capable of recognising the role of proprietors, but only in the narrow sense of facilitating transfer of title to purchasers.

The position of the SIRC as a waqf trustee is far more complex than that of an ordinary landowner. While it is the registered proprietor or the trustee of waqf land, its fiduciary role is not merely to convey title but to preserve the perpetual charitable and religious purpose of the property. The statutory schedules, however, do not accommodate such trustee obligations. If a waqf lease agreement departs from the statutory form without ministerial approval, the Tribunal and the courts as provided under Regulation 11(3), (*SEA Housing Corp v Lee Poh Choo* ; *Loh Tina*, will enforce the contract "as if" it was the prescribed Schedule G or H agreement, striking down any inconsistent clauses. In such

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circumstances, the carefully drafted provisions designed to protect the SIRC's control over alienation, its approval rights, and the requirement for Shariah-compliant financing could be sidelined, as the HDA's protective framework is skewed entirely toward the purchaser.

This creates a structural tension. The HDA, as reaffirmed in *Ang Ming Lee*, is social legislation prioritising the protection of homebuyers. Yet in the context of waqf property, this priority leaves the SIRC and the waqf asset itself without adequate protection. Accordingly, while waqf lessees may be treated as purchasers under the HDA and thus enjoy standing before the Tribunal, the Tribunal has no jurisdiction to recognise or safeguard the distinctive interests of the SIRC as trustee or the religious character of waqf property.

The sale and purchase agreements prescribed under the HDA differ fundamentally from waqf lease agreements used in endowment-based housing. While the former is structured around a purchaser–developer relationship, the latter embeds the fiduciary role of the SIRC as trustee. The main distinctions between both contractual forms are summarised in Table 1.

Table 1: Comparison between the Statutory Sale and Purchase Agreement (SPA) and the Waqf Lease Agreement

Aspect	Statutory SPA (HDA)	Waqf Lease Agreement
Structure of Agreement	Usually bilateral between licensed housing developer and purchaser; occasionally tripartite if the landowner differs from the developer.	Tripartite – SIRC as trustee and landowner, the developer, and the lessee.
Legal Character	Prescribed forms under Schedules G and H of the HDA; focus on purchaser–developer relationship.	Trust-based instrument embedding fiduciary duties of the SIRC; drafted to preserve the religious and perpetual nature of waqf property.
Ownership and Control	Transfers ownership to the purchaser upon completion and issuance of title.	SIRC remains as trustee of the Waqf; lessee gains a long-term right of use (typically 30–99 years) subject to SIRC approval.
Restrictions and Approvals	Governed by statutory terms; no role for trustee or religious authority in approving transactions.	Sublease, transfer, or alteration requires SIRC consent; use must comply with Islamic law and the charitable purpose of the waqf.
Financing and Succession	Not restricted to any financing model; follows statutory SPA provisions.	Financing must be through Shariah-compliant instruments (e.g., *ijarah*). Nominee succession subject to SIRC's approval.
Governance Role	Does not provide a role for trustee or religious authority beyond ownership transfer.	SIRC retains supervisory authority, participating with the developer and lessees in the management corporation to preserve the religious character of the project

Aspect	Statutory SPA (HDA)	Waqf Lease Agreement
Legal Effect of Deviation	Statutory form mandatory; deviations without ministerial approval invalid.	If a waqf lease agreement departs from the prescribed statutory form without ministerial approval, only the approved portions will be enforceable. The contract will be treated *as if* it were in the statutory Schedule G or H format, and any inconsistent clauses will be rendered void.
Policy Orientation	Social legislation prioritising purchaser protection	Balances lessee protection with the SIRC's fiduciary duty to safeguard the waqf's perpetual and intended purpose.

Procedural and Remedial Limitations of the Tribunal in Waqf Lease Disputes

Even if waqf lessees are accepted as purchasers under section 3 of the HDA and therefore enjoy standing before the Tribunal, limitations still remain in the Tribunal's composition, procedure, remedial jurisdiction as well as time limit. These features reveal why the Tribunal is not aligned with the distinctive nature of waqf leases, particularly the fiduciary role of the SIRCs.

The first limitation lies in the composition of the Tribunal itself. Under section 16C of the HDA, members of the Tribunal are appointed by the Minister from among persons legally qualified or with judicial or legal experience. This ensures competence in civil and housing law, but there is no requirement that Tribunal members have expertise in Shariah law or the governance of waqf. Yet waqf leases are built on trustee obligations and religious restrictions such as prohibitions on alienation, requirements for Shariah-compliant financing, and the preservation of the perpetual charitable purpose of the land. Without Shariah knowledge, these elements are unlikely to be meaningfully considered, much less enforced, in Tribunal proceedings.

Procedurally, the Tribunal is designed to be quick and accessible for homebuyers. Section 16U(2) generally restricts representation by counsel, although legal representation may be allowed where the Tribunal considers the matter to involve complex issues of law. In addition, Rule 24 of the Housing Developers (Tribunal for Homebuyers' Claims) Regulations 2002 entitles a claimant to adduce evidence, call witnesses, and produce documents to support a claim. On paper, these provisions appear flexible enough to accommodate more complicated disputes. However, in practice, the Tribunal is structured for straightforward housing claims and short hearings, not for protracted disputes involving fiduciary duties, perpetuity of waqf property, or Shariah compliance. Even if expert evidence could be tendered, and even if leave for counsel were granted, the Tribunal's streamlined process is not designed to accommodate the depth of argument and specialist expertise that waqf lease disputes may require.

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The Tribunal's remedial powers are similarly constrained. Section 16Y empower the Tribunal to order refunds, compensation, rectification of defects, delivery of vacant possession, or compliance with the terms of the prescribed sale and purchase agreement. These remedies are entirely purchaser-focused. They do not extend to upholding trustee-related provisions found in waqf leases, such as the requirement of SIRC approval before transfers, restrictions on occupation inconsistent with Shariah, or clauses ensuring the religious character of the land. If these provisions are inconsistent with the statutory schedules, they will simply be struck down, leaving the SIRC's fiduciary interests without protection.

The enforcement of Tribunal awards under Section 16AC further reinforces this purchaser-centric framework. Awards may be enforced in the Magistrates' or Sessions Court as if they were court judgments, providing strong remedies for homebuyers but doing nothing to address trustee obligations. Suppose an award enforces the statutory contract to the exclusion of waqf-specific clauses. In that case, the SIRC has no procedural recourse within the Tribunal, and any challenge would be limited to judicial review on narrow grounds.

Finally, a homebuyer must lodge a claim within twelve months from the later of: (a) the date of issuance of the Certificate of Completion and Compliance (CCC) for the housing unit or common facilities; (b) the expiry of the defect liability period; or (c) the termination of the sale and purchase agreement before completion. This limitation applies equally to conventional housing and to waqf leases, since both are susceptible to the same early disputes concerning late delivery, defects, and transfer of title. However, waqf leases carry an additional layer of complexity, as disputes can arise long after completion such as succession when a lessee dies, renewal or re-lease of units after the expiry of a long-term lease, or compliance with Shariah restrictions embedded in the agreement. Waqf housing also faces a higher risk of non-completion or delay, particularly where projects suffer from limited financing or lack sufficient backing from the State authority. These vulnerabilities mean that while the Tribunal may provide some protection for short-term issues, it remains structurally incapable of addressing the long-term and institutional challenges inherent in waqf housing.

Taken together, these features demonstrate that while waqf lessees may be protected as "purchasers" under the HDA, the Tribunal itself cannot safeguard the broader trustee obligations of the SIRCs or the religious character of waqf property. Its composition lacks Shariah expertise, its procedures are too simplified for complex fiduciary issues, its remedies are narrowly purchaser-centric, its enforcement mechanisms sideline trustees, and its time limits exclude long-term disputes such as succession or renewal. In effect, the Tribunal protects

the lessee but leaves the SIRC and the waqf asset itself without adequate protection.

The discussion above, therefore, highlights a regulatory gap: while the HDA safeguards individual lessees, it fails to accommodate the fiduciary and religious obligations inherent in waqf.

RECOMMENDATIONS

The preceding analysis revealed several structural incompatibilities between the HDA and the governance realities of waqf-based housing. To address these doctrinal and governance gaps, a series of reforms are proposed to align the HDA's protective regime with Malaysia's dual legal and housing governance framework.

First, it is recommended that the Housing Development (Control and Licensing) Regulations 1989 be amended to include a new prescribed schedule for waqf lease agreements. This would enable the introduction of a Waqf Lease Agreement as an approved contractual form alongside Schedules G and H. The proposed schedule should recognise the tripartite structure among the SIRC, developer, and lessee, while defining the fiduciary duties, powers, and responsibilities of the SIRC as trustee. It should also specify the rights and obligations of lessees under a fixed-term leasehold structure and include clauses that uphold the perpetual, charitable, and religious nature of waqf property. This reform would address the incompatibility between lease-based waqf arrangements and the current statutory model, allowing waqf developments to operate within a compliant legal framework while preserving their Shariah character.

Second, the definition of "homebuyer" in Section 16A of the HDA should be expanded to include individuals who enter into a lease agreement under the new prescribed waqf lease schedule. This would resolve the current ambiguity surrounding the standing of waqf lessees before the Tribunal for Homebuyer Claims. By explicitly recognising lessees as homebuyers, the law would extend statutory protection to participants in waqf housing and bring such disputes within the Tribunal's jurisdiction.

Third, the Tribunal's jurisdiction and remedial powers under Sections 16M and 16Y of the HDA should be broadened to cover lease-based housing disputes. The amendment should enable the Tribunal to hear claims involving breaches of fiduciary duties or non-compliance with waqf lease terms and to issue appropriate declaratory or compliance orders. A structured mediation mechanism, involving representatives of the State Islamic Religious Council (SIRC), could be introduced as a preliminary step before formal adjudication to ensure that disputes are resolved in a manner consistent with both statutory and religious obligations. In addition, the RM 50,000 monetary cap should be

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reviewed periodically to reflect current housing costs. These measures would enhance access to redress and promote cooperative, governance-based resolution of waqf housing disputes while ensuring parity of protection with conventional homebuyers.

Finally, the composition of the Tribunal should include at least one member with recognised qualifications or experience in Islamic law. This would ensure that waqf-related disputes are adjudicated with due regard to both statutory consumer protection and the fiduciary and religious dimensions of waqf property. The inclusion of Islamic-law expertise would also minimise jurisdictional friction between civil and Shariah authorities and enhance institutional competence in handling waqf matters.

Collectively, these recommendations would bridge the divide between Malaysia's secular housing legislation and the governance of religious endowment property. Embedding waqf-sensitive mechanisms within the HDA would not only strengthen legal protection for lessees but also preserve the perpetual and charitable objectives of waqf land. Such reforms would ultimately contribute to a more inclusive, equitable, and sustainable housing-governance framework in Malaysia.

CONCLUSION

Although waqf lessees may, in limited cases, be treated as "purchasers" under the HDA, the Act's purchaser-centric structure and the Tribunal's restricted jurisdiction are inadequate for waqf-based housing. The framework overlooks the fiduciary role of the SIRC and the governance complexities of developing perpetual religious land within a statutory housing regime.

This study highlights the need for a governance-oriented review of the HDA to better integrate waqf property into Malaysia's housing system. Broader recognition of lease-based arrangements, stronger institutional coordination between civil and religious authorities, and more inclusive regulatory oversight are necessary to balance consumer protection with the preservation of waqf assets. Such reforms would contribute to a more coherent, transparent, and equitable housing governance framework for Malaysia's plural legal environment.

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The first author was responsible for drafting and writing the manuscript. The conceptualisation and analytical approach were developed jointly through a series of discussions among all three authors. The analysis presented in the paper

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COMMUNITY-CENTRIC APPROACHES TO KITCHEN WASTE MANAGEMENT IN URBAN AREAS FOR SUSTAINABLE PLANNING: A SYSTEMATIC REVIEW

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Abstract

Kitchen waste is a major contributor to municipal solid waste in urban areas, posing significant environmental and management challenges. This study systematically reviews 29 peer-reviewed articles to assess how community-centric approaches support sustainable kitchen waste management. A mixed-method Systematic Literature Review (SLR), guided by the ROSES protocol, applied deductive thematic coding across five themes: Community Participation and Social Capital (CPS), Governance, Policy and Institutional Frameworks (GPI), Knowledge, Attitudes, and Practices (KAP), Socio-Economic Dimensions (SED), and Cost-Benefit Analysis (CBA). Results show that community participation and trust networks enhance waste separation and recycling, but weak enforcement and fragmented governance undermine sustainability. Awareness of proper practices is widespread, yet an attitude-behavior gap persists, often constrained by convenience, infrastructure, and cultural habits. Socio-economic conditions strongly influence outcomes: low-income and high-density communities face barriers to affordability and space limitations. Cost-benefit perspectives reveal that households are more likely to engage when immediate rewards are provided or visible improvements complement long-term environmental benefits. Kitchen waste management is an integral component of urban planning policy towards sustainability, which requires community engagement, supportive policies, and equitable services to strengthen resilience and inclusivity.

Keywords: systematic literature review, deductive thematic analysis, community participation, kitchen waste management, urban sustainability

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INTRODUCTION

By 2050, global municipal solid waste production is projected to reach 3.4 billion tons (Kaza et al., 2018). Daily activities are said to be among the contributing factors to generating municipal solid waste, showcasing a significant challenge to waste reduction efforts (Mor and Ravindra, 2023). As urbanisation is rapidly occurring, municipal solid waste must be appropriately managed. Organic waste refers to biodegradable materials that decompose naturally (Kadir et al., 2016) and is a part of the municipal solid waste. Rapid urbanisation and consumption trends have intensified the generation of household organic waste. Organic waste now constitutes a substantial portion of municipal solid waste in many cities. Any mismanagement of this biodegradable waste shall contribute significantly to environmental degradation, including methane emissions, groundwater contamination, and overburdened landfill sites. As cities pursue more sustainable development pathways, household organic waste management has become a critical intervention.

Community-centric approaches to urban kitchen waste management involve innovative strategies promoting sustainability and community engagement. Waste banks in Indonesia offer economic incentives for recycling, though challenges in participation and financial sustainability persist (Al Zahra and Shohibuddin, 2025). Smart city initiatives integrate technological solutions with community-centred approaches, emphasising the need for digitisation, community engagement, and policy development in waste management (Szpilko et al., 2023). Decentralised valorisation of organic waste through composting and anaerobic digestion presents cost-effective alternatives to traditional waste management systems, as demonstrated in Santiago, Chile (de Kraker et al., 2019). In Thailand, community learning centres have successfully transformed waste management challenges into educational opportunities, promoting the co-production of public services and working towards zero waste goals (Amornsiriphong et al., 2024). These approaches highlight the importance of community involvement, technological innovation, and localised solutions in addressing urban kitchen waste management.

Studies on household organic waste management highlight the importance of source segregation and community participation in sustainable urban development. For instance, in Hanoi, Vietnam, a source separation program revealed low participation rates and contamination issues, emphasising the need for improved education and policy measures (Kawai and Hu'o'ng, 2017). While a study in Dschang, Cameroon, highlighted the complex socio-political factors influencing organic waste segregation, including the importance of multiple waste bins, monetary compensation, and informal sector involvement (Kongnso et al, 2024). These studies underscore the multifaceted nature of organic waste management in urban settings.

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This study critically evaluates academic research on kitchen waste management techniques using a Systematic Literature Review (SLR) methodology. Through a social science lens, it tries to increase knowledge of community-centric kitchen waste management and find recurring trends. It looks at how social capital and community involvement affect group activities, how institutional frameworks, governance structures, and policy tools support or impede these initiatives, and how waste behaviours are influenced by practices, attitudes, and knowledge. It assesses the social and environmental effects of these programs and delves deeper into the socioeconomic aspects of local waste management techniques. The research attempts to produce insights that guide inclusive, egalitarian, and sustainable urban trash management solutions by including these viewpoints. The results are meant to guide future empirical research and scholarly discussions in urbanisation sustainability policy.

RESEARCH GAP

Studies have been carried out regarding solid waste from multiple management angles such as smart system which covers from the approaches, technologies and services (Sosunova and Porras, 2022), the use of kitchen waste as an organic fertilizer in sustainable agriculture (Kuligowski et al., 2023), to autonomous composting units as a sustainable solution for urban biowaste management leading to high quality compost product that is aligned with the EU environmental targets (Maragkaki et al., 2022) – to name a few. Although there is a spectrum of studies on municipal solid waste, there are insufficient scholars who have systematically reviewed the existing studies with a focus on community-centric kitchen waste management in urban areas. In doing so systematically, according to Robinson and Lowe (2015), traditional literature reviews face several issues, including being rarely comprehensive, highly susceptible to reviewer bias, and seldom taking into account differences in the quality of studies. This article attempts to contribute to the existing body of knowledge by developing a systematic literature review (SLR) on community-centric kitchen waste management in urban areas. A systematic literature review is a structured process used to identify, select, and critically evaluate existing studies to address a specific research question (Dewey and Drahota, 2016). The review procedure is preceded by the protocol. As a result, SLR is a systematic and open procedure in which the search is carried out across multiple databases, and others can duplicate the same procedure. It discusses a thorough search approach that helps researchers find the answer to a specific query (Xiao and Watson, 2019).

The review is guided by the central research question: How are community participation approaches applied in kitchen waste management within urban areas? This study aimed to identify the gap by reviewing existing related studies systematically to gain a depth understanding of community-centric

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kitchen waste management in urban areas. Urban areas were selected due to several reasons. Because of their dense populations, high household consumption, changing consumption patterns (Abdul Halim et al., 2025; Parfitt et al., 2010), and the substantial amount of organic waste produced every day, urban regions offer an extremely important backdrop for research on community-centric kitchen waste management. A significant and ongoing stream of kitchen trash is produced by the concentration of residential buildings, food-related companies, and marketplaces, which presents difficult management issues. However, a variety of socioeconomic strata with differing degrees of awareness (Kolawole and Owoigbe, 2025) and involvement in environmental projects frequently make up metropolitan communities. This variability offers a useful chance to investigate the ways in which various social dynamics, local norms, and community structures affect waste management practices.

RESEARCH METHODOLOGY

Some studies have addressed household organic waste management in relation to sustainable urban development. Key contributions in the literature have examined a range of themes, including waste segregation at source Kawai and Hu'o'ng, 2017), composting technologies and practices (Manea et al., 2024, Zhou et al., 2022), community-based waste initiatives (Meidiana, 2022, Joleha et al., 2024), and supportive policy frameworks for circular economy models (Saqib and Sadef, 2025). However, despite the growing body of research, there is a need to identify gaps in community-centric kitchen waste management in urban areas within the scope of community participation, governance & policy, knowledge & attitudes, socio-economic factors, and social & environmental outcomes. These are the predetermined themes that form the framework of the research, which is deductive in approach.

This study, therefore, adopts a Systematic Literature Review (SLR) approach to analyse and synthesise existing research on household organic waste management. Mixed-method approach is applied. The study aims to identify the research gaps that persist across different thematic areas and contextual settings, thereby informing future research directions and contributing to more holistic and sustainable urban waste management solutions.

The Review Protocol - ROSES

In conducting this study, the Reporting Standards for Systematic Evidence or known as ROSES is used as a guide. ROSES is designed specifically for systematic reviews and maps for the conservation and environmental management field (Haddaway et al., 2018). It offers a detailed template and flow diagram that makes reporting clearer. ROSES accelerates the review process by

providing a detailed and structured framework that ensures transparency and completeness in reporting.

Based on the ROSES protocol, the authors started the SLR by formulating the research question for the review. This is followed by the explanation of the systematic searching strategy, which comprises three main sub-processes: identification, screening (inclusion and exclusion criteria), and eligibility. The next step is the quality appraisal of the selected articles. During this process, a strategy is applied to ensure the quality of the articles to be reviewed. Finally, the method of data abstraction, analysis, and validation is explained.

Formulation of Research Question

A research question provides direction for any scientific study. For this study, the PICo mnemonic is applied as the research question development tool. PICo is based on three main concepts (Table 1), which are: Population or Problem; Interest, and Context (Hosseini et al., 2024), which then guides the formulation of the main research question: How are community participation approaches applied in kitchen waste management within urban areas?

Table 1: Three main aspects of the study according to the PICo mnemonic.

Element	Definition	Application to Study
P	Population or Problem	Residential communities generating kitchen/food waste
I	Interest (phenomenon of interest)	Kitchen waste management practices involving community participation
Co	Context	Urban areas with a focus on sustainability/environmental management

Systematic Searching Strategies

The systematic searching strategies involved three stages: identification, screening, and eligibility. The explanations are outlined in the following sections accordingly.

i. Identification

For the study on community participation in kitchen waste management in urban areas, the identification stage is the process where any synonyms, related terms, and variations related to the main keywords are searched. This is to enrich the existing keywords for a more comprehensive search of articles to be reviewed. The keywords are developed accordingly to the research question (Okoli, 2015).

The identification process relied on keywords suggested by the online thesaurus, and ChatGPT. Using the enriched keywords, a full search string/query was developed accordingly to the databases. However, Table 2 shows examples of search strings for Science Direct and Google Scholar only.

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Table 2: The search strings.

Database	Search string/ search advanced query
ScienceDirect	"residential kitchen waste" OR "household food waste") AND ("community participation" OR "community involvement" OR "citizen engagement" OR "public participation") AND ("organic waste recycling" OR "waste disposal" OR "garbage management")
Google Scholar	("residential kitchen waste" OR "household food waste" OR "domestic food waste" OR "kitchen organic waste" OR "residential organic waste") AND ("community participation" OR "community involvement" OR "citizen engagement" OR "public participation" OR "community-based approach*" OR "resident involvement" OR "community action") AND ("waste management" OR "waste treatment" OR "organic waste recycling" OR "waste disposal" OR "garbage management") AND ("urban sustainability" OR "sustainable urban development" OR "urban environmental sustainability" OR "sustainable city" OR "urban ecology" OR "sustainable urban planning")

The full search string is based on Boolean operators (AND, OR, NOT), truncation, wildcards (*), phrase searching, and field code functions, on several databases, which are Scopus, Web of Science, and ScienceDirect. These comprehensive (thousands of publishers) databases have several advantages, such as advanced search functions, multidisciplinary in nature, including environment-related, and good quality control of their articles (Martin-Martin et al., 2018). The searching process resulted in a total of 3273 articles identified.

ii. Screening

Several criteria are set to screen the initial number of articles obtained, which were: full articles published between 2015 to 2025 (books, reports, proceedings, and review articles are not included), within the field of social sciences, written in English (to avoid confusion in reading), and open access. The sorting functions that are available in the databases help the process. The literature search was limited to the past ten years to ensure the review captures the most up-to-date findings, reflecting recent advancements, evolving methodologies, and current trends, while avoiding reliance on outdated information. However, looking at the overwhelming quantity of articles obtained, the publication year is further reduced to the recent five years (2020 to 2025) except for Google Scholar, which is two years* (2024 to 2025). Google Scholar does not have the field selection by field. Thus, screening by Social Science is not possible. Articles have to be screened manually, hence a longer time is required, which leads to the decision of keeping to the recent two years. Table 3 shows the final number of articles after the exclusion due to the screening process.

Table 3: Comparison of the number of articles obtained before and after the screening process.

Database	Initial Number of Articles	Number of Articles Screened - 2015-2025	Number of Articles Screened - 2023-2025
Scopus	8	1	0
Web of Science	776	12	6
ScienceDirect	1529	76	7
Google Scholar*	960	864	43

Note: *2024-2025

For Google Scholar, the initial search, with no time restrictions, yielded 960 records. This pool was sequentially refined to 864 records using a 10-year publication window (2015-2025) and then to 305 records by focusing on the most recent two years (2024-2025). After manual screening of titles and abstracts, 44 records were selected for full-text retrieval. Following the removal of 1 duplicate, 43 full-text articles were assessed for eligibility. Of these, 16 met the inclusion criteria and were selected for the final review. The only article obtained from Scopus is found redundant in Web of Science and Google Scholar. The one in Web of Science is kept. The process had excluded 3217 articles following the unmatched criteria, leaving 43 articles for the eligibility stage.

iii. Eligibility

In this third process, retrieved articles are manually monitored by looking at the titles and abstracts to ensure they match the inclusion criteria. The finalised articles must focus on **community participation in kitchen waste management in urban areas**. Therefore, 27 articles were excluded during the title and abstract screening. In total, there were only 29 selected articles left, and they are called Primary Studies (PSs) (Abouzahra et al., 2020).

QUALITY APPRAISAL

The six quality assessments (QAs) developed by Abouzahra et al. (2020) are adopted for this study, and they are as follows:

- QA1: Is the purpose of the study clearly stated?
- QA2: Is the interest and the usefulness of the work clearly presented?
- QA3: Is the study methodology clearly established?
- QA4: Are the concepts of the approach clearly defined?
- QA5: Is the work compared and measured with other similar work?
- QA6: Are the limitations of the work clearly mentioned?

The use of AI is applied to examine these 29 articles based on the six defined QAs. To evaluate each QA, the scoring procedure used is as follows: Yes

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(Y) = 1; Partially (P) = 0.5; or No (N) = 0. An article will be considered of sufficient quality and included in the systematic literature review (SLR) if its total score exceeds 3.0 (50%). The result is shown in the following Table 5.

Table 5: Quality assessment of primary studies (PSs)

ID	QA1	QA2	QA3	QA4	QA5	QA6	Total Score	% by max PS
PS1	1	1	1	1	1	0	5	83.3
PS2	1	1	1	1	1	1	6	100
PS3	1	1	1	1	1	1	6	100
PS4	1	1	1	1	1	1	6	100
PS5	1	1	1	1	0	0	4	66.7
PS6	1	1	1	1	1	1	6	100
PS7	1	1	1	1	1	0	5	83.3
PS8	1	1	1	1	1	0	5	83.3
PS9	1	1	1	1	1	1	6	100
PS10	1	1	1	1	1	1	6	100
PS11	1	1	1	1	1	0	5	83.3
PS12	1	1	1	1	0	0	4	66.7
PS13	1	1	1	1	1	0.5	5.5	91.7
PS14	1	1	1	1	1	0.5	5.5	91.7
PS15	1	1	1	1	0.5	0	4.5	75
PS16	1	1	1	1	1	1	6	100
PS17	1	1	1	1	1	1	6	100
PS18	1	1	1	1	1	1	6	100
PS19	1	1	1	1	1	1	6	100
PS20	1	1	1	1	1	0.5	5.5	91.7
PS21	1	1	1	1	1	0.5	5.5	91.7
PS22	1	1	1	1	1	1	6	100
PS23	1	1	1	1	1	1	6	100
PS24	1	1	1	1	1	1	6	100
PS25	1	1	1	1	1	1	6	100
PS26	1	1	1	1	1	1	6	100
PS27	1	1	1	1	1	1	6	100
PS28	1	1	1	1	1	1	6	100
PS29	1	1	1	1	1	1	6	100

The overall process of the systematic searching strategies (identification, screening, and eligibility) as well as the quality appraisal is shown in a flow chart in the following Figure 1.

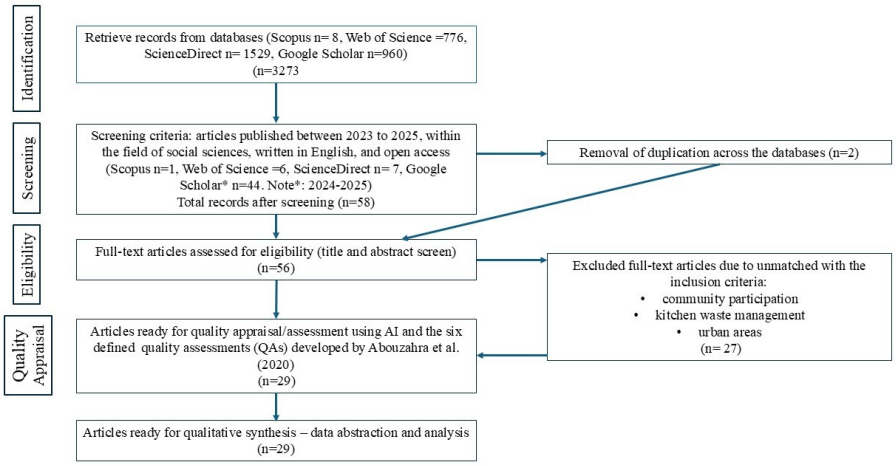


Figure 1: Flow chart of the systematic searching strategies and quality appraisal *(adapted from Sulaiman et al., 2023)*

DATA ABSTRACTION AND ANALYSIS

The qualitative method was used in this study, and the chosen articles were carefully reviewed, especially in the abstract, results, and discussion parts. The data abstraction process was directed by the study question, and the results are tabulated. This is followed by thematic analysis, a technique for finding, examining, and summarizing patterns (themes) in data. Thematic analysis is claimed as effective in summarising large datasets and praised for its flexibility, which allows adaptation to various research questions, epistemological positions, and data types (Braun and Clarke, 2006).

A deductive approach is applied for this research, where the themes are predetermined to address the scope of the research and align with the social science field. The sub-themes are then developed, which match the criteria for the themes. Thus, five themes and 25 sub-themes guided the analysis of the selected articles.

There are six steps involved in thematic analysis, and they are as follows: i) getting to know the data; ii) creating preliminary codes; iii) looking for themes; iv) reviewing themes; v) defining and labelling themes; and vi) creating the report, according to Braun and Clarke (2006). Writing, analysis, and reflection are all entwined during this process, directing the creation and improvement of themes to create a compelling narrative from the data.

Steps i and ii are covered in the data abstraction stage. Steps iii through v are where the authors developed the themes and sub-themes. The accuracy of themes is reviewed for usefulness and accurate representations of the data. This is followed by the report writing (step vi).

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RESULTS

Themes and Sub-Themes

The themes, sub-themes, and their brief descriptions are elaborated before discussing the findings (Table 6). The nature of methods is also stated: mixed–method (MM), quantitative (QN), and qualitative (QL).

Community Participation and Social Capital

This theme reflects the community members' active engagement in waste management initiatives. It comprises the strength of social networks and trust (ST), collective action (CA), and the local leadership's role in driving participation. Volunteerism (VO) plays an important role, with individuals contributing time and effort to support program activities. Community ownership (CO) ensures that the community feels responsible for the success of the initiatives, and this will foster long-term commitment. These elements build strong social capital that underpins sustainable waste practices.

Governance, Policy, and Institutional Framework

Governance and policy determine how waste management systems are structured and implemented. Policy instruments (PI) provide the regulatory and strategic framework for action, while decentralised governance (DG) allows local adaptation and responsiveness. Stakeholder collaboration (SC) ensures multi-sectoral input, transparency (TR) strengthens accountability, and institutional capacity (IC) supports effective delivery. Together, these sub-themes create an enabling environment for waste initiatives to succeed.

Knowledge, Attitudes, and Practices (KAP) in Waste Management

This theme addresses how awareness and values influence waste behaviours. Environmental literacy (EL) and waste attitudes (WA) shape public understanding, while cultural beliefs (CB) and intergenerational learning (IL) embed practices in social norms. Behavioral change (BC) results from aligning knowledge and attitudes with sustainable waste habits.

Socio-Economic Dimensions of Community Waste Practices

Socio-economic conditions can drive or hinder participation in waste management. Economic incentives (EI) encourage involvement, while gender roles (GR) influence household waste practices. Participation barriers (PB) and urban poverty (UP) can limit engagement, and cost-benefit analysis (CBA) informs feasibility and policy design.

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Table 6: Themes and sub-themes

Country	PS	authors	Main study design	Community Participation					Governance & Policy					Knowledge & Attitudes					Socio-Economic Factors					Social & Environmental Outcomes				
			(QN/QL/MM)	ST	CA	LL	VO	CO	PI	DG	SC	TR	IC	EL	WA	CB	IL	BC	EI	GR	PB	UP	CBA	LE	PH	CI	SI	SD
Malaysia	PS1	Subria et al., 2025 (GS)	MM	1	1	1		1	1	1	1		1	1	1				1						1		1	1	
Thailand	PS2	Srijuntrapun et al., 2025 (GS)	QN						1	1	1		1	1	1	1	1	1	1	1	1	1	1	1			1	1
China	PS3	He et al., 2025 (GS)	MM	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1		1	1		1	1	1
Iran	PS4	Khosravani et al. 2025 (GS)	MM	1	1	1		1	1		1	1	1	1	1			1						1	1	1	1	
Kuwait	PS5	Aljuwaiei & Al-Saber, 2025 (GS)	QN	1	1									1	1	1	1	1			1			1		1	1	
Zimbabwe	PS6	Musasa et al., 2025 (GS)	MM		1	1		1	1	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1
Indonesia	PS7	Nurfauziah et al., 2025 (GS)	QN						1		1			1	1	1		1			1	1		1	1	1	1	1
Czech Republic	PS8	Veselá et al., 2025 (GS)	MM		1	1			1	1	1	1	1	1	1		1	1	1	1	1		1	1		1	1	1
Japan	PS9	Morais & Ishida, 2025 (GS)	QN	1	1	1								1	1	1		1	1	1	1		1	1	1	1	1	
Indonesia	PS10	Lybaya et al., 2025 (GS)	QN											1	1		1	1		1	1	1		1			1	
Ukraine	PS11	Lyesnov et al., 2025 (GS)	MM						1			1	1	1	1	1	1	1	1	1	1		1					
Indonesia	PS12	Putra et al., 2024 (GS)	QL	1	1	1	1	1		1	1		1	1	1				1	1	1		1	1	1	1	1	
Indonesia	PS13	Ummamah et al., 2024 (GS)	MM		1	1		1	1	1	1		1	1	1	1	1	1	1	1	1		1	1		1	1	
Poland	PS14	Rogowska et al., 2024 (GS)	QN	1	1	1	1	1	1	1			1	1	1		1	1	1	1	1		1	1	1	1	1	
Indonesia	PS15	Winarsih et al., 2024 (GS)	QN	1	1	1		1	1	1	1		1	1	1		1	1	1		1		1	1		1	1	
Greece	PS16	Temmerman & Veeckman, 2024 (GS)	MM	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1		1	1		1	1	1
UK	PS17	Watsons et al., 2020 (SD)	QL	1	1	1		1	1	1	1		1			1		1		1				1			1	1
Australia	PS18	Jobson et al., 2025 (SD)	QN	1		1			1					1	1			1	1		1			1			1	1
USA	PS19	Wharton et al., 2021 (SD)	MM	1		1			1	1	1			1	1			1	1		1			1	1		1	
Ethiopia	PS20	Hatab et al., 2022 (SD)	QN	1	1	1		1	1	1	1		1	1	1	1		1	1		1	1		1	1		1	1
Australia	PS21	Landells et al., 2024 (SD)	MM	1	1	1		1	1	1	1	1	1	1	1			1	1		1			1		1	1	
Netherlands	PS22	Werkman et al., 2025 (SD)	QN	1					1					1	1	1		1	1		1			1			1	
China	PS23	Wang & Yu, 2025 (SD)	QN						1	1	1		1	1		1		1	1		1	1		1	1		1	1
USA	PS24	Alattar et al 2019 (WS)	QN	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1		1		1	1	1	1	1	
USA	PS25	Campbell et al 2025 (WS)	MM	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1		1			1	1	1	1	1
Ecuador	PS26	Davis et al 2016 (WS)	QN		1	1		1	1	1		1	1	1		1			1			1	1	1	1	1	1	1
Canada	PS27	Everitt et al 2024 (WS)	MM		1	1		1	1	1	1	1	1	1	1	1		1			1			1		1	1	1
Finland	PS28	Lehtokunnas et al 2020 (WS)	QL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1			1	1	1	1	1
Netherlands	PS29	Trevenen-Jones et al 2020 (WS)	QL	1	1	1		1	1	1	1	1	1	1	1	1		1	1		1			1	1	1	1	1

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Social and Environmental Outcomes of Community Waste Initiatives

Waste initiatives generate tangible community and environmental benefits. Local environmental improvements (LE) and public health benefits (PH) enhance quality of life, while community identity (CI) strengthens cohesion. Sustainability integration (SI) embeds waste practices into broader environmental strategies, and SDG contribution (SD) aligns them with global development goals.

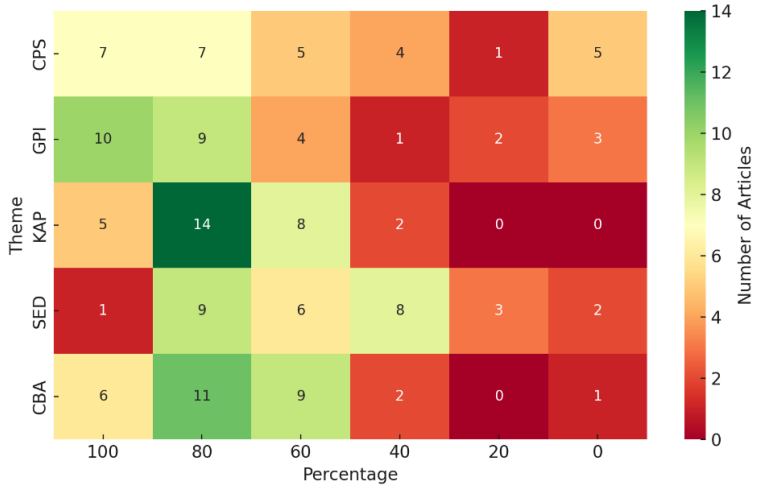


Figure 2: Heatmap of thematic distribution across percentage categories.

Figure 2 shows how the studies are distributed across themes and percentage categories. The Knowledge, Attitudes, and Practices (KAP) theme has the highest frequency of any theme or category, with 14 studies at the 80% level, as shown in the heatmap. This focus indicates that when looking at higher levels of engagement or outcomes, a sizable amount of the literature currently in publication places an emphasis on KAP. The themes of Governance, Policy, and Institutional Frameworks (GPI) and Cost-Benefit Analysis (CBA) are also well-represented at the 80% level (9 and 11 studies, respectively), underscoring the significance of institutional frameworks and economic viewpoints in the waste management discussion. Conversely, lower percentage categories—such as 20% and 0%—are hardly represented, especially in KAP, where no studies are documented. With a moderate but constant emphasis on mid-range values, the Socio-Economic Dimensions (SED) theme exhibits a fairly balanced distribution across categories, peaking at the 40% level (8 studies).

The radar chart (Figure 3) provides a comparative analysis of thematic coverage. The 80% polygon forms the most dominant profile across all themes,

underscoring its consistent prominence in the literature. KAP show has the greatest coverage, which is consistent with the heatmap's findings, while SED peaks at 40%, indicating its unique distributional focus. Furthermore, GPI and CBA continue to hold significant representation at 100% and 80%, respectively, indicating the importance of governance frameworks and cost-benefit analysis in forming successful interventions. On the other hand, the 20% and 0% polygons stay contracted for every theme, suggesting that there is little scholarly interest in situations with little involvement or influence.

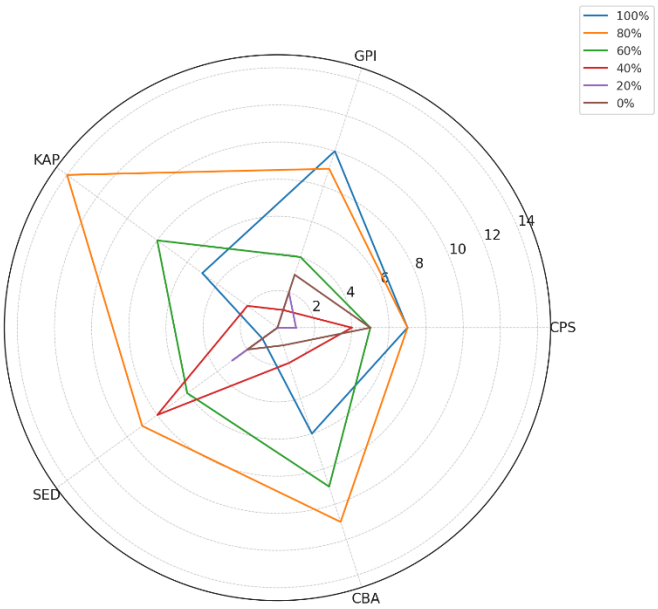


Figure 3: Radar chart of comparative thematic distribution.

The insights from Figures 2 and 3 reveal that research on community-centric approaches to kitchen waste management in urban areas predominantly emphasizes higher levels of community engagement, institutional support, and economic viability. KAP emerges as the central axis of scholarly attention, reflecting its importance in driving behavioral and attitudinal changes necessary for sustainable waste practices in urban households. The substantial coverage of GPI and CBA at higher percentage categories further highlights the pivotal role of governance frameworks and cost–benefit considerations in ensuring the long-term viability and scalability of such initiatives. In contrast, the persistent underrepresentation of studies in the lower categories (20% and 0%) signals a notable gap in understanding the barriers to participation and the challenges faced in contexts of limited community involvement. Collectively, these findings

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suggest that academic discourse is strongly oriented towards models of high engagement, positioning KAP, governance, and economic evaluation as cornerstones in advancing community-driven kitchen waste management strategies in urban areas.

Twenty-nine articles are reviewed. Five themes were developed based on the thematic analysis, namely: community participation; governance and policy; knowledge and attitudes; socio-economic factors; and social & environmental outcomes. Five sub-themes for each theme were developed, totalling 25 sub-themes.

The selected articles showcased research from developing (Malaysia, Thailand, China, Iran, Kuwait, Zimbabwe, Indonesia, Ukraine, Ethiopia, Ecuador) and developed countries (Czech Republic, Japan, Poland, Greece, United Kingdom, Australia, United States, Netherlands, Canada, Finland). The research pool for the developing countries reflects challenges in waste management due to rapid urbanization, population growth, and weaker infrastructure systems. In Southeast Asia, research often emphasizes community participation, composting, and informal waste systems as responses to limited municipal capacity. China and Iran contribute studies with strong governance and policy perspectives, reflecting their top-down institutional structures, and also a growing interest in household-level engagement. The global south countries (Zimbabwe, Ethiopia, and Ecuador indicate waste issues that intersect with poverty, informal economies, and limited resources. Research within this region often highlights the role of social capital and local initiatives. Although wealthy, Kuwait still faces the typical challenges of developing systems, particularly in waste minimization and public engagement.

In the developed countries context, research tends to emphasize policy frameworks, technological innovations, and cost-benefit assessment rather than basic infrastructure. Japan, the Netherlands, and Finland highlight advances in recycling systems and urban planning integration, where community-centric approaches complement already well-structured waste systems. The UK, USA, Canada, and Australia focus on the attitude-behavior gap and the role of policy incentives to improve household participation in segregation and recycling. The Eastern European countries contribute perspectives on transitioning waste systems, where EU regulations influence national waste governance, but local communities still face challenges in adoption.

DISCUSSION

The thematic analysis developed five themes and 25 sub-themes. Further discussion of findings stemming from the developed themes is presented in the following Table 7. The focus is on the impact, strength, weakness, and cause of each theme.

Table 7: Comparative thematic table

Theme	Impact	Strength	Weakness	Cause
A. Community Participation & Social Capital (CPS)	Builds trust, ownership, and collective identity; boosts household waste sorting & reduction	Local leadership (e.g., PKK groups, councils), citizen science, and participatory workshops strengthen social capital	Low sustained participation due to time limits, weak volunteerism, and trust deficits	Insufficient awareness, poor reinforcement of collective norms, and limited infrastructure
B. Governance, Policy & Institutional Frameworks (GPI)	Policies (EU Bioeconomy Strategy, Jakstrada Jakarta, SDG 12.3) enable scaling up of community initiatives	Multi-level governance (councils, NGOs, city compost programs) ensures integration of top-down & bottom-up approaches	Implementation gaps: weak enforcement, inadequate facilities (bins, compost sites), poor transparency	Resource constraints, fragmented governance, misalignment between policy & community needs
C. Knowledge, Attitudes & Practices (KAP)	Education & awareness campaigns (nudging, school programs, intergenerational learning) reduce household food waste	High positive attitudes toward waste prevention (e.g., 98% respondents support sorting)	Persistent attitude–behavior gap; knowledge does not always translate into practice	Low environmental literacy, cultural habits undervaluing food, and weak intergenerational transfer
D. Socio-Economic Dimensions (SED)	Generates savings, livelihood opportunities (biofertilizer, compost markets), and women-led empowerment	Economic incentives (cost savings, subsidies) and gender-targeted programs improve participation	Barriers: space limits, financial costs, infrastructure weakness, and poverty are overlooked	Inequalities in income, education, housing, lack of targeted support for the urban poor
E. Cost–Benefit Analysis (CBA)	Communities weigh environmental, financial, and moral benefits against time, odor, and space costs	Visible co-benefits: health improvements, income, reduced pollution, moral satisfaction	Perceived costs (time, inconvenience, disruption) outweigh the long-term benefits	Lack of incentives, poor subsidy schemes, and weak demonstration of household-level benefits

Referring to Table 7, the findings from the reviewed and assessed articles across the three databases consistently underscore the critical role of community participation (CPS) as the foundation of sustainable kitchen waste management. When communities are actively engaged through grassroots initiatives, participatory workshops, and citizen science, trust and social capital are strengthened, leading to more consistent waste sorting and composting practices. However, weak participation due to low awareness, time constraints, and limited infrastructure remains a persistent challenge.

At the institutional level, governance, policy, and institutional frameworks (GPI) provide the enabling structure to scale these community efforts. Initiatives such as Jakarta's Jakstrada policy, the EU circular Economy Strategy, and municipal composting programs demonstrate that supportive

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policies can anchor local initiatives into broader sustainability agendas. Yet, implementation gaps and fragmented governance often reduce policy effectiveness, highlighting the need for stronger alignment between institutional capacity and community needs.

The dimension of knowledge, attitudes, and practices (KAP) shows that educational interventions, nudging, and social marketing approaches are effective in shaping household behavior. While positive attitudes towards waste prevention are widely reported, the attitude-behavior gap continues to limit progress, suggesting that awareness campaigns must be paired with practical tools and supportive environments to ensure behavior change.

Socio-economic considerations (SED) reveal that demographic and household characteristics, such as income, education, housing type, and gender roles, shape participation levels in waste management. Economic incentives, subsidies, and women-led initiatives can drive positive outcomes, yet barriers such as poverty, limited space, and weak infrastructure remain significant obstacles. Addressing these inequalities through targeted support is essential for inclusive waste management strategies.

Finally, a cost-benefit perspective (CBA) highlights the tension between perceived short-term costs (time, space, odour, inconvenience) and long-term benefits (environmental protection, health improvements, and economic empowerment). Programs that make benefits visible and immediate at the household level, through subsidies or community incentives, are more likely to sustain participation.

These findings affirm that community-centric kitchen waste management requires a holistic approach – balancing grassroots engagement with supportive governance, bridging knowledge gaps, addressing socio-economic inequalities, and ensuring that cost-benefit outcomes are favorable to households. This integrated perspective positions communities not only as waste generators but also as central actors in co-creating sustainable urban futures.

The synthesis of themes demonstrates that effective kitchen waste management in urban areas relies on fostering strong community participation, supported by enabling governance and policy frameworks. While awareness and positive attitudes exist, translating these into sustained practices requires addressing socio-economic disparities and visible cost–benefit gains for households. A community-centric approach that balances top-down policy support with grassroots ownership, reinforced by education and incentives, provides the most sustainable pathway for reducing kitchen waste and advancing circular economy goals in urban contexts.

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RECOMMENDATION

The recommendations are outlined by the themes and the gaps identified based on the findings (Table 6). Under the community participation and social capital (CPS), most existing studies (Subria et al., 2025; Campbell et al., 2025) focus on traditional participation (workshops, waste banks, citizen science). Few examine how technology-enabled participation can strengthen social capital and intergenerational knowledge transfer in an urban context. Thus, for future research direction, innovative participatory models that integrate digital platforms and social media can be explored to sustain long-term community involvement. As for the governance, policy, and institutional frameworks (GPI), studies (Ummamah et al., 2024; Everitt, 2024) highlighted strong policies but weak implementation. There is limited research on how spatial planning regulations (zoning, land use, infrastructure provision) can operationalize waste management policies at neighborhood levels. Hence, future research can be directed to assess the effectiveness of decentralized waste governance systems and their integration into urban master plans. Such research should evaluate cross-sector collaborations (local authorities, private sector, NGOs, and communities). For the knowledge, attitudes, and practices (KAP) theme, many studies (Rogowska et al., 2024; Jobson et al., 2025) confirm positive attitudes but weak actual practice. Few connect these behavioral patterns to urban design and accessibility of facilities. Thus, behavioral interventions within planned urban spaces such as eco-districts and green neighborhoods can be tested to assess how planning design impacts waste-sorting compliance. Examination of the attitude-behaviour gap in greater depth with a focus on how physical urban environments influence household practices. As for the socio-economic dimensions (SED), some studies (Winarsih et al., 2024; Wang & Yu, 2025) recognize the socio-economic constraints but lack of comparative analysis across high-rise apartments, informal settlements, and low-income housing. Comparative studies across different income groups and housing typologies to understand barriers in dense urban environments can be conducted in trying to design equitable access to waste facilities for marginalised groups. In terms of cost-benefit analysis (CBA), the number of studies that measure long-term community-level savings versus short-term household costs is quite few. It is recommended that the true economic and environmental costs of household-level participation, including hidden costs and co-benefits can be evaluated. Such research can apply life-cycle assessments and spatial economic models to integrate the cost-benefit analyses into urban planning decisions.

CONCLUSION

This study has been able to explore the application of community participation approaches in kitchen waste management within urban areas, framed within the

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identified themes and sub-themes. It demonstrates that sustainable kitchen waste management in urban areas must be community-centric and firmly integrated into urban physical planning. Effective waste management is not only a matter of behavioral change but also of how cities are spatially organized and the services. Urban planners, policymakers, and local authorities must work together to ensure that physical infrastructure, such as designated sorting facilities, accessible composting spaces, and efficient collection points, aligns with community needs. Community participation and social capital (CPS) can only thrive when supported by physical spaces that encourage collective action. Governance, policy, and institutional frameworks (GPI) require reinforcement through spatial planning that ensures adequate facilities and equitable service delivery. Knowledge, attitudes, and practices (KAP) in waste management depend on visible, well-designed urban systems that make sustainable behavior convenient and practical. Similarly, socio-economic dimensions (SED) demand that planning addresses inequalities in housing, land availability, and service access. Finally, cost-benefit outcomes (CBA) are shaped by how well urban systems reduce inconvenience while maximizing visible benefits for households.

Thus, the future of community-centric kitchen waste management lies in co-created urban systems where spatial planning, governance, and citizen engagement converge. Urban planners must design enabling environments; policymakers must embed waste strategies within broader sustainability frameworks; and local authorities must provide the infrastructure, incentives, and enforcement needed for long-term success. The integrated approach ensures that waste management is not only environmentally sustainable but also socially inclusive, spatially just, and resilient for future urban generations.

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CULTURAL URBAN MOTIF: KIMARAGANG SYMBOLISM IN URBAN PLANNING

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Abstract

This study discusses issues related to preserving the cultural elements of the Kimaragang ethnic group (indigenous people) in urban areas and urban expansion in Sabah. The Kimaragang community lives in Kota Marudu and Pitas and has great potential to showcase their unique cultural identity in public spaces such as open areas, wall murals, architectural decorations, and sculptures. Although urban planning has focused on preserving historical monuments and buildings, intangible cultural elements like ethnic motifs are becoming sidelined due to modernization and lack of recognition in development plans. This research uses a qualitative approach through field studies, participatory design analysis, and demographic and urban planning analysis. The findings show that visual elements, especially cultural motifs, have great potential to inspire urban development and landscape planning. Cultural continuity should be creatively expressed and felt by the local community, which could also boost cultural tourism. The article proposes several strategic recommendations for inclusive and culturally sensitive urban planning. It emphasizes the importance of preserving both tangible and intangible heritage of ethnic communities in urban development. This study aims to contribute to shaping local urban identity, increasing awareness about cultural heritage, and supporting sustainable development based on local culture.

Keywords: Kimaragang, cultural heritage, Indigenous planning, cultural attire., urban identity

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INTRODUCTION

Cultural urban motif refers to the cultural elements in city or urban area. Symbolism representation from architectural styles and ornamentation and reflecting the unique traditions and history of a place. The purpose of this study is to explore the cultural motifs (Figure 1 and 2) of the Kimaragang ethnic (Shim, 2007; Damilan, 2015; Kroger, 2015; Pugh-Kitingan, 2015; Pangayan, 2016; Denis et al., 2019; Ginsari, 2022; Lee et al., 2022) live in Kota Marudu and Pitas district (Map 1) that have the potential to be developed into urban planning and sprawl. This study also focuses on the motifs and patterns of traditional elements in highlighting their unique cultural features. The expressive elements of the Kimaragang ethnic community are based on the natural surroundings in their environment. Each motif chosen as a cultural symbol is an element that has a significant influence on their daily lives. Every motif carries its own meaning and function, not only possessing aesthetic value but also reflecting the life values, philosophy, and belief practices of past generations (Ismail et al., 1990; Mahfar & Jusilin, 2017; Pagayan et al., 2016).



Figure 1: Floral Motifs of the Kimaragang Ethnic
Source: Author (2025)

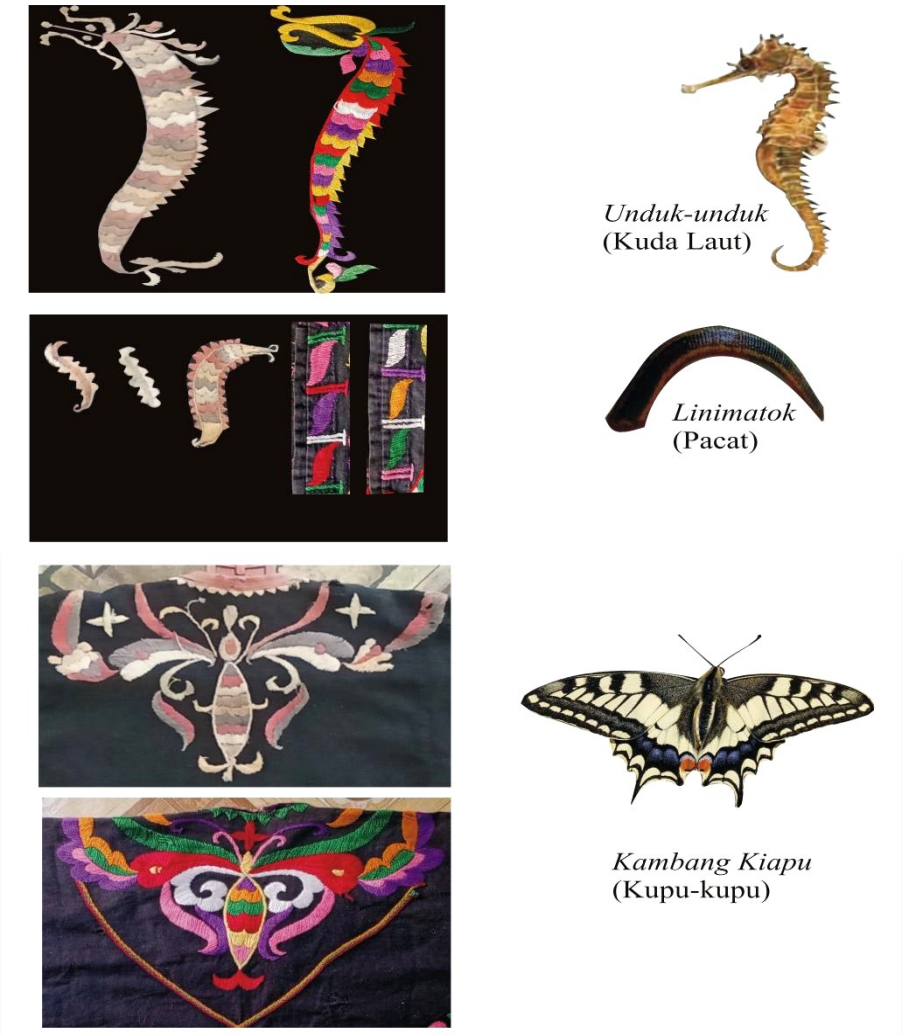


Figure 2: Faunal Motifs of the Kimaragang Ethnic
Source: Author (2025)

Now, urban planning is increasingly recognizing the importance of cultural heritage (Nursanty, Rusmiatmoko, & Husni, 2023) as part of the sustainable development agenda in Malaysia. However, developers tend to focus more on preserving physical heritage or tangible heritage culture such as historical buildings and monuments, like colonial-era shophouses in Penang and Melaka (Zubir et al., 2018; Isa, 2021). In contrast, there is still a lack of emphasis on intangible cultural heritage, such as cultural motifs, which are not yet fully integrated into urban development and spatial planning frameworks.

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Map 1: Maps of Study area
Source: Author (2023)

LITERATURE REVIEW

In urban planning theory, the concept of placemaking (Afify, 2024) emphasises the connection to the identity of the community within a particular area. Therefore, a proactive step to maintain harmony is to preserve sentimental elements that are familiar and meaningful to the community. Cultural symbolism in urban spaces can take many forms, such as architectural design, murals, landscape design, and symbolism in shapes and colours. Architectural design includes elements such as monuments and traditional house structures.

Several countries, such as Japan (Morokuma,2016), Russia, Vietnam, and Indonesia, have long integrated cultural elements into their urban landscapes and development planning (Nursahanty, et.al, 2023; Nordin & Amir Nordin, 2020; Zawawi, 2010). Indonesia and New Zealand have successfully incorporated ethnic motifs into urban design through murals, directional signage, and architectural ornamentation. This demonstrates that cultural motifs can serve as both visual and spatial representations of cultural identity and help strengthen the sense of place within a community.

In Sabah, motifs from the Rungus (Mahfar, 2017; Appell,1976) and Murut ethnic groups (Ismail, 2012) are commonly used as decorative elements during both formal and informal events. Additionally, *linangkit* motifs (Figure 3) from the Dusun Tindal and Dusun Lotud communities (Jusilin et.al, 2015) frequently used as stage backdrops or wall decorations in schools (Figure 4). These elements not only enhance the aesthetic appeal of the surroundings but also foster a deeper connection to heritage and tradition among residents. By incorporating these motifs into public spaces, communities in Sabah are able to celebrate their unique identities while simultaneously promoting cultural awareness and pride. However, these landscape designs and uses of cultural motifs often lack of identity (Figure 5) or unoriginality design and are typically created based on temporary needs or trends (Jukim, 2020; Duxbury et.al, 2016). Although murals are found on school walls, their application has not significantly extended into public or urban spaces. This oversight limits the potential for these artistic expressions to foster a sense of belonging and continuity within the community. To truly honour and preserve local heritage, it is essential for urban planners and artists to collaborate on more permanent installations that reflect the rich narratives and histories of Sabah's diverse populations. This suggests that the potential of ethnic cultural motifs remains underutilised in the visual and spatial development of Sabah's urban context.

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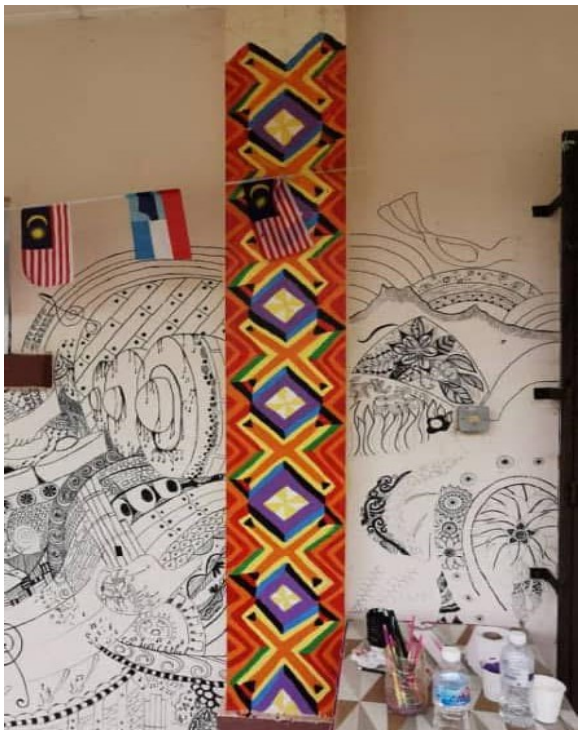


Figure 3: *Lotud Linangkit* motifs
Source: Author (2025)

Challenges and Obstacles

The integration of cultural motifs in urban planning faces challenges due to limited cultural documentation. Most symbolic elements of ethnic cultures have not yet been studied in a scholarly or systematic manner. This lack of comprehensive research hinders the ability to effectively incorporate these motifs into urban designs, as planners may struggle to understand their significance and context. Furthermore, there is often a disconnect between traditional practices and modern urban development, which can lead to the dilution of cultural identities in the face of rapid urbanisation. Awareness of the importance of cultural documentation has only emerged in recent years. As a result, access to knowledge about cultural elements and symbolism remains limited and restricted.

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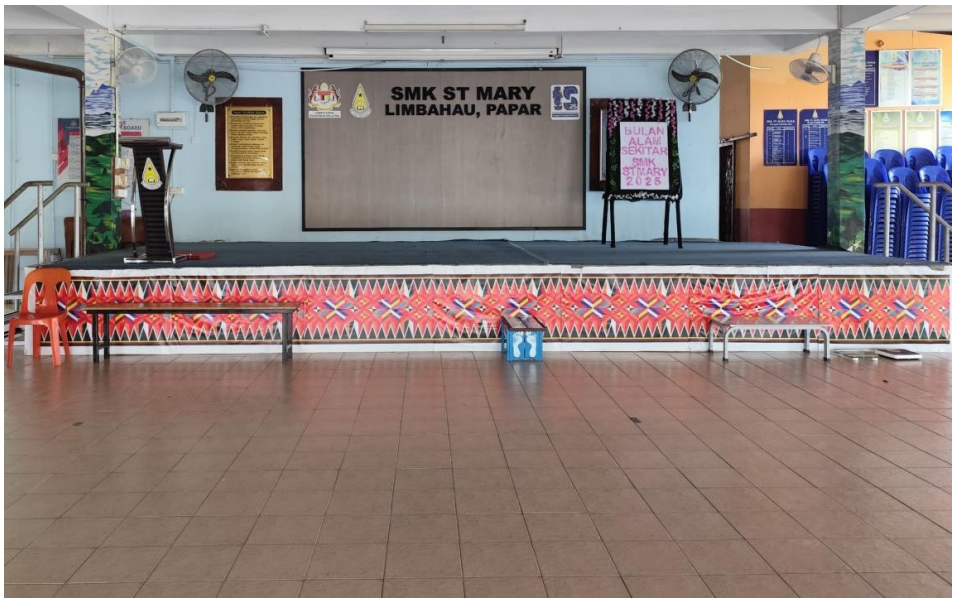


Figure 4: Linangkit at St. Mary Limbahau,Papar
Source: Author (2025)



Figure 5: Motifs without Cultural Identity
Source: Author (2025)

The lack of understanding and insight into cultural elements carries the risk of shallow representation and may be perceived as disrespectful toward certain cultural symbols. This is a sensitive matter that could potentially disrupt

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social harmony and unity. In addition, financial constraints and limited capacity also pose challenges to the implementation of ethnic symbolism in landscape projects and urban development plans. Local authorities often lack the cultural expertise required to represent the intended heritage effectively.

In many cases, ethnic motifs displayed in public areas do not align with the dominant ethnic composition of those locations, often due to insufficient research. For example, *linangkit* motifs traditionally associated with the Lotud community primarily lived in Kota Belud and Tuaran are frequently featured in districts such as Papar and Penampang, where Kadazan communities form the majority. This misplacement can lead to cultural misinterpretation about the symbolic of motif among the local community and tourists.

This highlights the clear need to bridge the gap between urban planning and cultural sustainability through the integration of intangible heritage, such as ethnic motif elements, into development strategies. By doing so, we can foster a sense of identity and belonging among communities, ensuring that development is not only economically viable but also socially enriching. Moreover, this approach encourages the preservation of local traditions and practices, contributing to a more inclusive urban landscape. This approach not only empowers communities through inclusive spatial and visual representation but also strengthens the visibility of minority cultures within the urban and expanding city landscape. In doing so, urban development becomes not only a physical transformation but also a reflection of enduring local identity and heritage.

METHODOLOGY

This study employs an ethnographic apporach and combining several research methods such as field observation, interviews with community leader, motifs analysis and document analysis about Kimaragang ethnic and policy documents. Each of these research methods provides different views on Kimaragang symbolisme as well as its potential in cultural urban planning motifs. These methods include:

1. Field observation. The researcher visited the Kota Marudu, Pitas and Kg. Salimpodon Pitas where the Kimaragang cultural attire *(sabung sinudaan* - male cloth and *sabung Kinaling* - female cloth) making.
2. Interviews were conducted with 12 informants, including community members, traditional chiefs, and cultural leaders who possess in-depth knowledge of Kimaragang cultural attire and symbolism.
3. Motifs analysis. The study involved analyzing every motifs from old *sabung sinudaan*.
4. Document analysis. The study anayzing and understanding the history background about Kimaragang ethinc, urban policy, enactment and landscape in Sabah.

DISCUSSION

Urban development and expansion in Sabah, especially along the coast and in areas that are not yet urban, have been moving quickly. Nonetheless, cultural aspects, including ethnic motifs from the Kimaragang community, are predominantly neglected in development planning. There are two key policies that form the foundation for preserving cultural identity within urban landscape design in Sabah: the Sabah State Cultural Heritage Conservation Enactment 2017 and the Sabah State Landscape Policy 2022.

The 2017 Cultural Heritage Conservation Enactment provides legal provisions to identify, protect, and conserve Sabah's cultural heritage in both tangible and intangible forms. This enactment could make traditional Kimaragang designs like *Unduk-unduk, Kambang Kiapu, Linimatok, wusak do gosing, Tolutu,* and *Kulubung* stand out as important design elements in urban areas like Kota Marudu and Pitas (Figures 6 and 7). These motifs can be incorporated into architecture, street furniture, building murals, sculptures, gateway arches, and visual signage. Moreover, the enactment allows these ethnic motifs and cultural expressions to be officially registered as part of the state's cultural heritage, making it possible for them to be integrated into the local or state structure plans and used as guidelines for physical planning (Sabah State Government, 2017).

Meanwhile, the Sabah State Landscape Policy 2022 highlights the importance of creating landscapes that are sustainable, driven by a sense of identity, and inclusive. One of its key pillars is the preservation of cultural elements and greenery in every public space developed. Under this policy, the use of ethnic motifs in the design of urban parks, pedestrian walkways, and public spaces is encouraged, provided it does not compromise the ecological balance of the area. The policy adopts a place-based approach to landscape development, focusing on the preservation and promotion of local community identity. As a result, it puts a high value on protecting both tangible and intangible heritage through landscape designs that are in harmony with and reflect the local character (Urwasi, 2015; Morokuma, 2016).

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Figure 6: One of the Roundabout located in Kota Marudu Town
Source: Author, 2025

Several progressive steps can be undertaken to preserve and conserve cultural elements within urban development plans in areas inhabited by the Kimaragang ethnic community, particularly in districts such as Pitas and Kota Marudu. These steps include:



Figure 7: One of the Landmarks in Pitas district
Source: Author, 2025

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Several progressive steps can be undertaken to preserve and conserve cultural elements within urban development plans in areas inhabited by the Kimaragang ethnic community, particularly in districts such as Pitas and Kota Marudu. These steps include:

1. **Cultural Integration in Urban Development.** Urban planning in Kimaragang areas should incorporate local cultural elements, particularly in physical design and social structures. The symbolic motifs of the Kimaragang ethnic community should be displayed in public spaces by transforming them into

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crafts, street furniture (Figure 8), mural art, sculptures, or using them as inspiration for architectural forms. For instance, establishing cultural centres that showcase traditional attire, such as *Sabung Sinudaan, Sabung Kinaling*, and accessories, and organising regular events such as the Kaamatan Festival, can serve as platforms to preserve and promote local culture.



Figure 8: Example of street furniture using Rungus cultural motifs
Source: Nordin et.al (2020)

2. **Culture-Based Economic Development**. Cultural preservation can also stimulate local economic growth, particularly through the development of creative industries, including the production of traditional clothing, sublimation apparel, handicrafts, and other cultural products. The Kimaragang ethnic community can generate income by creatively adapting cultural motifs into crafts, which have the potential to become attractions in the tourism sector. Pugh-Kitingan (2015) notes that cultural tourism is a significant source of income for rural communities. Therefore, developing creative industries centred around Kimaragang attire, such as *Sabung Sinudaa*n, can create employment opportunities and attract both domestic and international tourists.

3. **Community Involvement in Planning Processes.** It is crucial to involve the Kimaragang community actively in urban planning processes to ensure that development does not marginalise or compromise their cultural heritage. Engagement programmes such as dialogues between local authorities and cultural practitioners can help identify the most appropriate ways to balance development

with cultural preservation. Miller et al. (2019) emphasise that community participation is essential in culturally-based urban planning.

4. **Preservation of Open Spaces for Cultural Activities.** Designating open public spaces with identical elemen motifs for cultural activities and traditional ceremonies, such as Kaamatan, *moginakan*, weddings, or local performances, is essential. These areas can also be used for craft exhibitions, performing arts, and community workshops, which not only revive cultural practices but also support the growth of the tourism sector. According to Pangayan (2016), such spaces provide communities with opportunities to maintain and practise their traditions in an inclusive and supportive environment.

5. **Infrastructure Planning Based on Cultural Identity.** Urban infrastructure (Figure 7 and 8) such as roads, public buildings, and parks should reflect the cultural identity of the Kimaragang community by incorporating symbolism motifs in architecture and landscape design. This approach not only creates a unique visual identity for the area but also enhances community awareness of the importance of cultural preservation in a modern development context.like the Kaamatan Festival. Such programs not only aid in preserving customs but also raise public knowledge of their cultural history..



Figure 7: Pinakol Steps at UMS using Rungus cultural motifs
Source: UMS website (2019)

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Figure 8: Pinakol Steps at UMS using Rungus cultural motifs
Source: Author (2025)

CONCLUSION

Cultural motifs and symbolism should be seen as strategic assets in urban planning, not simply as decorative additions. In Sabah, adopting an urban development model that respects, enhances, and revitalises local cultural heritage is an essential step towards creating cities that are sustainable, rooted in identity, and inclusive.

This study emphasises the importance of documenting and promoting traditional attire within the context of cultural tourism and heritage education to ensure its preservation and continued appreciation by future generations. Sabah's rich ethnic diversity encompassing the Kadazan-Dusun, Bajau, Murut, Rungus, and Kimaragang communities provides a solid foundation for incorporating cultural motifs into urban spaces as expressions of historical stories, shared values, and ethnic identity. However, such efforts must be approached with care and sensitivity to local demographics to prevent the marginalisation of minority groups and to promote social fairness and unity.

Among the key recommendations are the creation of official and comprehensive records of Kimaragang motifs and traditional clothing; encouraging youth involvement through both formal education and informal activities such as school programmes and community workshops; and

strengthening collaboration between cultural practitioners, local authorities, and tourism organisations. These initiatives aim to position Kimaragang traditional attire as a proud cultural symbol of Sabah. Through such efforts, cultural heritage can be safeguarded while also serving as a driver for socioeconomic growth and helping to reinforce the cultural identity and branding of both Sabah and Malaysia overall.

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PRESERVING INTANGIBLE CULTURAL HERITAGE: PLANNING FOR A DIGITAL AUDIOVISUAL ARCHIVES FOR SABAH AND WIDER BORNEO

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Abstract

The preservation of intangible cultural heritage (ICH), such as music, dance, language, indigenous law and other oral traditions and practices, is essential for peoples who are experiencing rapid culture change. This enables them to access and understand their cultural past as a valuable preparation for the future. Unlike tangible cultural heritage such as sites, monuments, and objects that can endure for centuries, intangible cultural heritage exists only momentarily. It is traditionally preserved in the minds of its practitioners. When these experts pass away, the intangible cultural heritage may be lost. This heritage can be preserved by its continual performance and by passing it on to the next generation, by writing it down through descriptive transcription, or by recording it. Various recording procedures have been used throughout the past century to record intangible cultural heritage, and today older analogue data can be digitised. But there are inherent difficulties in this process. This article examines the UNESCO Convention for Safeguarding the Intangible Cultural Heritage and issues arising thereof. It discusses processes of transcription and especially the recording of intangible cultural heritage. Finally, it proposes the planning and establishment of an audiovisual archives in Kota Kinabalu to preserve the intangible cultural heritage of all ethnic groups in Sabah and wider Borneo that will also ensure that the indigenous property rights of the people are preserved.

Keywords: intangible cultural heritage, preservation, audiovisual archives, Kota Kinabalu, Sabah

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INTRODUCTION

Sabah, the northernmost region of Malaysia on Borneo Island, is home to around sixty ethnic groups, of whom over thirty-five speak languages from the ancient indigenous Dusunic, Murutic and Paitanic Families of Austronesian Languages. There are also several Sama-Bajau groups, the Iranun, and others from other parts of Borneo and beyond (Pugh-Kitingan, Miller, Wong, Petrus Atin, Porodong, Lajumin & Kluge, 2018; Malaysia: Sabah, 2021). Each group has its own distinctive tangible and intangible cultural heritage.

This article looks at the nature of the intangible cultural heritage (ICH) of Sabah and the importance of its preservation. It begins by discussing definitions of intangible cultural heritage. Then it looks briefly at the types of this heritage found in Sabah, and the main sources of research that has been conducted on this. It also discusses the importance of access to ICH for people to develop a capacity to deal with change in their lives.

Methods of preserving this heritage are discussed, and problems associated with this in Sabah are outlined, especially the lack of digitisation and archiving facilities. Finally, it proposes the establishment of a properly planned and managed audiovisual archives to maintain recordings, photographs, films and other sources of intangible cultural heritage.

This springs from the needs of the writer as an ethnomusicologist, as well as some former postgraduate students, and other researchers in Sabah and also Kalimantan, who have expressed the necessity for a safe and secure repository for the storage and preservation of their audiovisual research data. Most government museums in Borneo concentrate on storing materials from their particular State or Province, but many do not have adequate digitisation facilities. Other non-government charitable organisations are focussed on specific cultures in the region. The Tun Jugah Foundation of Sarawak, for example, administers several departments that include an excellent archive. But it is focused mainly on Iban cultures (The Tun Jugah Foundation, n.d.).

DEFINITIONS OF INTANGIBLE CULTURAL HERITAGE (ICH)

The 2003 UNESCO *Convention for the Safeguarding of the Intangible Cultural Heritage* defines Intangible Cultural Heritage as:

> "the practices, representations, expressions, knowledge, skills—as well as the instruments, objects, artifacts and cultural spaces associated therewith—that communities, groups and in some cases individuals recognize as part of their cultural heritage. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their interaction with nature and their history, and it provides them with a sense

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> of identity and continuity, thus promoting respect for cultural diversity and human creativity."

Its Article 2 of the Convention states:

> "The 'intangible cultural heritage', as defined in paragraph 1 above, is manifested inter alia in the following domains:
> (a) oral traditions and expressions, including language as a vehicle of the intangible cultural heritage;
> (b) performing arts;
> (c) social practices, rituals and festive events;
> (d) knowledge and practices concerning nature and the universe;
> (e) traditional craftsmanship."

Some ethnomusicologists and other cultural researchers, however, question elements of this definition and its Article 2. "Instruments, objects, artifacts and cultural spaces" are regarded primarily as elements of tangible cultural heritage or material culture, although as sound-producers musical instruments might be linked to ICH in terms of their music.

The idea that ICH is transmitted simply "from generation to generation" does not allow for change over time. Cultural interactions of communities with other groups do produce elements of cultural convergence in their ICH (Ku, 2019; Pugh-Kitingan, 2004, pp.185-198; 2019; 2024a).

The use of the term "performing arts" in Article 2 reflects Western ideas about music, dance and other performative genres, rather than the ethnosemantic concepts of many traditional societies across the world. Similarly, there is an overlap in many traditional societies between "rituals" and "knowledge and practices concerning nature and the universe" in Article 2. Yet these are separated as different categories in Article 2.

The concept of "performing arts" is often equated with music and dance as "the arts". Yet for many cultures in the world, this concept of "the arts" is foreign and does not adequately express the nature and purpose of their knowledge and ICH genres.

Thus, for this writer, John Blacking's definitions of music as *"*sound that is organised into socially accepted patterns," and music making as "a form of learned human behaviour" (Blacking, 1995, p. 33), are preferred because they allow for wide cultural diversity as well as change in the intangible cultural heritage. Similarly, Adrienne Kaeppler"s definition of dance as "a structured-movement system of knowledge" (Kaeppler, 2005, pp. 295-296) covers dance in all its forms and contexts, whether in ritual or social secular settings. Apart from

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these, ICH embodies indigenous legal systems, traditional medicinal practices, and other forms of traditional knowledge.

THE ICH OF SABAH AND RESEARCH

Sabah has a rich diversity of ICH, that includes wide varieties of oral literature, music, and dance, many forms of traditional knowledge, indigenous law, ritual and other practices. The main categories of oral literature encompass riddles, folktales, epics, legends of oral history, myths embodied in long sacred poetic ritual chants such as the genres of *rinait* (sometimes called *inait* or *buntuh*) that are recited or chanted by priestesses of the traditional religions among Dusunic, Paitanic and Murutic peoples, and secular vocal music (Photo 1). Oral literature also includes various other poetic genres, secular songs, different types of call-and-response singing, such as group verse debates spontaneously sung back and forth during circulating line dancing (Pugh-Kitingan, 2019; Regis, Pugh-Kitingan & John Baptist, 2003; Sather, 1975; Smith & Hassin, 2011; Subinon, 2016).



Photo 1: The late Odun Rinduman, the *tantagas lawid* or "high priestess" of the Lotud Dusun, chanting *rinait* long during during rituals at Kampung Bantayan Tuaran
Source: Jacqueline Pugh-Kitingan, 16 June 2003

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Apart from these, there are many varieties of solo and group instrumental music. Solo instruments are traditionally performed in secular contexts for personal expression, while group ensembles accompany ceremonial and also ritual events. Solo instruments include aerophones such as endblown and transverse flutes, nose flutes, mouthorgans including the renowned *sompoton* of the Kadazan Dusun (see Plate 2), and orally-resonated lamellaphones or palmwood jews harps, and chordophones including bamboo tube zithers and long-necked strummed or plucked lutes, as well as rare bowed lutes. Membranophones such as single drums or occasionally frame drums (in some coastal communities) are normally played with ensembles of idiophones (Pugh-Kitingan, 2004, 19, 30-39).

Sabah's idiophones consist of ensembles of different kinds of brass hanging gongs, that vary according to culture, and the *kulintangan* row of small kettle gongs. Gong ensembles are found in all Sabahan cultures with interior ethnic groups having large numbers of hanging gongs. The *kulintangan,* however, is normally only played among certain coastal communities or interior groups with river access to the coasts. Apart from these metallophones, groups of bamboo idiophones known as *tagunggak* in Murutic languages or *togunggak* in Dusunic languages are also played as substitutes for gongs in some contexts, and some cultures have wooden xylophones (Pugh-Kitingan 2004, 22-30).

There is not room here to discuss all the studies that have been conducted over the years on the vocal ICH of Sabah. Only some key long-term research projects will be mentioned.

The Sabah Oral Literature Project of anthropologists George and Laura Appell, who spent years of research among the Rungus of northern Sabah, is one of the largest bodies of documented oral literature from Borneo. Together with their Rungus friends and informants, the Appells recorded and transcribed the texts of the many different genres of Rungus oral literature, from *longoi* (secular songs) to *rinait* (C.R. Appell, 2022; G.N. Appell, 2011). Inspired by the work of the Appells, some younger scholars, community members, and cultural associations have conducted further research on the oral literature of their cultures (Morie, 2019, 2022; Olim Marsh, 1988; Roland, 2020, 2022; Simeon, 2022; Simeon & Pugh-Kitingan, 2021).

Researchers of SIL Malaysia, also known as the *Institut Linguistik SIL-Cawangan Malaysia* (Summer Institute of Linguistics – Malaysia Branch) have conducted detailed linguistics research among most of the ethnic groups of Sabah under a Memorandum of Understanding with the Sabah Government since 1977, and more recently with Universiti Malaysia Sabah. They have worked continuously with indigenous communities to produce many linguistic research papers, dictionaries, trilingual phrase books, and other documents including books of folktales (see for example Brewis, K., 1991and Brewis, R., 1986).

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Former staff of Sabah Museum including Judeth John Baptist, formerly Senior Curator, and Patricia Regis, a former Director, have conducted in-depth research on the *rinait* kept by traditional priestesses among indigenous ethnic groups. Judeth's extensive research includes the *rinait* of the Lotud of Tuaran District, the *inait* of the Kadazan of Penampang District, and the *rinait* of the Kujau of Keningau District, as well as that of other ethnic groups (Cai, John Baptist, Pugh-Kitingan, & Hussin, 2022a, 2022b, 2022c, 2022d).

There have been changes in the intangible cultural heritage of Sabah. While ritual chanting has declined, gong ensembles continue to be markers of distinctive local cultures, and are played in newer contexts such as state and national festivals, church events and on other occasions. Traditional secular singing has led to the development of indigenous pop music genres and also modern church singing. Solo secular instruments, however, are declining as new electronic digital media are replacing traditional genres.

THE IMPORTANCE OF PRESERVING ICH

For many people, especially those from the indigenous Austronesian ethnic groups, their ICH reflects their distinctive ethnic identities. The loss of traditional knowledge about ICH due to the demise of older knowledge-bearers and inroads made by new digital entertainment media is regarded with alarm.

Traditional musicians, such as *sompoton* player Thadius Yongut from Tambunan (Plate 2), sadly note that nowadays many village children not only lack knowledge of their own culture's solo instruments, but are no longer interested in playing even introduced instruments such as the guitar. Instead, they are obsessed with playing games on their cellphones. With the decline in performance of traditional long-necked lutes and other solo instruments in several communities, some young people have formed associations to revive these. But lack of knowledge due to the passing of older musicians creates some difficulties in cultural continuity (Pugh-Kitingan, 2024b).

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Photo 2: En. Thadius Yongut of Kg. Tikolod, Tambunan playing his *sompoton* mouthorgan
Source: Jacqueline Pugh-Kitingan 17 June 1985

Thus, the preservation of intangible cultural heritage is not merely an academic exercise, but is vital for the social health of cultures and communities undergoing change. As the Appells observed, access to the ICH of one's culture enhances the capacity to deal with change among all peoples.

> "The essential feature of the capacity to deal with change is an appreciation of the past and where one has come from. Thus, people can deal with change when they know that their past was a valuable experience in preparation for the future, when their past is viewed in such positive terms as a foundation for dealing with change. On the other hand, when it is devalued, when it is lost and not available for reference in history books, in ethnographies, in museums, people become lost. They can become apathetic with the loss of their roots. Or they can become normless, without any guideposts to help them deal with the future. And so they throw themselves into the mental opium of sexual excess, excess of

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> alcohol, mindless entertainment, drugs, whatever" (G.N. Appell, 1986, p. 33).

This raises the question of how to preserve intangible cultural heritage for future generations.

HOW TO PRESERVE ICH

Intangible cultural heritage can be preserved essentially through three main techniques: performing it, recording it visually and aurally, and transcribing or writing it down. In terms of performance, older practitioners can perform their genres for recording or train younger performers if that is appropriate. In terms of recording, photographic, film and audio recordings can be used to record and document intangible cultural heritage. In terms of transcribing it, descriptive musical transcription using Western staff notation, or cipher notation, or other specially-invented types of notation appropriate to the recorded genre in question can be used by the researcher.

Formerly, older analogue technology was used to record intangible cultural heritage. In Sabah, this included the use of photographic glass slides by G.C. Woolley, an officer of the North Borneo Company from the early 1900s. Woolley's collections of slides, diaries and artifacts later formed part of the collection of Sabah Museum, as well as for the Sabah State Archives and some of his diaries are kept with the Sabah State Library.

From the mid-twentieth century, slide transparencies and photographic prints were used by researchers and others who were keen to document Sabah's heritage. Sound recordings were made with open-reel tapes and cassette recordings, and could even be used for compiling LP records in the local contemporary music industry. Even some of this writer's recordings were made using open-reel and cassette tapes. Analogue recordings and slide transparencies, however, have limited lifespans.

Digitalisation has enabled the preservation of older analogue recordings, photographs and films, even those over a century old, in many parts of the world. But the digitisation of audiovisual materials is not readily available in Kota Kinabalu, Sabah, nor in most other places of Malaysia.

PROBLEMS WITH PRESERVATION OF ICH IN SABAH

There are no proper archives devoted exclusively to the preservation and digitisation of existing intangible cultural heritage in Kota Kinabalu at present. As for access to digitisation facilities, there was one photographic shop that formerly digitised slides, but this has since closed. A new shop in a shopping complex has now opened, but staff have problems producing the correct digital size and their products are quite poor in quality. The Sabah State Archives, whose

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main role is to archive historical government documents, is starting to digitise some of the analogue recordings of stories in its own collection. The digitisation of musical tapes and photographic slides and films, however, is still not readily available in Kota Kinabalu.

In Peninsular Malaysia, Universiti Malaya and Sunway University in Kuala Lumpur have facilities for the digitisation of analogue audiovisual materials held in their collections. In Penang, the Penang House of Music was a centre for the digitisation of analogue recordings. Unfortunately, this Penang House of Music that housed many valuable collections of recorded music, has recently been closed down.

Formerly, taped recordings of story telling and linguistic data by researchers of SIL Malaysia were sent to PARADISEC in Australia for copying and digitisation. PARADISEC was originally established by Prof. Emeritus Linda Barwick of the Sydney Conservatorium of Music. It is one of the few regionally located places that specialises in the digitisation of analogue tapes at a professional level.

Copies of the recordings collected under the Appell's Sabah Oral Literature Project, are kept with a trusted and reliable member of the Rungus culture. Researchers from other parts of Borneo, however, have expressed the need for an audiovisual archives that also digitises analogue recordings, films and photographs. Since Kota Kinabalu is regionally centred for Borneo and other parts of Southeast Asia, it is suggested that an audiovisual archives be established here.

PLANNING AN AUDIOVISUAL ARCHIVES IN SABAH

There is clearly a need for the proper planning and establishment of an audiovisual archives in Sabah. This will help to preserve and protect the intangible cultural heritage of Sabah's peoples for future generations. It could also serve the wider Borneo region.

The audiovisual archives could be established in Kota Kinabalu, possibly at Universiti Malaysia Sabah. Its holdings, however, should also be copied and stored securely among other bodies, such as the Sabah Museum, the Sabah State Archives, the Centre for Borneo Studies of the Sabah Foundation, and other properly established bodies. This would help to protect its holdings should any disaster befall the archives.

The archives would be tasked with the preservation and conservation of recordings and documentations of Sabah's intangible cultural heritage. It should have state of the art facilities for existing analogue recordings, films, slides and photographs to be digitised and preserved. Newer digital materials would be maintained and conserved. Properly trained staff would be needed for digitisation and for preserving the older analogue originals. Thus, the archives would require

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its own building with a laboratory, and large sections for storing hard data, while copies could be scanned for cloud storage.

ETHICAL CONSIDERATIONS

In establishing the audiovisual archives, the ethics of keeping intangible cultural heritage must be strictly adhered to. Thus, the intellectual property rights of those recorded should be fully recognised and acknowledged. The permissions and acknowledgements of the recordists should also be strictly adhered to in the archives and all affiliate organisations so that the heritage collections cannot be discarded or destroyed.

The same ethnical compliance requirements, intellectual property rights of the people and communities recorded, and informed consent of the recordists should be applied to the access of all forms of data in the archives. This includes all still photographs, sound recordings of music, interviews and other data, films, and any accompanying field notes or diagrams.

There have been alleged cases in parts of Malaysia where priceless recordings have been mishandled or destroyed. There have also been alleged examples of foreign visitors having access to recorded interviews and illegally publishing transcripts from these without the informed consent of the recordist nor any acknowledgements of the sources. Problems such as these can be avoided, and the recorded ICH of Sabah's peoples can be preserved if proper ethical standards are enforced.

CONCLUSIONS

Sabah has many ethnic groups, each with its own rich diversity of both tangible and intangible cultural heritage. Access to their intangible cultural heritage provides a valuable link to the past for people experiencing cultural change as they look to the future.

While some field recordings of intangible cultural heritage in Sabah have been kept privately by members of the host cultures, there remains a need for the proper planning and establishment of an audiovisual archives to maintain and preserve Sabah's intangible cultural heritage for future generations. It is suggested that such an archives be established as a distinct body in Kota Kinabalu, Sabah, possibly at Universiti Malaysia Sabah. Copies of its holdings should also be stored with other established bodies such as Sabah Museum, the Sabah State Archives, the Centre for Borneo Studies of the Sabah Foundation and other organisations managing heritage collections, provided they respect the indigenous intellectual property rights and the informed consent of the recordists in the use of any of these materials.

The proposed archives could become a repository for intangible cultural heritage for other Borneo cultures beyond Sabah. In this way, the intangible

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cultural heritage of Borneo can be maintained for future generations. This will serve to fill the needs of skilled local indigenous practitioners, their communities, and serious researchers and scholars across Borneo.

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ULUNG BUAYEH: FROM MYTHOLOGY TO ECOTOURISM

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Abstract

This study explores the potential of the Ulung Buayeh ritual practiced by the Lundayeh community as a foundation for sustainable ecotourism in the interior region of Sabah, particularly in Long Pasia. Using ethnographic methods and structured interviews, the research documents the historical context, socio-cultural values, and aesthetic dimensions of Ulung Buayeh ritual sites. It also examines how this cultural tradition aligns with the core principles of sustainable tourism, namely cultural heritage preservation, community participation, and environmental stewardship. Findings indicate that, when integrated within a community-based tourism (CBT) framework, the Ulung Buayeh ritual site holds significant potential as a unique tourism product that promotes cultural appreciation, supports local livelihoods, and strengthens the empowerment of the Lundayeh community.

Keywords: Ulung Buayeh, Lundayeh, Long Pasia, ecotourism, community-based tourism (CBT)

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INTRODUCTION

Cultural heritage plays a vital role in shaping the identity of a community and serves as a valuable foundation for the development of culture-based tourism. In the context of indigenous communities in Sabah, ethnic groups such as the Lundayeh possess a wealth of traditions that remain well-preserved yet are often underrepresented in mainstream tourism narratives. One of the most distinctive elements of Lundayeh culture is the *Ulung Buayeh* ritual, a traditional ceremony deeply intertwined with the community's belief system, social hierarchy, and relationship with the natural environment.

The *Ulung Buayeh*, or crocodile effigy, holds profound cultural significance for the Lundayeh people of Long Pasia. Historically, these earthen crocodile mounds were constructed to commemorate a warrior's victory in headhunting expeditions. The crocodile symbolized strength, heroism, and the subjugation of enemies. During the *Nui Ulung Buayeh* ceremony, the community gathered to construct the effigy, perform ritual dances, and sing heroic songs (*fekuab*) led by women. The victorious warrior would then strike the effigy with a sword (*felefet*) to proclaim his triumph (Ricky Ganang et al., 2018). With the advent of Christianity in the early 1930s, such practices were deemed incompatible with new religious teachings, and the tradition gradually evolved into a more symbolic form. Today, during special occasions such as weddings, the community prepares *Luba' Buayeh*, rice molded into the shape of a crocodile, to honour their ancestral heritage (Daily Express Sabah; Utusan Borneo). Although the ritual itself has disappeared, the *Ulung Buayeh* sites remain scattered across Long Pasia. According to records from the Sabah State Museum Department (JMNS) and the Borneo Archaeological Research Unit (UPArk), Universiti Malaysia Sabah, there are only 13 identified *Ulung Buayeh* sites in Long Pasia and the nearby area of Long Mio (Baco & Majinus, 2019).

Located in the southern interior of Sabah, Long Pasia is one of the main settlements of the Lundayeh people, where many traditional practices continue to be observed. The area is not only rich in biodiversity and natural beauty but also possesses significant potential for sustainable ecotourism development. In efforts to diversify the state's tourism offerings, an approach that integrates cultural heritage preservation with environmental sustainability has become increasingly relevant.

The present study evaluates the potential of *Ulung Buayeh* as a distinctive and competitive tourism product within a community-based tourism (CBT) framework. It further examines how this cultural heritage can be developed and promoted in a manner that respects its sacred value while contributing to the social and economic empowerment of the Lundayeh community.

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LITERATURE REVIEW

Community-based tourism (CBT) has gained increasing attention as a sustainable approach to tourism development, particularly in rural and Indigenous contexts. It emphasizes local ownership, community participation, and the responsible management of natural and cultural resources (Sundar & Govindan, 2016; Giampiccoli & Mtapuri, 2012). As a development model, CBT empowers communities to actively engage in tourism planning and operations, ensuring that economic benefits remain within the locality while strengthening cultural preservation (Gössling & Telfer, 2009). Within this framework, cultural and mythological heritage often serves as a foundational asset for place-based tourism, offering visitors authentic experiences that reflect community identity and ancestral traditions (George et al., 2009). In the context of cultural tourism, traditional ceremonies and rituals such as *Ulung Buayeh* provide a unique and authentic value-added experience for tourists. These rituals not only introduce tourists to the beliefs and values of the community but also connect them with the environment, which forms the foundation of many indigenous traditions (Cohen, 2004). *Ulung Buayeh* is deeply embedded in Lundayeh oral traditions and mythological narratives. The site is believed to be sacred, associated with ancestral stories of crocodiles as guardians or spiritual beings, and it holds an integral place in the collective memory and cultural identity of the Lundayeh community.

According to Timothy and Boyd (2003), the preservation of cultural heritage can serve as a major attraction in cultural-based tourism, particularly when integrated with environmental conservation. Similarly, McCool and Moisey (2008) emphasize that a key challenge in ecotourism is preventing tourism activities from harming natural habitats or local cultures. Hence, sustainable tourism principles must be applied holistically to balance economic development with the preservation of both natural and cultural resources.

Scholarly work on Lundayeh traditions, such as those by Harrisson (1959) and, more recently, Crain (2000) highlights the spiritual ecology of highland communities in Sabah and Sarawak, where sites like *Ulung Buayeh* function not only as cultural landmarks but also as nodes of environmental stewardship. These beliefs often inspire conservation practices rooted in taboo and ritual, reflecting an indigenous ethic that aligns closely with the principles of ecotourism and community-based tourism (CBT). In parallel, studies on indigenous tourism in Southeast Asia (Cole, 2007; Hitchcock et al., 2009) demonstrate that mythological heritage can serve as a distinctive tourism asset when interpreted ethically and collaboratively. The community of Long Pasia, for instance, has shown growing interest in promoting its heritage through tourism, as reflected in pilot projects and initiatives led by NGOs and local tour operators that integrate cultural narratives into trekking routes and homestay experiences (WWF Malaysia, 2010).

In Sabah, particularly in rural areas such as Long Pasia, there is growing awareness of the potential for ecotourism development. A study by WWF Malaysia (2019) indicates that this region is not only rich in biodiversity but also endowed with diverse cultural traditions that remain underexplored. Bala and Basrah (2010) actively promoted the cultural importance of *Ulung Buayeh* and explored its potential in advancing community-based tourism in Long Pasia. Their research highlights how *Ulung Buayeh* sites, as integral components of Lundayeh heritage, can be leveraged to foster sustainable tourism that benefits local communities while preserving cultural landscapes. Similarly, Ismail et al. (2015) identified rural areas in Sabah such as Long Pasia as promising locations for ecotourism initiatives that engage local participation and emphasize the conservation of both cultural and environmental heritage.

Overall, the literature underscores that community-based tourism and cultural preservation not only create economic opportunities but also enhance intercultural understanding by introducing the unique heritage of Indigenous peoples to the wider world (Sharpley, 2009). Through the CBT framework, the Lundayeh community has transformed *Ulung Buayeh* from a fading warrior ritual into a living symbol of cultural identity and sustainable livelihood allowing heritage to be safeguarded while empowering local communities (Sabah Tourism Board, 2023).

Ulung Buayeh therefore holds substantial potential as a focal point for community-based ecotourism in Long Pasia. It embodies the key pillars of CBT cultural preservation, community empowerment, and environmental stewardship. Realizing this potential, however, requires a culturally grounded and community-led approach supported by institutional collaboration and ethical tourism practices.

METHODOLOGY

This study adopts an ethnographic approach, which integrates participant observation, structured interviews with community leaders, and document analysis of historical texts related to the *Ulung Buayeh* ritual. The ethnographic method was selected because it enables a deep understanding of the cultural, social, and spiritual dimensions of the Lundayeh community. Each research technique offers a unique perspective on how *Ulung Buayeh* is perceived and valued within the community, as well as its potential to serve as a sustainable ecotourism attraction. The specific methods employed include:

i. Participant Observation:

Participant observation was conducted at former ritual sites in Long Pasia, where the *Ulung Buayeh* ceremony was historically performed by the Lundayeh community. This method allowed the researcher to document the physical

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characteristics of the sites and observe the community's current engagement with these cultural landscapes.

ii. Structured Interviews with Community Leaders:
Structured interviews were carried out with traditional leaders and village elders who possess extensive knowledge of the history, meanings, and values embedded in the *Ulung Buayeh* tradition. These narratives provided valuable insights into the community's perception of the ritual and its contemporary relevance to cultural identity and tourism development.

iii. Document Analysis:
Document analysis involved reviewing historical texts, archival materials, and previous academic works related to the *Ulung Buayeh* ritual. This approach helped contextualize the evolution of the tradition and its transformation within the broader cultural history of the Lundayeh people.

iv. Limitations of the Study
While the ethnographic approach provided rich and in-depth insights into the cultural and spiritual meanings of *Ulung Buayeh*, this study was limited by the small number of key informants and its reliance on oral narratives that may be affected by memory bias. Accessibility to remote sites and seasonal conditions also posed logistical challenges during fieldwork. Accordingly, the findings should be interpreted as contextually grounded rather than broadly generalizable, reflecting the lived experiences and perspectives of the Lundayeh community in Long Pasia.

v. Ethical Considerations
This research was conducted in accordance with the Universiti Malaysia Sabah (UMS) Research Ethics Guidelines. Informed consent was obtained from all participants prior to interviews and observations. Participation was entirely voluntary, and respondents were assured of confidentiality, anonymity, and the respectful representation of their cultural knowledge in line with community norms and ethical research standards.

FINDINGS & DISCUSSION

This section presents and interprets the key findings of the study, focusing on the transformation of *Ulung Buayeh* from a sacred ritual monument to a cornerstone of contemporary community-based tourism (CBT) in Long Pasia. Drawing upon ethnographic fieldwork, participant observation, and interviews with local elders and community leaders, the discussion highlights how *Ulung Buayeh* functions as both a cultural memory site and a potential model for sustainable ecotourism.

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The findings are organised thematically to reflect the multidimensional significance of *Ulung Buayeh*: as a mythological and spiritual symbol, as an ecological and educational space, and as a foundation for community-driven tourism initiatives. These themes not only capture the cultural and spiritual meanings embedded in *Ulung Buayeh* but also reveal the challenges of preserving Indigenous heritage amid modernisation, migration, and changing belief systems.

By integrating these cultural insights with principles of sustainable tourism, this section discusses how the Lundayeh community is actively reinterpreting ancestral traditions to align with conservation goals and socio-economic development. Ultimately, the findings demonstrate that *Ulung Buayeh* is more than a historical relic; it is a living heritage that bridges mythology, identity, and modern community resilience in the context of ecotourism.

Ulung Buayeh and Its Significance to the Lundayeh

Ulung Buayeh, or the "crocodile mound," derives from the Lundayeh words *ulung* (structure or monument) and *buayeh* (crocodile). Traditionally, this monument was erected at the centre of the village to commemorate a warrior's victorious return from a headhunting (*Ngayau*) expedition. Shaped like a crocodile, the effigy symbolizes strength, endurance, and courage, which are the core virtues of the Lundayeh warrior ethos. Beyond its symbolic representation, the crocodile was revered as a mystical creature intimately linked to the spirit world. As part of the ritual, the returning warrior would strike the effigy with a traditional sword (*felefet*), symbolizing his triumph over enemies. The ceremony was accompanied by war chants, traditional dances, and communal feasting rituals that celebrated the warrior's achievement while reinforcing social unity and ethnic identity within the community.

Beyond its commemorative role, *Ulung Buayeh* holds profound spiritual significance, believed to be the dwelling place of a guardian spirit manifested in crocodile form. This entity embodies protective natural forces and ancestral heritage, making the mound both a sacred and cultural landmark. In the Lundayeh belief system, *Ulung Buayeh* represents the intersection of the physical and spiritual realms, a site where human courage, ancestral reverence, and ecological harmony converge. In the local Lundayeh dialect, *ulung* signifies "origin" or "source," while *buayeh* means "crocodile" (Langub, 2003).

i. Headhunting Ritual and Sacred Space

Ulung Buayeh played a central role in the headhunting traditions of the Lundayeh people. It was not merely a symbolic monument but a spiritually charged site integral to their cosmological worldview. The mound functioned as a ritual space for communication with the spirit realm, particularly in matters of warfare, purification, and ancestral reverence. Before embarking on headhunting expeditions, warriors would seek spiritual strength and protection at sacred sites

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such as *Ulung Buayeh*. The crocodile spirit, known as *Nui Ulung*, embodied ferocity, territorial power, and guardianship, traits considered essential for a successful headhunter (Talla, 1979).

Monuments such as Ulung Buayeh served to demarcate areas of both spiritual and territorial importance. Headhunting was more than a personal quest for honour; it was a communal assertion of dominance over land and sacred sites. These structures embodied historical memory, spiritual authority, and territorial legitimacy (Bala, 2008). In Lundayeh oral tradition, the crocodile is at times portrayed as a former headhunter spirit or a warrior transformed into a guardian entity, further reinforcing Ulung Buayeh's position as a mythic-spiritual nexus that validates and empowers traditional codes of conduct (Hose & McDougall, 1912; Talla, 1979).

ii. Spiritual Purification and Protection

Upon returning from headhunting expeditions, Lundayeh warriors performed purification rites at *Ulung Buayeh*, a sacred process known as *mamat*. These rituals were intended to cleanse the warrior of malevolent forces or vengeful spirits associated with the slain. Neglecting such rites was believed to invite afflictions, including illness or misfortune (Crain, 1978; Langub, 2003). Dreams involving crocodiles were often regarded as omens, either blessings or warnings, that required interpretation by ritual specialists or village elders (Talla, 1979). Adherence to the sacred protocols surrounding *Ulung Buayeh* was therefore essential to maintaining spiritual balance and ensuring personal well-being.

iii. Offerings to Ancestral Spirits

Ulung Buayeh also functioned as a ceremonial site for offering tributes to ancestral spirits and protective deities. Enemy heads taken during expeditions were presented as tokens of valor, intended to secure blessings and continued protection for the community. Such offerings symbolized the transference of *semangat* (life force), believed to enhance fertility, vitality, and collective prosperity (Sather, 2006). Sacrificial gifts such as animal blood or heirloom beads were made to appease *Nui Ulung*, the guardian spirit, in exchange for spiritual protection and success. The nearby river regarded as a liminal space between the human and spirit worlds, further amplified *Ulung Buayeh*'s significance in rites of passage and purification (Talla, 1979).

Ulung Buayeh is also revered as the dwelling place of a guardian spirit known as *Tawun*. According to Lundayeh oral tradition, it is connected to the community's myth of creation and is regarded as the place where ancestral spirits first descended to establish the foundations of social and spiritual life (Bala, 2008). Practices such as ancestral worship, ritual offerings (*ipung*), and taboos against encroachment embody a worldview that values harmony between humans and the metaphysical realm. Moreover, the site functions as a narrative space

where myths and stories are transmitted orally, reinforcing communal identity, continuity, and respect for ancestral wisdom.

iv. Ecological Resource and Traditional Knowledge

Situated near rivers, forests, and valleys, *Ulung Buayeh* forms part of an ecologically rich landscape that sustains the Lundayeh community. The area provides vital natural resources such as freshwater fish, rattan, medicinal plants, and other non-timber forest products (Zawawi, 2010). Embedded within this landscape is a body of traditional ecological knowledge that reflects generations of environmental stewardship. Practices such as seasonal harvesting, the conservation of *tana' ulun* (sacred land), and *ipung* (temporary fishing bans) demonstrate a sustainable environmental ethic deeply rooted in indigenous wisdom and the community's reciprocal relationship with nature.

v. Social and Traditional Educational Centre

As a neutral yet sacred space, *Ulung Buayeh* plays a vital role in the social fabric of the Lundayeh community. It serves as a venue for key life-cycle ceremonies, including youth initiation rites, conflict resolution processes, and communal deliberations. Traditional justice and conflict mediation practices, including *adat ba'at* (peace negotiations), are conducted here, reflecting the community's deep commitment to social harmony and collective well-being (Crain, 1978). The site also functions as an informal educational space where elders transmit knowledge of customs, taboos, and survival skills to younger generations, by reinforcing *Ulung Buayeh*'s enduring role as a community-based institution for cultural learning and intergenerational continuity.



Figure 1: Image and Shape of Ulung Buayeh
Source: Abd Talib et al. (2022)

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The Abandoned *Ulung Buayeh* of Long Pasia

Once the ceremonial and communal heart of the Lundayeh people, *Ulung Buayeh* has witnessed a gradual erosion of its spiritual and cultural significance as social, religious, economic, and policy forces have reshaped community life. Although modernisation has brought improvements in education and infrastructure, it has simultaneously weakened the continuity and visibility of local cultural heritage, leaving sacred sites such as *Ulung Buayeh* increasingly vulnerable to neglect.

i. Modernisation and the Christianisation of the Lundayeh Community

Since the early 20th century, the Lundayeh have experienced significant religious and social transformation, particularly following the introduction of Christianity into the interior regions of Borneo. Evangelical and Anglican missionary movements promoted a monotheistic worldview that rejected traditional animist beliefs and ancestral spirit worship (Langub, 2003; Crain, 1978). As a result, rituals once central to *Ulung Buayeh*, such as *ipung* (spiritual offerings) and the veneration of *Tawun* spirits, came to be regarded as incompatible with Christian teachings. This religious shift led many community members including traditional leaders to abandon long-held ceremonial practices. Consequently, *Ulung Buayeh*'s role as a sacred communal site diminished, and its spiritual relevance within contemporary Lundayeh life continues to fade as new religious identities take precedence.

ii. Migration and the Marginalisation of Traditional Spaces

Economic demands and the pursuit of formal education have driven widespread migration among younger Lundayeh to urban centres such as Miri, Kota Kinabalu, and beyond. This rural-to-urban movement has led to the depopulation of ancestral villages, leaving sacred sites like *Ulung Buayeh* increasingly isolated (Bala, 2008). The outmigration of younger generations has disrupted the transmission of cultural knowledge and weakened the intergenerational bonds that once sustained rituals and oral traditions. As community engagement with *Ulung Buayeh* diminishes, its role as a site of cultural learning and collective identity continues to fade, and its symbolic meanings risk being forgotten within the pressures of modern life.

iii. Government Development Policies and Urban-Centric Planning

In Malaysia, development priorities centred on roads, dams, and agricultural expansion have often overshadowed Indigenous cultural preservation. Consequently, sacred sites like *Ulung Buayeh* remain absent from formal land-use, heritage, and tourism planning (Zawawi, 2010; Nicholas, 2000). The absence of legal or administrative recognition renders these sites highly vulnerable to encroachment and unregulated development. In some cases, traditional lands have been exploited without the free, prior, and informed consent of local

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communities. This situation reflects a broader disconnect between Indigenous worldviews and top-down development models that fail to recognise or integrate intangible cultural heritage into national planning priorities.

iv. Lack of Documentation and Legal Protection

A critical threat to *Ulung Buayeh*'s preservation is the absence of legal recognition and systematic documentation. Many culturally significant sites within Indigenous territories remain unregistered under national heritage legislation or excluded from community-based forest governance frameworks (Colchester, 2002). *Ulung Buayeh* is no exception. Its cultural protocols, oral histories, and geospatial boundaries are preserved primarily through the memories of ageing elders. Without formal documentation or protective legislation, the site remains highly vulnerable to degradation, neglect, and eventual erasure from collective memory.

v. Changing Cultural Values and Youth Perception

Globalisation, together with increasing exposure to urban lifestyles through education, media, and digital technologies, has reshaped the cultural perceptions of Lundayeh youth. Traditional beliefs and rituals are often regarded as outdated or irrelevant, particularly among those raised outside the ancestral homeland (Sather, 2006). *Ulung Buayeh*, once revered as a sacred living landscape, is now frequently perceived as a relic of the past. The narratives, symbolism, and communal meanings once embedded in the site are seldom invoked, diminishing its role as a marker of collective identity. Unless intentional, community-driven revitalisation efforts are undertaken, *Ulung Buayeh* risks fading into nostalgic memory rather than enduring as a living expression of Lundayeh heritage.

***Ulung Buayeh* as a Model for Community-Based Tourism (CBT)**

Ulung Buayeh, or the "crocodile mound," is a traditional ritual site that holds deep cultural significance for the Lundayeh people of Long Pasia, a remote highland village in Sabah, Malaysia. Historically, these mounds were constructed by returning warriors to symbolise triumph and spiritual strength, accompanied by ceremonial dances and the striking of the effigy with a traditional sword known as the *felefet*. Although the original ritual practices diminished following the spread of Christianity in the 1930s, *Ulung Buayeh* remains a powerful symbol of Lundayeh identity and heritage, reinterpreted today through symbolic foods, such as *luba' buayeh* (crocodile-shaped rice) and community storytelling (Daily Express, 2018).

While traditional practices have declined under religious influence and official discouragement, they continue in modified yet culturally accepted forms. For instance, during wedding ceremonies, the bride's family prepares a *luba' buayeh* made of cooked rice, which the couple cuts at the back of the crocodile's

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neck before the feast begins. Similarly, at the *Irau Rayeh Lundayeh* festival, miniature crocodile replicas are ceremonially cut by VIPs to mark the opening or closing of key events. The crocodile motif also appears in traditional male attire and headdresses, symbolising strength, heroism, and ancestral pride in Lundayeh culture (Ganang, 2018).

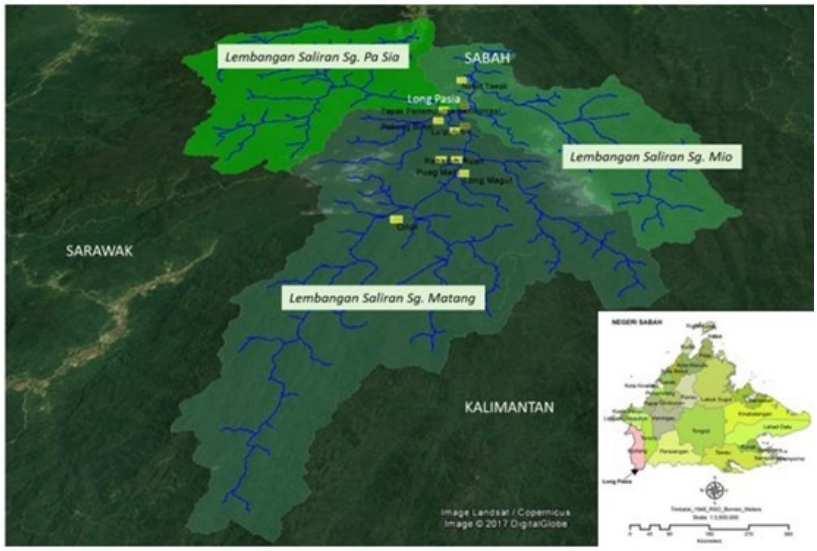


Figure 2: Ulung Buayeh Site Locations Based on River Basins and Networks.
Source: Abd Talip el al (2022)

This cultural heritage has been successfully integrated into the village's community-based tourism (CBT) framework. In Long Pasia, CBT emphasises the active participation and ownership of tourism initiatives by the local Lundayeh community. Instead of passively receiving external tourism investment, the community has developed an inclusive model that centres on Indigenous culture, environmental sustainability, and local economic development.

Ulung Buayeh plays a pivotal role in this model as both a cultural anchor and a key tourism attraction. Visitors to Long Pasia are introduced to *Ulung Buayeh* through guided storytelling sessions, site visits to ancient mound locations, demonstrations of traditional food preparation, and participatory cultural festivals. Homestay programmes allow tourists to experience daily life in a Lundayeh household, often featuring *luba' buayeh* during weddings or ceremonial meals. Local guides, particularly youth trained in cultural interpretation, play a pivotal role as intermediaries in conveying ecological and

mythological knowledge linked to *Ulung Buayeh* and other sacred landmarks, including the footprints of Upai Semaring (Sabah Tourism Board, n.d.).

The CBT model also supports ongoing environmental conservation efforts. Long Pasia lies within a biodiverse tropical highland ecosystem, and several *Ulung Buayeh* sites are located in ecologically sensitive zones. The integration of cultural and natural heritage within tourism routes promotes a strong conservation ethic among both residents and visitors. Community initiatives, including the mapping of sacred landscapes and collaborations with NGOs such as WWF and FORMADAT, have strengthened local capacity to protect ancestral territories while diversifying sustainable livelihood opportunities.



Figure 3: The Bride and Groom Symbolically Cut the Luba' Buayeh
Source: Ganang et al. (2018)

Economically, the *Ulung Buayeh*-based tourism model has diversified village income, particularly benefiting women, youth, and cultural practitioners. Tourism revenues are reinvested into education, infrastructure, and heritage documentation projects. Notably, the revival of the *Nui Ulung Agung* ritual ceremony in 2016, held in conjunction with Long Pasia's recognition as a recipient of the UN Equator Prize, exemplified the synergy between cultural revitalisation and sustainable development. The event brought together traditional leaders, local youth, and visitors in a powerful demonstration of how CBT can rejuvenate indigenous traditions while reinforcing environmental and cultural stewardship.

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In essence, *Ulung Buayeh* represents more than a historical artifact; it is a dynamic cultural asset that illustrates the potential of community-based tourism (CBT) to safeguard intangible heritage while fostering socio-economic resilience. The case of Long Pasia illustrates how ethically managed and community-driven Indigenous narratives can inform models of sustainable and culturally rooted tourism development.

Key Dimensions of the *Ulung Buayeh* Community-Based Tourism (CBT) Model

The success of community-based tourism (CBT) in Long Pasia can be best understood through several interrelated dimensions that reflect the integration of cultural heritage, community participation, environmental stewardship, and economic sustainability. Each dimension demonstrates how *Ulung Buayeh* functions not only as a cultural symbol but also as a catalyst for local empowerment and ecological awareness. Together, these interconnected elements form the foundation of a holistic CBT model that aligns traditional Lundayeh values with contemporary principles of sustainable tourism.

i.Cultural Heritage as the Foundation

The *Ulung Buayeh* crocodile-shaped earth mounds built by Lundayeh warriors represent a tangible and enduring link to the community's ancestral past. Traditionally erected to celebrate headhunting victories, these effigies formed part of elaborate communal rituals that combined storytelling, dancing, and feasting. Although the headhunting era has long ended, the symbolism of the crocodile endures through modern practices such as *luba' buayeh* (crocodile-shaped rice prepared during ceremonies), local folktales, handicrafts, and community festivals.

Integrating these ancient effigy mounds into community-based tourism (CBT) initiatives offers opportunities to promote awareness and safeguard these culturally significant landmarks. This heritage provides a powerful foundation for CBT that reinforces Lundayeh identity and ancestral wisdom, aligning with broader sustainable development goals that emphasise environmental conservation, cultural preservation, and community empowerment (Hemming & Pugh, 2019). With responsible community stewardship, *Ulung Buayeh* can be presented to visitors as a living heritage site that promotes cultural interpretation, ecological education, and economic opportunities through local crafts, guided tours, and traditional performances, while ensuring that the site's sanctity and ecological integrity are respected. Although the physical carving of *Ulung Buayeh* has faded with time, the Lundayeh people continue to preserve its symbolic meaning through ritual songs and traditional foods (Ganang, 2022).

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ii. Tourism Rooted in Local Participation

Community-based tourism (CBT) in Long Pasia is fully owned and managed by the Lundayeh community. Local community serve as guides, homestay hosts, storytellers, and craft producers, ensuring that tourism activities remain rooted in local culture and values. The story of *Ulung Buayeh* is shared during village tours, cultural performances, and at the local museum, reinforcing the community's connection to its ancestral heritage.

CBT empowers villagers to control tourism narratives, protect sacred sites, and derive direct benefits from visitor spending. This participatory model has strengthened Lundayeh cultural identity while promoting tourism that is respectful, inclusive, and community-driven (Ganesan et al., 2021).

iii. Environmental and Cultural Sustainability

Ulung Buayeh is deeply embedded within Long Pasia's forested landscape, an area renowned for its ecological richness and biodiversity. Community-based tourism (CBT) in the region integrates natural conservation with cultural safeguarding, positioning both as complementary pillars of sustainable development. Villagers lead ecotours through sacred landscapes, waterfalls, and forest trails, weaving nature experiences together with cultural narratives.

The mapping of *Ulung Buayeh* sites has been proposed to establish "archaeo-ecotourism zones," enhancing both environmental protection and educational engagement. The preservation of ancient *Ulung Buayeh* effigies can thus be integrated into sustainable tourism planning to promote awareness, protect cultural landscapes, and reinforce the community's long-standing relationship with the natural environment (Abd Talip et al., 2022).

iv. Economic Empowerment and Cultural Revival

Tourism centred on *Ulung Buayeh* has generated new economic opportunities through homestays, local guiding, food preparation, and handicraft production, particularly benefiting youth and women. Income derived from community-based tourism (CBT) is reinvested into village infrastructure, education, and cultural revitalisation initiatives such as the *Nui Ulung Agung* ceremony, held to celebrate Long Pasia's receipt of the UN Equator Prize. The *Nui Ulung Agung* event exemplifies how traditional Lundayeh practices are being revived through community tourism, effectively linking cultural identity with sustainable development (Daily Express Sabah, 2018).

v. Model of Respectful, Community-Led Tourism

Ulung Buayeh-based community-based tourism (CBT) in Long Pasia exemplifies how Indigenous knowledge and heritage can drive bottom-up tourism initiatives. It emphasises respect for sacred traditions, environmental ethics, and community autonomy, aligning closely with the UNWTO's principles of sustainable and

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inclusive tourism. Engaging the local community in research and heritage-based activities fosters the co-creation of knowledge and elevates the site's standing as a legitimate cultural and ecological research area (Colchester, 2002). Such academic collaboration further validates the significance of *Ulung Buayeh* within both national and international heritage discourses.

When thoughtfully designed and implemented, tourism can serve as a powerful instrument for cultural revitalisation and sustainable development. By integrating Indigenous cultural practices, environmental education, and community leadership, *Ulung Buayeh* can be reimagined as a dynamic ecotourism destination. These efforts not only safeguard the unique heritage of the Lundayeh people but also ensure its continued relevance and vitality in an increasingly globalised world.

CONCLUSION

Ulung Buayeh represents a profoundly significant cultural heritage for the Lundayeh community, reflecting not only spiritual and historical dimensions but also symbolising the symbiotic relationship between humans, nature, and ancestral spirits. Within the Lundayeh worldview, *Ulung Buayeh* is understood as a cosmological space that bridges human existence with metaphysical and ecological realms. It is a sacred locus embodying deep reverence for nature as a living entity imbued with spirit, and a site for ritual practices where traditions, customs, and taboos have been passed down through generations.

In the current socio-cultural context, characterised by modernisation, rural migration, and the marginalisation of heritage in national development agendas, numerous *Ulung Buayeh* sites have fallen into neglect due to the absence of systematic conservation measures. Contributing factors include the erosion of cultural values among younger generations, the influence of external religions that discredit animistic traditions, and the lack of comprehensive heritage preservation policies. Collectively, these challenges raise serious concerns about the continuity of Lundayeh's intangible cultural heritage, which is becoming increasingly fragile.

In this context, *Ulung Buayeh* holds immense potential to be developed as a focal point for community-based tourism (CBT), offering an integrated approach that combines heritage conservation with sustainable socio-economic development. When developed holistically and guided by local cultural values, heritage-based tourism can serve as a platform for cross-cultural education and mutual understanding between visitors and host communities. Activities such as guided visits to *Ulung Buayeh* sites, culturally sensitive ritual demonstrations, the documentation and reinterpretation of local myths, and the establishment of cultural interpretation centres can revive *Ulung Buayeh*'s role as a social, spiritual, and educational space.

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Moreover, such initiatives provide an ethical and alternative source of income for the Lundayeh community, provided that cultural ownership and narrative authority remain under community control. The active participation of the Lundayeh in every stage of tourism planning and implementation, coupled with policy support from state authorities through heritage gazettement, and partnerships with academics, NGOs, and tourism practitioners, is essential for the long-term sustainability of *Ulung Buayeh*. These collaborative efforts not only advance the broader agenda of Indigenous heritage preservation in Malaysia but also reaffirm tourism's potential as an inclusive, equitable, and culturally grounded instrument for sustainable development.

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LANGUAGES, PLACES, AND PEACE: ETHNIC HARMONY ACROSS URBAN AND RURAL SABAH, MALAYSIA

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Abstract

This study tackles two research questions: RQ1: Do positive attitudes toward linguistic diversity foster ethnic harmony? and RQ2: Does place of residence influence that relationship? Surveys with 2,725 adults in seven districts of Sabah, Malaysia, captured daily language use, support for linguistic diversity, and perceived inter-ethnic harmony. Overall, respondents expressed strong approval of linguistic diversity and high levels of harmony. Statistical testing confirmed that favourable diversity attitudes are a consistent predictor of harmony, addressing RQ1. A follow-up comparison of urban and rural respondents revealed that this attitude–harmony link is noticeably stronger in rural districts, where mother-tongue use remains part of everyday life - thereby answering RQ2. In urban centres, well-established intercultural activities appear to provide a baseline of harmony, making individual attitudes less decisive. These findings suggest that social-cohesion efforts should be tailored to local contexts. Rural areas can benefit from low-cost, community-run initiatives such as heritage-language media, mother-tongue classes, and intergenerational storytelling, which reinforce positive diversity attitudes already aligned with daily practice. Urban settings, meanwhile, should focus on keeping intercultural programmes genuinely engaging rather than tokenistic. By showing how linguistic attitudes and residential context work together to shape harmony, the study offers a practical framework for other multi-ethnic societies aiming to turn cultural diversity into a shared strength.

***Keywords*:** linguistic diversity, ethnic harmony, Sabah, place of residence, language attitudes

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INTRODUCTION

Sabah, a state in Malaysia known for its rich ethnic and linguistic diversity, presents a compelling case study for understanding the dynamics of social harmony in a multicultural setting. With numerous indigenous groups alongside sizable Malay, Chinese, and other communities, Sabah's social fabric is interwoven with a multitude of languages and cultural practices. While diversity can sometimes be perceived as a source of potential conflict, Sabah has largely maintained a commendable level of peaceful coexistence among its various ethnic and religious groups (Sintang, 2014; Sintang, 2024). This paper seeks to delve into this phenomenon by focusing on two key factors: language and place of residence, and their influence on ethnic harmony. The research is guided by two primary questions:

RQ1. Do positive attitudes toward linguistic diversity foster ethnic harmony?
RQ2. Does place of residence influence that relationship?

Addressing these questions, the study uniquely integrates linguistic diversity with urban–rural context to show how attitudes and place jointly shape ethnic harmony, drawing valuable lessons from the unique context of Sabah. The findings of this research hold significance for policymakers, educators, and community leaders seeking to build more inclusive and cohesive societies in Malaysia and beyond. While previous studies have examined either linguistic diversity or urban-rural differences in isolation, this research uniquely integrates both dimensions to reveal how language attitudes interact with place-based contexts in shaping ethnic harmony. By empirically testing the moderating effect of place of residence on the relationship between support for linguistic diversity and inter-ethnic cohesion, this study advances beyond descriptive accounts of Sabah's multiculturalism to provide actionable insights into the specific mechanisms through which linguistic ecologies sustain peace in both urban superdiverse settings and rural vernacular communities.

LITERATURE REVIEW

The study of ethnic harmony in diverse societies necessitates an examination of various theoretical frameworks and empirical findings related to language, culture, and social cohesion. This literature review synthesizes existing scholarship to provide a theoretical foundation, contextualize the research within broader discussions of diversity, and identify the specific research problem and gap addressed by this study in the context of Sabah.

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Theoretical Framework

Several theoretical perspectives inform the understanding of the relationship between language, diversity, and social harmony. Spolsky's language-management model offers a sharper explanatory lens for our research questions by treating language policy as a systemic interplay of three mutually reinforcing components—actual practices, underlying beliefs, and deliberate management interventions—filtered through the social domains in which people interact, such as the family, workplace, and civic life. By conceptualising residents' *attitudes toward linguistic diversity* as a subset of the "beliefs" component, we position RQ1 within the very mechanism that Spolsky argues either sustains or undermines harmonious multilingual co-existence. Moreover, Spolsky emphasises that management efforts must be *domain- and level-specific* to succeed; rural communities, where vernacular practices remain deeply embedded in family and village life, therefore offer different leverage points than urban settings, where market and bureaucratic domains dominate. This insight directly informs RQ2, which probes whether and how the place of residence moderates the attitudes-harmony link by shifting the relative weight of these domains (Spolsky, 2009).

Complementing Spolsky's systems view, Pérez Báez reframes language vitality as a matter not only of cultural rights but of *scientific urgency*, warning that "large percentages of our very object of study may disappear within this century" if proactive measures are not embedded in community life (Pérez Báez, 2018). Integrating her call for documentation and revitalisation underscores the broader scholarly and ethical stakes of examining how positive diversity attitudes can translate into tangible social cohesion. Together, Spolsky's domain-sensitive framework and Pérez Báez's vitality imperative justify our dual focus on micro-level attitudes and meso-level residential contexts as critical levers for both harmonious inter-ethnic relations and the preservation of Sabah's linguistic heritage.

Gavin et al. (2013) also contribute to a mechanistic understanding of linguistic diversity, exploring the drivers of language diversification and the factors that maintain or reduce it. These theoretical insights provide a basis for understanding how the linguistic landscape of Sabah has evolved and how it might influence ethnic interactions.

The notion of "harmony in diversity" is another important theoretical underpinning. Banban's (2018) empirical study on harmonious co-existence in the multi-ethnic culture of Qinghai offers valuable insights into how different ethnic groups can coexist peacefully while maintaining their distinct cultural traditions. This study highlights the importance of mutual borrowing, seeking common ground, and respecting differences as key elements of harmonious coexistence (Banban, 2018).

General Background

Linguistic diversity is a global phenomenon, with thousands of languages spoken across the world. This diversity is not merely a matter of different vocabularies and grammatical structures but also reflects diverse ways of knowing, interacting with the environment, and organizing social life. Báez (2018) emphasizes the link between linguistic diversity, language vitality, and the advancement of linguistics as a science, underscoring the importance of documenting and understanding endangered languages. Gavin et al. (2013) discuss the various environmental, geographical, and sociocultural drivers of linguistic diversification, providing a broader context for understanding the origins and maintenance of language diversity in a region like Sabah.

The relationship between language and inter-racial harmony has been a subject of study in various multi-ethnic societies. Chan's (2016) paper on "Language and inter-racial harmony: The Battle for English as Singapore lingua" provides a comparative perspective, illustrating how language policies and the choice of a lingua franca can impact intergroup relations in a different Southeast Asian context. While the historical and socio-political context of Singapore differs from Sabah, the challenges and strategies related to language and harmony discussed in this paper offer valuable points of comparison (Chan, 2016).

The concept of linguistic landscape, which refers to the visibility and salience of languages in the public space, can also provide insights into the dynamics of language use and intergroup relations. Benu et al.'s (2023) study on local language vitality in Kupang city, Indonesia, using a linguistic landscape approach demonstrates how analyzing the presence and use of languages in public signs, advertisements, and other forms of public discourse can reveal patterns of language dominance, vitality, and potential areas of linguistic tension or harmony.

Sabah Context

Sabah's context of ethnic and religious diversity is particularly relevant to this study. Sintang's work on Understanding Sabah's Exemplary Interfaith Relations from a Grassroots Perspective (2024) and Peaceful Co-Existence in Religious Diversity in Sabah, Malaysia (2014) highlights the remarkable degree of cohesion, mutual respect, and accommodation among the diverse communities in Sabah, contrasting it with the often more tense relations in Peninsular Malaysia (Sintang, 2014; 2024). Sintang (2024) attributes this harmony, particularly between Muslim and Christian communities, to familial attitudes and outlooks at the grassroots level. These studies underscore the importance of local-level interactions and attitudes in fostering peaceful coexistence (Sintang, 2014; 2024). The empirical investigation in this study, which gathered data across seven diverse locations in Sabah, including both urban and rural areas, aims to further

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explore how these dynamics of harmony are influenced by linguistic practices and specific geographical contexts within the state.

Research Problem and Gap

Despite the existing literature on linguistic diversity, social harmony, and the specific case of Sabah's interfaith relations, there remains a gap in the comprehensive understanding of how the *interaction* between language use, particularly daily dialect and mother tongue use, and *place of residence* specifically influences ethnic harmony in Sabah. While Sintang's work provides valuable insights into interfaith relations (Sintang, 2014; 2024), a detailed analysis of how the *combination* of linguistic practices and urban versus rural settings shapes ethnic harmony is less explored.

The research problem, therefore, is to empirically investigate the specific influence of language use patterns in conjunction with different places of residence on the levels of ethnic harmony experienced by individuals in Sabah. Existing studies have focused on broader aspects of intergroup relations or examined language or location in isolation or with different variables. This study aims to fill this gap by providing a focused quantitative analysis of these intersecting factors, drawing on the diverse linguistic and geographical landscape of Sabah and the data collected across various locations within the state. By doing so, it seeks to offer a more granular understanding of the complex interplay between linguistic diversity, spatial context, and the achievement of social harmony in a multi-ethnic society.

Spolsky's tripartite ecology - language practices, language beliefs, and language management - clarifies why our study interrogates not only *what* Sabah residents believe about multilingualism but *where* those beliefs operate. By conceptualising "support for linguistic diversity" as a belief-level variable and "place of residence" as a domain bundle that shapes daily practices, we position RQ1 (Do positive attitudes toward linguistic diversity foster ethnic harmony?) and RQ2 (Does place moderate that link?) squarely inside Spolsky's mechanism for sustainable social cohesion. Complementing this systems lens, Pérez Báez reframes language vitality as a matter of *scientific urgency*, warning that the loss of minoritised languages erodes the empirical base of linguistics itself. Together, these perspectives justify our focus on *attitudinal levers* and *spatial context* as dual drivers of both social harmony and the preservation of Sabah's linguistic heritage.

METHODOLOGY

This study employed a quantitative survey design to examine the relationship between support for linguistic diversity and perceptions of social harmony among residents of Sabah, Malaysia. The research focused on how these attitudes and experiences vary across seven different districts in the State and between urban

and rural communities. The map in Figure 1 displays the geographic location of the districts involved in this study. These districts were selected to represent both urban and rural respondents across Sabah, with varying levels of ethnic and linguistic diversity.



Figure 1: Map of Sabah State Showing the Districts Surveyed
Source: https://sabah.gov.my/ms/content/pengenalan

Sampling and Data Collection

To ensure a representative sample, the survey employed a probability sampling approach, with the sampling frame constructed using population data from the Department of Statistics Malaysia. A total of 2,725 respondents were selected from seven key locations across Sabah: Sandakan, Tawau, Kuala Penyu, Ranau, Keningau, Kota Kinabalu, and Kota Marudu. Trained enumerators conducted face-to-face interviews, administering the questionnaire in the respondents' preferred language to maximize comprehension and data quality. This approach ensured that the sample reflected the demographic and linguistic diversity of the region, providing a robust foundation for analyzing language-related variables. The study received ethical clearance from the Research Management Centre,

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Universiti Malaysia Sabah for the research code SDK0328-2021. Prior to data collection, all respondents were provided with information
about the study's purpose and procedures, and written informed consent was obtained from each participant. Participation was entirely voluntary, and respondents were informed of their right to withdraw at any time. To ensure confidentiality, all responses were anonymized and no personally identifiable information was retained.

Instrument and Measures
Data were collected using a structured questionnaire comprising several validated scales:

- **Support for Linguistic Diversity:** This construct was measured using nine items (B5.1 to B5.9), each rated on a Likert scale. These items assessed respondents' attitudes toward the maintenance and promotion of local dialects and multiple languages within their communities. The mean of these items was used as a composite score for subsequent analyses.
- **Social Harmony:** The Social Harmony scale was constructed by combining responses from five key domains measured on a 5-point Likert scale: religious tolerance (9 items), attitudes toward interethnic marriage (9 items), experiences in local markets/tamu (9 items), participation in ethnic celebrations (9 items), and support for linguistic diversity (9 items). The mean of these 45 items formed the social harmony scale (Cronbach's $\alpha = 0.95$).
- **Urban/Rural Status and Region:** Respondents indicated their place of residence, which was coded to distinguish between urban and rural areas, as well as the specific region (Kota Kinabalu, Kota Marudu, Keningau)

All items were measured using a Likert-type scale, with higher scores indicating greater frequency, stronger support, or higher perceived harmony.

Reliability Analysis
To ensure the reliability of the measurement instruments, Cronbach's Alpha was calculated for the main scales. The Support for Linguistic Diversity scale demonstrated excellent internal consistency with a Cronbach's Alpha of 0.889. The Social Harmony scale showed good reliability with a Cronbach's Alpha of 0.794.

Data Analysis
Descriptive statistics were computed to summarise the central tendencies and variability of the main variables. Correlation analysis was conducted to examine the relationships between support for linguistic diversity and social harmony. To explore regional and urban-rural differences in social harmony, one-way

ANOVA and independent samples t-tests were performed, respectively. A multiple regression analysis was then conducted to assess the influence of support for linguistic diversity and urban/rural status on social harmony, including an interaction term to test whether the effect of linguistic diversity support differed by urban or rural context.

FINDINGS & DISCUSSION

This section discusses the findings of the study regarding how language use and place of residence shape ethnic harmony across diverse locations in Sabah.

Demographic Profile

The analysis began by examining the demographic profile of the 2,725 respondents who participated in the survey. Understanding the composition of the sample is essential for contextualizing the findings and ensuring the representativeness of the results. Table 1 presents the distribution of respondents across key demographic variables including gender, ethnicity, age group, education level, and district of residence. Percentages are calculated based on the total sample size. The sample includes representation from Sabah's major ethnic groups (Dusun, Bajau, Chinese, Kadazan-Dusun, and others) and spans seven districts. Table 1 summarises the distribution of respondents by gender, ethnicity, age range, religion/beliefs, and education level. This comprehensive overview highlights the diversity of the sample and provides a foundation for interpreting subsequent analyses.

As shown in Table 1 below, 1,500 female and 1,225 male respondents participated. Dusun was the largest ethnic group with 925 respondents, followed by Bajau (383), Malays (254), and others. The table lists all ethnicities with their respective counts, including smaller groups like Rungus, Iban, Jawa, and more. In terms of age, the respondents were distributed across typical age ranges. The largest group is 35-44 years old (719), followed by 25-34 years old (609), 45-54 years old (557), 18-24 years old (421), 55-64 years old (296), and above 65 years old (123). There were no respondents under 18. Finally, the most common educational qualification was SPM (1,075), followed by Bachelor’s degree (445), SRP (385) Master’s, (347), UPSR (263).

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Category	Label	Count
Gender	Female	1500
	Make	1225
Ethnicity	Dusun	925
	Bajau	383
	Melayu	254
	Bugis	174
	Sungai	125
	Kadazan	115
	Suluk	106
	Murut	91
	Tidung	80
	Bisaya	80
	Kedayan	74
	Brunei	69
	Cina	57
	Sino	41
	Rungus	37
	Banjar	27
	Iban	21
	Jawa	14
	Cocos	9
	Lain-lain	9
	India	6
	Ubian	5
	Filipino	4
	Kegayan	3
	Idahan	3
	Timur	2
	Rumanau	2
	Bidayuh	2
	Visaya	2
	Kayan	2
	Buton	1
	Lundayeh	1
	Dumpas	1

Category	Label	Count
Age range	<18	0
	18-24	421
	25-34	609
	35-44	719
	45-54	557
	55-64	296
	65+	123
Religion/ Beliefs	Islam	2102
	Kristian	575
	Buddha	21
	Bahai	9
	Others	8
	Pagan	7
	Hindu	3
Education	SPM	1075
	Bachelors	445
	SRP	385
	Masters	347
	UPSR	263
	No formal education	171
	Others	20
	PhD	19

Table 1: Demographic Profile of Survey Respondents

Language Use and Attitudes

Table 2 presents descriptive statistics for items B5.1–B5.9, which index respondents' attitudes toward linguistic diversity in Sabah. All items used a 5-point Likert scale (1 = Strongly disagree; 5 = Strongly agree), with higher means indicating stronger support for linguistic diversity. A composite mean across the nine items provides the overall 'support for linguistic diversity' measure used in subsequent analyses:

Table 2: Mean Scores for Support for Linguistic Diversity Items

Item	Mean Score	Item Statement
B5.1	4.5	I know the existence of various ethnic languages in Sabah as one of the uniqueness that contributes to the unity of the community.
B5.2	4.5	I agree that the use of Sabah Malay dialect as an intermediate language that fosters ethnic harmony in Sabah.
B5.3	4.5	The use of multiple languages does not affect the harmony of the various ethnicities in Sabah.
B5.4	4.4	I don't mind if I need to learn another ethnic language.
B5.5	4.3	I support the teaching of KadazanDusun subject in schools in Sabah.
B5.6	4.5	I support efforts to conserve (preserve) the various ethnic languages in Sabah.
B5.7	4.3	I learned the language of other ethnicities to make it easier for me to communicate with other ethnicities.
B5.8	4.1	I try to use other ethnic languages when I'm at a party or at a *tamu*.
B5.9	4.1	I like to follow the broadcasts of various ethnic languages of Sabah on electronic media and social media.

The results indicate that, overall, respondents express strong support for the items on linguistic diversity, with mean scores for most items well above 4 on a 5-point scale. This suggests that the majority of participants agree on the importance of preserving local dialects and supporting efforts to maintain multiple languages in their communities. Notably, items such as B5.1 ("It is important to maintain local dialects") and B5.6 ("I support efforts to preserve multiple languages in my community") have particularly high mean scores, reflecting widespread endorsement of these values. These results reinforce the idea that linguistic diversity is not only accepted but actively supported by the communities, which is a positive sign for language preservation initiatives and social cohesion in Sabah.

Building on the strong support for linguistic diversity observed among respondents, it is important to consider how these positive language attitudes relate to broader patterns of social harmony within Sabah's multiethnic communities. To this end, the Social Harmony scale was constructed by combining responses from five key domains: religious tolerance, attitudes toward interethnic marriage, experiences in local markets (*tamu*), participation in ethnic celebrations, and support for linguistic diversity. This comprehensive scale

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provides a holistic measure of how individuals perceive and experience harmonious relations across ethnic lines in their daily lives.

Table 3 below presents descriptive statistics for survey items measuring various dimensions of social harmony, including interethnic trust, cooperation, and peaceful coexistence. All items were measured on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree), with higher scores indicating greater perceived social harmony. The composite mean score across all items provides an overall measure of social harmony used as the dependent variable in regression analyses. The high reliability of this scale (Cronbach's Alpha = 0.95) underscores its robustness in capturing the multifaceted nature of social harmony in the state:

Table 3: Mean Scores and Standard Deviations for Social Harmony Items by Districts

No.	**Location**	**Mean**	**SD**	**N**
1	Keningau	4.16	0.5	400
2	**Kota Kinabalu**	**4.34**	0.4	400
3	**Kota Marudu**	**4.38**	0.4	385
4	Kuala Penyu	4.26	0.5	385
5	Ranau	4.18	0.5	385
6	Sandakan	4.14	0.5	385
7	Tawau	4.20	0.5	385

The results indicate that perceptions of social harmony are generally high across all regions, with mean scores ranging from 4.14 in Sandakan to 4.38 in Kota Marudu on a 5-point scale. Notably, Kota Marudu and Kota Kinabalu report the highest levels of social harmony, suggesting particularly strong interethnic relations in these areas. The relatively low standard deviations across regions further suggest that these positive attitudes are widely shared within each community.

A one-way ANOVA was conducted to test whether these regional differences are statistically significant. The analysis reveals a significant effect of region on Social Harmony scores, with an F-statistic of 16.25 and a *p*-value less than .001. This indicates that there are meaningful differences in perceived social harmony among the seven fieldwork locations in Sabah. Post-hoc Tukey HSD tests further clarify which regions differ from each other. The most notable findings were:

- Kota Kinabalu and Kota Marudu both have significantly higher Social Harmony scores compared to Keningau (mean differences of 0.18 and 0.22, both $p < .001$).
- Kuala Penyu also differs significantly from Keningau (mean difference 0.10, $p = .038$).
- Some region pairs, such as Keningau vs. Ranau and Keningau vs. Sandakan, do not show significant differences, indicating similar levels of social harmony between these locations.

These results highlight that while social harmony is generally high across Sabah, certain regions - particularly Kota Kinabalu and Kota Marudu - stand out for their especially strong interethnic relations. The significant differences observed may be influenced by factors such as demographic diversity, urbanization, economic opportunities, and the presence of multicultural initiatives in these regions.

A key objective of this study was to examine whether place of residence -specifically, urban versus rural context - shapes experiences of social harmony in Sabah. The analysis revealed a clear and significant distinction between these groups. Urban residents, represented by Kota Kinabalu, reported a higher mean level of social harmony compared to their rural counterparts across the state. This pattern is summarised in the following Table 4:

Table 4: Urban and Rural Respondents Comparison of Social Harmony Mean Scores

No.	UrbanRural	mean	std	n
0	Rural	4.22	0.47	2325
1	Urban	4.34	0.41	400

As shown on Table 4, the mean social harmony score among urban respondents was 4.34, while rural respondents reported a mean of 4.22. Notably, the standard deviation was lower in urban areas (SD = 0.41 vs. 0.47), indicating a greater consensus among urban dwellers regarding the state of social harmony. An independent-samples t-test indicated higher harmony among urban respondents than rural respondents, ($t = 5.28$, $p < .001$, Cohen's $d = 0.26$). The effect size, while small, represents a meaningful difference given the large sample size and the practical implications for understanding urban-rural dynamics in Sabah's multicultural context. Consistent with this pattern, studies of Kota Kinabalu's Taman Awam Teluk Likas indicate that inclusively planned parks can help institutionalise routine interethnic contact, consistent with a higher urban harmony baseline (Abdul Latip et al., 2023).

These findings suggest that the urban environment in Sabah, characterized by greater exposure to diversity and more opportunities for

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interethnic interaction, may foster stronger social cohesion. At the same time, the consistently high mean scores across both urban and rural groups highlight Sabah's overall success in maintaining social harmony within its multi-ethnic society.

This urban–rural difference is not only statistically significant but also meaningful in practical terms. The literature review highlighted the challenges of fostering cohesion in rapidly urbanizing environments; our findings suggest that, in Sabah, urban settings may actually provide more opportunities for positive interethnic contact and shared values, perhaps due to greater exposure to diversity and more inclusive urban policies. Importantly, the relationship between support for linguistic diversity and social harmony is moderated by urban/rural status. The positive effect of supporting linguistic diversity on social harmony is even more pronounced in rural areas. To further clarify these dynamics, a regression analysis was conducted to examine how support for linguistic diversity, urban–rural status, and their interaction jointly influence social harmony in Sabah. The results are summarised in Table 5 below:

Table 5: Regression Analysis Predicting Social Harmony from Linguistic Diversity Support and Urban-Rural Status.

Predictor	B	SE	t	*p*
Intercept	1.151	0.044	26.28	< .001***
Linguistic Diversity Support	0.708	0.01	70.66	< .001***
Urban/Rural Status	0.532	0.118	4.5	< .001***
Linguistic Diversity x UrbanRural Status	-0.108	0.027	-4.04	< .001***

As shown in Table 5, support for linguistic diversity was a significant positive predictor of social harmony (B = 0.708, SE = 0.010, t = 70.66, $p < .001$), indicating that for rural residents, each one-unit increase in support for linguistic diversity was associated with a 0.71-point increase in social harmony. Urban-rural status also significantly predicted social harmony (B = 0.532, SE = 0.118, t = 4.50, $p < .001$), with urban residents reporting higher social harmony scores than rural residents at average levels of linguistic diversity support.

Most importantly, the interaction between linguistic diversity support and urban-rural status was statistically significant (B = -0.108, SE = 0.027, t = -4.04, $p < .001$), indicating that urban-rural status moderates the relationship between linguistic diversity support and social harmony. Specifically, the positive effect of linguistic diversity support on social harmony was stronger for rural residents than for urban residents.

All predictors in the model are statistically significant at the $p < .001$ level, underscoring the robustness of these relationships. This complex pattern

highlights that both language attitudes and place of residence play important, interacting roles in shaping social harmony in Sabah. To visually illustrate this interaction and make the statistical relationship more accessible, Figure 2 below presents the association between support for linguistic diversity and social harmony separately for urban and rural respondents:

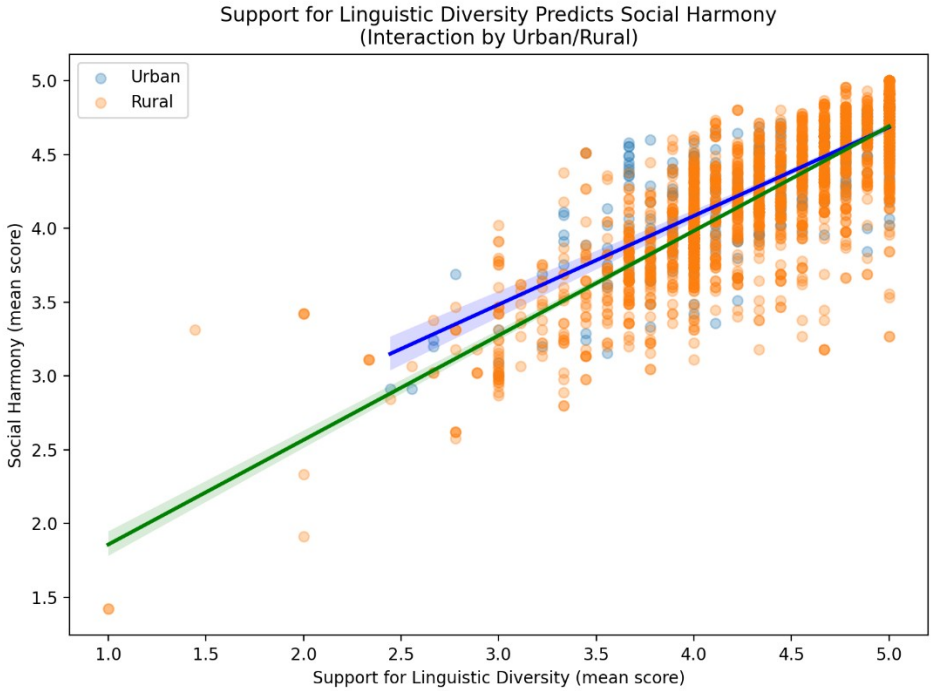


Figure 2: Interaction Between Support for Linguistic Diversity and Urban-Rural Status in Predicting Social Harmony

The chart displays two regression lines: blue line for urban respondents and green line for rural respondents. Both lines slope upward, indicating that, regardless of where people live, those who are more supportive of linguistic diversity tend to report higher levels of social harmony. This positive association is consistent with the idea that valuing multiple languages fosters mutual respect and peaceful coexistence.

However, the key insight from the visualization - and from the regression analysis results - is that the slope of the line is steeper for rural respondents. In practical terms, this means that the "boost" in social harmony associated with supporting linguistic diversity is even greater in rural areas than in urban ones. For example, a rural resident who strongly supports linguistic diversity is likely to report much higher social harmony than a rural resident who

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does not, and this difference is larger than the corresponding difference among urban residents.

This study set out to answer two fundamental questions: (1) Does language and place of residence influence ethnic harmony in a society like Sabah? and (2) How do these factors exert their influence? Through a rigorous quantitative analysis of a diverse sample spanning urban and rural Sabah, our findings provide robust, multi-layered answers that not only advance academic understanding but also offer practical insights for policy and community action.

Linguistic Diversity as a Foundation for Social Harmony

The first and most consistent finding is the powerful, positive association between support for linguistic diversity and social harmony. Respondents who more strongly endorse the preservation and use of multiple languages in their communities report significantly higher levels of social harmony. This result is not only statistically significant but also substantial in practical terms, echoing the arguments of Schreiber and Carius (2016), who contend that embracing diversity - including linguistic diversity -is essential for fostering social cohesion. Their work on inclusive urban planning highlights the value of multilingual public services and accessible urban spaces in strengthening residents' sense of belonging. While their examples focus on global cities such as Toronto and Melbourne, the present findings suggest that similar strategies are both relevant and feasible in Sabah, particularly in urban centres like Kota Kinabalu. The strong endorsement of linguistic diversity among respondents indicates a fertile ground for such inclusive initiatives, which could further enhance inter-ethnic interactions and reduce social exclusion.

The concept of linguistic superdiversity, as articulated by Blommaert and Rampton (2011) and expanded by Duarte and Gogolin (2013), is also highly relevant to the Sabah context. Superdiversity describes the complex, dynamic nature of language use in urban settings with high migration flows, challenging planners to move beyond monolingual frameworks and adopt flexible, multilingual policies. In Sabah, where indigenous languages coexist with Malay and English, our findings underscore the need for planning that supports linguistic pluralism while promoting integration. The high mean scores for support for linguistic diversity reflect a community that is not only tolerant of, but actively values, its multilingual heritage. This is a crucial insight: it suggests that the foundation for social harmony in Sabah is not assimilation, but the celebration and maintenance of difference.

Recent scholarship by Siemund (2023) further supports this interpretation, emphasizing that multilingual development is not merely a byproduct of globalization but a deliberate, community-driven process. Siemund's work demonstrates that when communities invest in the maintenance and development of multiple languages, they foster environments where mutual

respect and understanding can flourish. Our findings resonate with this perspective, showing that support for linguistic diversity is a key driver of social harmony in both urban and rural Sabah.

Urban and Rural Dynamics: The Role of Place

The influence of place of residence - urban versus rural - emerges as another significant determinant of social harmony. Urban residents, on average, report higher levels of social harmony than their rural counterparts. This finding is particularly striking in the case of Kota Kinabalu, Sabah's most cosmopolitan city, which records the highest mean score for social harmony among all regions studied. This result is not coincidental. Kota Kinabalu's demographic diversity, economic opportunities, and history of migration have created a vibrant, multicultural urban environment. The city's high level of social harmony can be attributed to several interrelated factors.

First, as Schreiber and Carius (2016) argue, urban planning that embraces diversity - through multilingual signage, inclusive public services, and accessible community spaces - can significantly enhance residents' sense of belonging. In Kota Kinabalu, such initiatives are not merely theoretical; they are visible in the city's everyday life, from the languages spoken in markets to the cultural festivals celebrated throughout the year. The findings of Isar (2016) further reinforce this point, highlighting that creative urban diversity and intercultural policies can transform multicultural cities into genuinely inclusive spaces. In such environments, the marginal benefit of additional support for linguistic diversity, while still positive, is less dramatic because the baseline for social harmony is already high. This is reflected in our regression analysis, which shows that the positive effect of support for linguistic diversity on social harmony is somewhat weaker in urban areas compared to rural areas. In other words, urban residents in places like Kota Kinabalu already benefit from a broad array of multicultural experiences and institutional supports that foster harmony, regardless of individual attitudes.

Second, the concept of linguistic superdiversity is particularly salient in Kota Kinabalu. The city's population is characterized by a high degree of linguistic and cultural heterogeneity, with indigenous languages, Malay, English, and various migrant languages coexisting in a dynamic, ever-evolving landscape. Blommaert and Rampton (2011) and Duarte and Gogolin (2013) argue that such superdiverse environments require flexible, adaptive policies that go beyond traditional monolingual or even bilingual frameworks. Our findings suggest that Kota Kinabalu's success in fostering social harmony is due, in part, to its ability to accommodate and celebrate this superdiversity. The city's high mean score for social harmony is a testament to the effectiveness of these inclusive, pluralistic approaches.

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Rural Strengths: The Case of Kota Marudu

Equally noteworthy is the case of Kota Marudu, a rural area that also records a high mean score for social harmony. This finding challenges the assumption that urban areas are inherently better equipped to manage diversity and suggests that rural communities possess their own unique strengths. In Kota Marudu, the strength of social cohesion may be rooted in the close-knit nature of rural life, where interpersonal relationships are more direct and language plays a central role in daily interactions. The regression analysis supports this interpretation, showing that the positive effect of supporting linguistic diversity is especially pronounced in rural contexts. In practical terms, this means that a rural resident who strongly supports linguistic diversity is likely to report much higher social harmony than a rural resident who does not, and this difference is larger than the corresponding difference among urban residents.

This finding aligns with Duarte and Gogolin's (2013) argument that rural multilingualism, when valued and supported, can serve as a powerful engine for social integration and mutual trust. In rural communities, language is often more than a tool for communication - it is a marker of identity, belonging, and mutual respect. Thus, efforts to promote linguistic inclusivity in these areas can yield substantial dividends for social harmony. Siemund (2023) also emphasizes the importance of local language practices and attitudes in sustaining social cohesion in less urbanized settings. Our findings provide empirical support for this perspective, demonstrating that rural communities like Kota Marudu can achieve high levels of social harmony when linguistic diversity is embraced.

Interpreting the Regression Analysis: Implications for the Research Questions

The regression analysis offers a rich and persuasive interpretation into the interplay between language attitudes and place of residence in shaping social harmony. Most notably, the significant and negative interaction term indicates that while support for linguistic diversity is associated with higher social harmony in both urban and rural contexts, the strength of this association is somewhat weaker in urban areas. In other words, the "boost" in social harmony that comes from supporting linguistic diversity is more pronounced in rural settings. This is a critical finding, as it challenges the often-unquestioned assumption that urban environments, by virtue of their diversity and cosmopolitanism, are always the most fertile ground for interethnic harmony.

What does this mean for our understanding of social cohesion in Sabah? First, it underscores the importance of context. In urban areas like Kota Kinabalu, where social harmony is already high—likely due to a combination of demographic diversity, economic opportunity, and the presence of multicultural initiatives—the marginal benefit of additional support for linguistic diversity, while still positive, is less dramatic. This aligns with the arguments of Schreiber

and Carius (2016), who highlight that urban planning and policy interventions, such as multilingual signage, inclusive public services, and intercultural community centres, can create environments where diversity is normalized and celebrated. In such settings, the baseline for social harmony is already elevated, and the incremental gains from further support for linguistic diversity, though real, are less pronounced.

Conversely, in rural areas like Kota Marudu, where linguistic and cultural ecologies tend to be more homogeneous, individual attitudes toward linguistic diversity play a more decisive role in shaping interethnic relations. In that context, the Lower Kinabatangan case shows how these attitudes can be institutionally scaffolded: collaborative management structures create predictable opportunities for contact and trust-building routines that thereby amplify the attitudinal gradient observed (Pimid et al., 2020). Here, the regression analysis reveals that the positive effect of supporting linguistic diversity on social harmony is especially strong. This finding resonates with the work of Duarte and Gogolin (2013) and Siemund (2023), who argue that in less urbanized settings, language is often a core marker of identity and belonging. When rural residents value and support linguistic diversity, the resulting boost in social harmony is substantial. This suggests that efforts to promote linguistic inclusivity in rural areas can yield significant dividends for social cohesion, perhaps even more so than in urban contexts.

The significance of these findings cannot be overstated. They provide a powerful empirical rebuttal to the notion that diversity is inherently destabilizing or that rural areas are less capable of managing pluralism. Instead, the data show that both urban and rural communities in Sabah are capable of achieving high levels of social harmony, provided that linguistic diversity is valued and supported. This is a crucial insight for policymakers, educators, and community leaders, as it highlights the need for context-sensitive interventions that recognize and build upon the unique strengths of different communities.

The "So What?": Implications and Significance

The implications of these findings are far-reaching. First, they challenge simplistic narratives about the risks of diversity and instead highlight the potential for inclusive, context-sensitive policies to build stronger, more cohesive societies. In urban areas, the high levels of social harmony observed in places like Kota Kinabalu demonstrate that diversity, when managed thoughtfully and inclusively, can be a source of strength rather than division. The presence of multicultural initiatives, economic opportunities, and everyday intercultural contact creates an environment where social harmony can flourish.

In rural areas, the findings suggest that social cohesion is not only possible but can be exceptionally strong when linguistic diversity is embraced. The case of Kota Marudu illustrates that rural communities, often perceived as

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less adaptable to change, can in fact be leaders in fostering interethnic harmony when they value and support linguistic pluralism. This challenges deficit-based views of rurality and highlights the potential for rural areas to serve as models of inclusive community-building.

Second, the findings underscore the importance of language as a vehicle for social integration. The consistent positive association between support for linguistic diversity and social harmony across all contexts suggests that language policies and practices are not merely symbolic but have real, tangible effects on the quality of interethnic relations. This aligns with the arguments of Siemund (2023), who emphasizes the role of multilingual development in promoting social cohesion, and with the broader literature on linguistic superdiversity, which calls for flexible, pluralistic approaches to language policy in both urban and rural settings.

Third, the results highlight the need for tailored interventions. While promoting linguistic diversity is beneficial everywhere, the mechanisms through which it enhances social harmony may differ between urban and rural contexts. In urban areas, policy interventions that normalize and celebrate diversity such as multilingual signage, inclusive public services, and intercultural community centres are likely to be most effective. In rural areas, efforts to foster positive attitudes toward linguistic diversity at the community level may yield the greatest benefits.

CONCLUSION

This study's unique contribution lies in empirically demonstrating that the relationship between linguistic diversity attitudes and ethnic harmony is not universal but place-contingent - a finding that challenges one-size-fits-all language policy approaches and advances the discourse beyond static descriptions of multiculturalism to dynamic, context-sensitive models of how language ecologies sustain peace across different settlement types.

Our analysis extends Spolsky's (2009) ecology of language management from theory to evidence and, crucially, to action. We demonstrate that favourable beliefs about linguistic diversity are a reliable predictor of inter-ethnic harmony, yet their influence is not uniform: the effect intensifies in rural districts where vernacular languages still anchor everyday life. This pattern suggests that beliefs, practices, and locally designed language initiatives converge most powerfully where the community's linguistic repertoire remains intact - precisely the synergy Spolsky identifies as the engine of sustainable language policy. In urban settings, however, intercultural programmes and bureaucratic routines already scaffold multilingual interaction; individual attitudes therefore add only marginal gains, producing a "floor" beneath which harmony is unlikely to fall.

Taken together, these patterns invite a wider lens. Viewed through Pérez Báez's (2018) call to safeguard the empirical foundation of linguistics, these findings carry twin imperatives. First, scholars can leverage the rural amplification effect to trace fuller causal chains linking beliefs to observed practices and, in turn, to measurable social outcomes. Second, policymakers should prioritise low-cost, high-impact interventions that strengthen pro-diversity beliefs where vernacular use is still vibrant -community-run media, mother-tongue schooling, and intergenerational storytelling circles - while fine-tuning urban programmes to ensure they remain responsive rather than merely symbolic. By situating attitudes within the lived ecology of language, our study not only clarifies how harmony is produced but also charts a practical route for preserving the linguistic heritage on which both local cultures and linguistic science depend.

Policy and Research Implications

The findings of this study carry concrete implications for language and social cohesion policy in multilingual settings such as Sabah. First, they affirm the critical importance of embedding linguistic diversity within development planning - not only through national language policies but also through localized initiatives that resonate with community values.

In urban areas, where infrastructural supports for intercultural interaction already exist, efforts should focus on sustaining inclusive practices such as multilingual signage, cultural festivals, and equitable access to public services. In rural contexts, however, policy interventions must centre on community-led language initiatives, intergenerational transmission, and capacity building for linguistic awareness at the grassroots level. Education systems, media platforms, and civic spaces can all play pivotal roles in normalizing linguistic plurality as a foundation for social unity. These differentiated strategies are essential for advancing Malaysia's commitments to social integration under frameworks such as the SDGs and the International Decade of Indigenous Languages.

Limitations and Future Research Directions

While this study offers valuable insights, it is not without limitations. The use of self-reported survey data, while appropriate for measuring perceptions and attitudes, carries inherent limitations that warrant acknowledgment. First, responses may be subject to social desirability bias, whereby participants overstate their support for linguistic diversity and ethnic harmony to align with perceived social norms, potentially inflating the observed positive associations. Second, self-reported attitudes may not fully correspond to actual behaviors or lived experiences of interethnic interaction, meaning our findings reflect stated beliefs rather than behavioral outcomes. Third, the cross-sectional design precludes causal inference; while we observe that positive language attitudes

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correlate with higher harmony scores, we cannot definitively establish whether favourable attitudes foster harmony or whether harmonious environments cultivate positive attitudes toward diversity.

These limitations suggest that our findings are best interpreted as revealing associations between language beliefs and perceived social cohesion within Sabah's specific context, rather than universal causal mechanisms. Generalizability beyond Sabah - particularly to contexts with different colonial histories, language policies, or patterns of ethnic settlement, should be approached cautiously. Additionally, although the sample was large and geographically diverse, future research should explore longitudinal designs or ethnographic approaches to better capture the evolving nature of language ideologies and intergroup dynamics. Comparative studies across other Malaysian states or Southeast Asian regions could also illuminate how regional variations in language policy and migration patterns influence social cohesion. Finally, further research should interrogate the role of digital media and online linguistic landscapes in shaping contemporary attitudes toward multilingualism, especially among youth populations.

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THE SIGNIFICANCE OF INTERIOR PRESERVED ATTRIBUTES OF MASJID AL-QADIM IN SIBU, SARAWAK, CONCERNING THE IMPLEMENTATION OF CONSERVATION PRINCIPLES

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Abstract

Religious heritage structures are essential to Malaysia's diverse cultural identity, embodying the great nation's diversity of religions. Preserving these structures needs a comprehensive evaluation to maintain their historical and artistic importance. In Sarawak, the lack of documentation for ancient buildings has impacted local identity and communal cohesion. This study examines Masjid Al-Qadim in Sibu, Sarawak, to assess its conserved elements in accordance with recognised conservation standards. The research revealed distinctive conclusions concerning aspects of the architecture and interior design of the timber mosque case study. The findings indicate that the mosque was well-preserved, employing retrofitting methods guided by concepts of authenticity, community involvement, conservation, and sustainability. The modifications, although intended to modernise the area, often deviate from fundamental conservation principles, eliciting apprehensions about the enduring preservation of its heritage significance. The research employed qualitative approaches, including site observation analysis, interviews with one of the conservation teams, and a literature review evaluating the preservation process against the principles of the Burra Charter. The studies benefit both the researcher and the institution, particularly in the context of Sarawak conservation, which is underrepresented in Malaysian literature. The findings indicate a need for further research on timber mosque building and conservation techniques in Malaysia.

Keywords: heritage building, documentation, conservation elements, architecture conservation, timber mosque

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INTRODUCTION

Masjid Al-Qadim falls under Category 1 of heritage buildings in Malaysia, as designated by the National Heritage Department (JWN) under the National Heritage Act 2005. The building was conserved through the Burra Charter conservation principle, whereby conservation work was done with minimal impact on the building, adhering to the concept of "*do as much as necessary and as little as possible*"(Abdul Gapor et al., 2023). Through the conservation of the mosque, any further renovation to the building must be non-permanent and reversible to keep the originality of the mosque.

The significance of the mosque that contributes to its nomination as a heritage building and has been gazetted as a heritage building based on the National Heritage Act 2005, under Section 67, is that the mosque is undoubtedly a building that has (a) the historical importance, association with or relationship to Malaysian history and (d) the social or cultural associations, especially in Sibu's Malay-Melanau community. This significance has been proven through the mosque's functionality as a centre of society and the Muslim community in Sibu since Brooke's colonisation (Abdul Gapor et al., 2022).

As for the mosque, the interior planning was straightforward, tailored to the needs of users who came to the mosque to pray, and as an early institution of Islam. The function of the mosque is still maintained and filled with new contents that meet the needs of the Islamic community in Sibu, and it is also part of the tourism significance to the city, as the mosque was already gazetted under the Sarawak Heritage Ordinance (1993) (Abdul Gapor et al., 2023).

The conservation principles guided the carrying out of conservation works, ensuring that every single work was done while sustaining the heritage value of the site or building. This was achieved through a process of analysis and consideration aimed at preserving the heritage value of the mosque. The principles are crucial as the source of information and recommendations for the conservator and partitionist in instructing a conservation project, which defines their decisions (Downey et al., 2022). In this study, the conservation principles were identified and analyzed to determine whether they align with the conservation work undertaken by the conservator for Masjid Al-Qadim, which includes authenticity, community involvement, conservation, and sustainability.

Effective heritage building conservation is crucial for preserving the authenticity and historical significance of cultural landmarks, necessitating adherence to the building's original form and condition. The interior design elements of Masjid Al-Qadim are crucial, as they embody traditional and influential details that significantly contribute to the building's historical value. A thorough evaluation of these elements, spanning structure, interior schemes, and other significant aspects, before and after conservation efforts, is essential to prevent unauthorised alterations. Such changes necessitate approval from the

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JWN (Harun et al., 2020). Addressing this gap is crucial for understanding the impact of conservation on the interior elements of heritage buildings and for developing strategies that preserve their historical and cultural integrity.

This study examines Masjid Al-Qadim in Sibu, Sarawak, to assess its conserved elements in accordance with recognised conservation standards. In doing so, the study identifies and documents the interior conservation approach used to analyse the conservation approach. The findings then led to the recognition of best practice in the conservation of the mosque.

LITERATURE REVIEW

Vernacular architecture interior is seen as a setting that merges the surroundings and the cultural attributes of living circumstances. Practically, the interior was well-suited to the community's lifestyles, resulting in increased productivity. The types of vernacular architecture encompass not only residential buildings but also community spaces, such as mosques.

Vernacular Architecture in Nusantara

Vernacular architecture in Malaysia and Nusantara uses local materials (Ariffin & An, 2021) and techniques to meet local needs, influenced by climate, temperature, topology, and geography (Figure 1). Each region has its own unique characteristics, influenced by the country and its sociocultural context. It highlights the locals' creativity in carving skills and contributions to the development of spatial design (Aulia & Veronica, 2024).



Figure 1: Example of Vernacular Architecture of Mbaru Niang shows the uses of local materials and is designed to suit the local conditions
Source: Purwaningrum, 2019

The needs of the local population shaped the transformation of vernacular architecture styles. The absence of limitations in terms of spatial design and forms makes it outstanding and well-adapted (Zhang et al., 2023). It was also admired for its high efficiency in sustainability and energy conservation, which was convenient compared to typical architecture (Solikhah & Bere, 2021).

Typology of Traditional Mosque Architecture in Nusantara

Nusantara, comprising Malaysia, Indonesia, Brunei, southern Thailand, and the southern Philippines, has a diverse range of cultural and historical influences on its mosque architecture. Designs are culturally adapted to local traditions, with Nusantara architecture being a philosophy formed by formal, tectonic, structural, representational, and aesthetic principles. Timber was the primary building material, especially for buildings built starting in the 1800s (Nabilunnuha et al., 2022). The Nusantara region mosque was not designed with domes and built without nail involvement in the construction, especially in Malaysia and Indonesia (Idham, 2018). Features of multi-tier roofs are seen as distinct characteristics that reflect the Malay Archipelago Mosque styles, which were influenced by Hindu-Buddhist traditions. The adaptation of a raised floor and timber as the primary construction material in Nusantara mosques differs from the traditional design of mosques. During the introduction of Islam in Nusantara, the architecture of the mosque was not entirely influenced by religion. The locals believed that the value of the Islamic culture can also be seen in the fusion of cultural backgrounds into mosque architecture (Nasr & Abbas, 2020).



Figure 2: A multi-tier roof mosque that can be seen in the Malay Archipelago
Source: Author

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Typology of Traditional Mosque Architecture in Malaysia

Malay architecture shifted towards Islamic guidance, influencing the development of a unique style that incorporates Islamic beliefs. Traditional mosques in Malaysia are closely tied to traditional Malay architecture, emphasising space and climate, and are connected to the Nusantara vernacular architecture. In addition to timber as the primary material, traditional mosques in Malaysia were also constructed using bamboo, rattan, and attap leaves (Mood & Ramli, 2022). During the 15th century, Malaysia's mosque architecture adapted the local traditional house style in terms of materials and construction (Mohd Nawayai et al., 2020).



Figure 3 Masjid Kampung Laut shows and early typology of Malay mosque
Source: Skyline Heritage (2011)

Traditional ornament elements, such as *buah buton, tutup perabung, tumpu kasau,* wall, *tiang seri,* and *tunjuk langit,* were also part of the specially designed components of Malaysia mosque architecture. The mosques were rich in craftsmanship, featuring intricate carvings and ornamentation that reflected the lives of their surroundings (Mood & Ramli, 2022).It was an approach that reflected the conceptualisation of Islamic values and merged the cultural context.

The Interior of Timber Heritage Mosque in Malaysia

The interiors offer insights into Malaysia's rich cultural and religious heritage, blending local craftsmanship with Islamic art. The prayer hall is the largest space,

designed to accommodate worshippers with minimal furnishings. Timber columns with Islamic motifs and polished wooden floors contribute to a serene atmosphere. The mimbar and mihrab lead the direction of Mecca as the qibla for Muslims. It was carved heavily, which enhances local craftsmanship.

The interior of the Malaysian heritage mosque embodies the 'sense of place', a perception that fosters a sense of intimacy with God, created through the historical forms, culture, and function of the spaces (Bahauddin, 2021).

The Historical Interior Assessment and conservation work

According to Harun et al. (2020), the historical interior assessment of heritage buildings aims to determine the degree of renovation required for the interior floor plan and to evaluate whether it complies with preservation standards. This study looks. According to the interior historic building guidelines (Rocchi, 2016; Grimmer, 2017), all interior designs are recommended to adhere to the original scheme or, at a minimum, to incorporate elements of British colonial style through furniture and decorations. The prospective use of this ancient edifice must consider the quality, design, materials, and craftsmanship of the initial structure, alongside the modifications that have transpired over time. Renovations that align with the building's design may be preserved and repaired. This finding and guideline will reveal the true history of the structure, together with details regarding the architectural period, interior design, and conservation efforts.

According to Abdul Karim et al. (2022), interior conservation efforts can also preserve the buildings' authentic character in terms of architecture, craftsmanship, materials, finishes, interior features, and interior scheme, which would otherwise deteriorate and fade over time if care is not taken. Therefore, a good choice of material for conservation work, combined with a principled approach, can help sustain the heritage building.

RESEARCH METHODOLOGY

This study employs a qualitative research approach, with site observations conducted using a single-case study design, chosen based on the research objective. The pictograph data on-site and conservation records were analysed, as the site observation was believed to provide firsthand experience and better visualisation (Nayan et al., 2022). An interview was conducted with one of the conservator members to gain deeper insight into the research. No specific data analysis system was included in the research. The study aims to determine the significance of the preserved attributes of Masjid Al-Qadim in Sibu, Sarawak, in relation to the implementation of conservation principles. The analysis of the study is expected to show that the implementation has successfully preserved the significance of Masjid Al-Qadim in Sibu, Sarawak, in accordance with the principles and safeguards put in place to maintain its importance. The data is also

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expected to detail the interior and exterior components of the mosque that were preserved and conserved according to the principles used.

This paper includes an analysis of data, figures, comparison tables, and a descriptive study. Assessment on the condition of the Masjid Al-Qadim, Sibu, Sarawak, should be capable of reflecting the conservation results through the National Heritage Act 2005, under section 67. The mosque was conserved using the Burra Charter principles, a methodical procedure employed to enhance the cultural significance value of Masjid Al-Qadim, as analysed in the interior conservation approach. The Burra Charter method was a procedure that applied relevant disciplines to culturally significant heritage, requiring special professional skills (ICOMOS, 2021). The data should also highlight the application of conservation principles, which serve as guidelines for maintaining the mosque's significant values through a specific management style defined by the conservation aims, namely to sustain the mosque's values and its function for the Islamic community in Sibu.

However, the study had limitations, including the accessibility of the mosque, which was hindered by additional structures around the area, a language barrier with the community that speaks Sarawak native languages, and data accessibility issues that were not correlated with each other. Despite these limitations, the findings are expected to demonstrate the expected results of effective conservation through the application of these principles. The ethical integrity of the study was maintained throughout the research with prior notice of the interview, informed consent to ensure the interviewee understood the purpose of the study. Additionally, a formal request was made to the mosque management for on-site observation. The data collected was handled with strict confidentiality, and the research adhered to general professional ethical standards regarding honesty in reporting, accuracy of data, and respect for the cultural significance of the site.

ANALYSIS AND DISCUSSION

According to Historic England, the conservation principles, determined through an understanding of heritage assets and values, include analysing history, cultural relevance, emotions, and symbolic meanings (Brown et al., 2022). The principles were defined through an interview session with one of the conservation team members, which included authenticity, community involvement, conservation, and sustainability (ibid). The Burra Charter method, applied to the preservation of the mosque, is part of the conservator team's efforts to maintain the mosque's significant value, as outlined in the *Principles for the Preservation of Historic Timber Structures* under the general Burra Charter (ICOMOS, 2021). The studies conducted on Masjid Al-Qadim, the oldest mosque in Sarawak, hold significance for the Muslim community of Sibu.

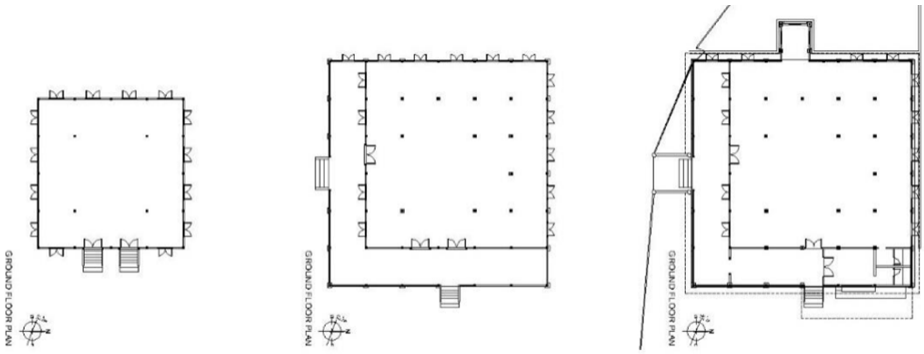


Figure 4: Development of Masjid Al-Qadim est 1861
Source : Abdul Gapor & A. Rahman, 2019

Figure 4 displays the extension made towards the mosque from its initial construction to its latest expansion during the conservation that concluded in 2022. The conservation project was conducted by the Borneo Regionalism and Conservation Society at the University of Technology Sarawak (UTS) (Abdul Gapor et al., 2023). The figure shows the extension development of the mosque over the years as the congregation increases. Hence, it demonstrates that the structure, added through conservation guidelines on sustainability, preserves authenticity by maintaining the main structures, such as timber, as the primary material. Figure 5 shows the photo transformation.



Figure 5: Transformation of Masjid Al-Qadim before renovation, after renovation and after conservation
Source: The Borneo Post (2022)
https://www.theborneopost.com/tag/masjid-al-qadim/

To further analyse whether the mosque was conserved in accordance with the guidelines, Table 2 below presents pictographic data comparing the condition of the mosque before and after conservation was made. According to the table below, the conservation standard employed was the Burra Charter, as the replacement of materials was the primary method of conservation for the

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mosque. The replacement involved the interior and exterior spaces of the mosque. This data should be able to emphasise its conserved elements by replacing materials accordingly to its original to be guided by concepts of authenticity, community involvement, conservation, and sustainability as the principles.

Table 2: Comparison of Before and After Conservation for the Renovated Masjid Al-Qadim

Before Conservation	After Conservation	Description
		The material for the flooring replaced from floor tiles back to its original which is *Belian* wood. The wood came from various sources in the state just to fulfil the principles of the conservation. Areas with tiles removed and replaced with the material.
		The main hall of the mosque enhances substantial changes. The wall decorated with retrofitting features to keep its original timber wall. Carving details added with motifs based on the craftsmen knowledge. The ceiling also covered with webbing bamboo to protect the thrust structure.
		The exterior façade of the mosque transformed accordingly to balance the interior elements by using the same retrofitting and burra charter method. A minaret structure rebuilt to replace the old one as the structure affected with the road development of the city.
		The exterior railings demolished and replaced with same timber that cover the whole mosque. The railings are adorned with a carved floral motif that complements the mosque's design.

Source: Author

In addition to the analysis presented in Table 2, the table provides details of the retrofitting method applied to the mosque, which was based on the principles of community involvement. The artistry on the detailing imported by bringing over craftsmen from Sambas, Indonesia, as there was a historical relation of the mosque with the region. The conservator also proposed a method to avoid future damage to the original interior components and structures. The features were an added structure on the front and back part of the original. It protects from direct contact that can cause friction on the original surfaces, which can lead to damage.



Figure 6: Retrofitting detailing on the window of Masjid Al-Qadim
Source: Author

Figure 6 illustrates the retrofitting features integrated into the original structure and their implementation. The timber feature covered the original window in a white-painted colour, decorated with carvings carved by imported craftsmen from Kalimantan, Indonesia, and coloured glass detailing featuring a floral motif. This method prevents the loss of authenticity in the structure by protecting its elements. The study reveals the interior aspects of Masjid Al-Qadim that have changed through the adaptation of retrofitting features. Table 3 shows data for the elements recorded through on-site observation. The components are mostly incorporated into new materials, such as *kayu jati* and gold, and pleated metal finishes for the retrofitting finishes. The old structure was retained behind the retrofitting setup to maintain authenticity.

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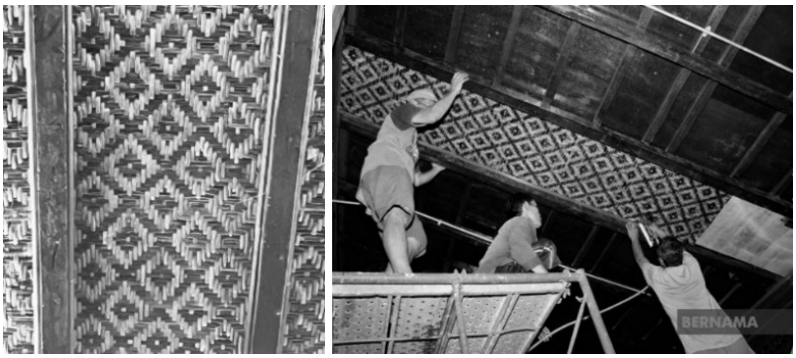


Figure 7 Roof finishes and installation on Masjid Al-Qadim
Source: Author (2024); Bernama News (2022) https://bernama.com/bm/news.php?id=2068432

Figure 7 shows the roof cover motif and its installation on the mosque structure. The installation is designed to shield the roof structure from sunlight exposure and preserve the mosque's aesthetic. The participation of the local community, as a principle of conservation, is evident here, as they are involved in the process of making the bamboo-woven cover. The person in charge said the woven bamboo, made locally by the native Sarawakians, enhances the local culture and motif. This helps promote the local culture seamlessly while keeping the heritage.

Those elements were temporary and can be removed for future conservation work on the mosque, which promotes conservation principles related to the sustainability concept. The initiative taken not just to protect but to fulfil the client requirements in promoting the mosque as part of the Islamic community centre in Sibu and a tourist attraction with its historic values.

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Table 3: Interior Elements of Masjid Al-Qadim

Elements	Description	Motif pattern	
		Material	**Pattern**
Door 	The door detailing and shape are the same as the main door but without detailing on top of it. It was double leave door that detailed with gold petal. The doorknob was a round shape railing in gold colour that detailed with name of prophet Muhammad PBUH in the middle.	Jati timber with gold metal plate detailing on door leaves.	The pattern motif is combination of geometry and floral on the door leaves.
Window 	The window was a sliding door with patterned glass detailing and geometry pattern carving on its window leave. This window is double leave window.	Jati timber and patterned glass.	The pattern inspired by floral motif and coloured with blue, yellow, green, and red in colour. The geometry shaped which rectangular patter carved on the lower part of the window.
Wall 	The internal wall also covered with jati timber that detailed carved. The carving also has gold plate detailing.	The wall made from jati timber.	The motif that carved on the wall is floral pattern such as flower and geometry carving on the other parts of the wall.
Ceiling 	The ceiling covered with woven bamboo mat. The mat was to cover the ceiling and the truss structure of the mosque.	Bamboo	Geometric pattern.

Source: Author

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As the concepts of the conservation principles in the study aim to preserve authenticity, community involvement, conservation, and sustainability, the elements of interior design in the mosque appear to promote Sako Guru, who is known as the main character in the mosque, with vernacular architecture. It was also part of the craftsmanship that was applied in promoting the cultural values.



Figure 8: Masjid Al-Qadim's Sako Guru
Source: Author

Figure 8 above shows the Sako Guru located in the main prayer hall area of Masjid Al-Qadim. The study finds that the elements carved with floral motifs consist of flowers and waving stems. The heavy carving emphasises these four main column structures, which hold the entire mosque structure together as its main pillars. The conservator primarily chose the motif to follow the craftsmen's expertise, and the floral motif also highlights Islamic visual art, which is predominantly based on floral patterns over human or animal motifs, as Islam is influenced by the belief in aniconism (Haidar et al., 2023). The pattern was decided upon to follow community recommendations as part of the community's involvement in the conservation of the mosque.

The study found that the mosque was fully utilising mechanical ventilation, which was part of an air-conditioned system, after the retrofitting renovations were introduced. The installation of the ventilation system is more practical, as the floor air conditioner unit is integrated with the decorative elements in the mosque, thereby preventing damage to the original structure of the mosque and preserving the authenticity of the materials used.



Figure 9: Installation of an air conditioner at the bottom of Soko Guru, and concealed and served as a bookshelf without compromising the traditional ambience
Source: Author

Figure 9 shows the approach to installing the air conditioner. It is installed and placed inside a cabinet proposed by the conservator to conceal its presence and is attached to the Sako Guru structure to make it more seamless. The cabinet also served as a bookshelf to store the Qurans and other religious books for visitors to use. The cabinets are detailed with carvings that are designed to align with the interior carvings created by the craftsmen.

CONCLUSION

This study examines the conserved attributes of Masjid Al-Qadim in accordance with the National Heritage Act 2005. The conserved elements were retained or restored to their original form, as the Burra Charter method was applied through the adaptation of conservation principles. The conservation was thoroughly done, involving both the interior and exterior spaces. The mosque's features and embellishments also reflect the local ability and historical significance of the mosque.

The conservation principles listed for this study, which are concepts of authenticity, community involvement, conservation, and sustainability, were concluded by the author through the pictographic data analysis on site. Hence, the conservation process of Masjid Al-Qadim is conducted in accordance with standard regulations, following guidelines throughout the entire conservation process.

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The analysis also concludes that the modernisation of a heritage building is feasible while preserving its heritage significance through methods such as retrofitting, despite altering the entire structure. The principles help ensure that the conservation process is derived and prevent the loss of heritage features and values.

As modernisation progresses, the conservation of timber structures in Malaysia may face difficulties in securing resources due to a lack of natural resources and deforestation. Further research is needed to provide a feature reference and gather additional information to enhance conservation efforts and techniques for Malaysia's timber heritage buildings and structures. The challenges documented at Masjid Al-Qadim, which enhance the barriers to balancing community-driven modernisation, informed the current policy in Malaysia's debates on managing religious heritage sites. These findings present critical and transferable lessons on the conservation of historic timber architecture in the region to be more widely applied.

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DIAGNOSING TIMBER DEFECTS IN TRADITIONAL MALAY HOUSE: A CASE STUDY OF RUMAH KUTAI KAMPUNG SELAT

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Abstract

Timber traditional houses can bring a significant image of the Malaysian built environment heritage. Indeed, it is one of the most valuable treasures that must be sustained for future global reference. The building owners and professionals are responsible for ensuring that these assets are in good condition and safe for its occupants. However, the occurrence of defects contributes to significant cost overrun. There are limited studies undertaken on diagnosing the nature of timber defects for traditional timber houses. Thus, it is crucial to systematically track and record these defects. This paper aims to identify the nature of timber defects that occurred in Rumah Kutai Kampung Selat. This house was selected due to its unique Perak traditional architecture. Three research objectives were established: (i) to identify the types of timber defects, (ii) to determine the causes of the defects, and (iii) to analyse the overall building condition rating. A qualitative research approach was adopted. The building inspection was carried out to record only architectural and structural defects. These defects were recorded in the conditional survey form via visual inspection and survey tools. The data were analysed using frequency analysis to measure the frequency of the defects manifested. In addition, the condition of the property was also evaluated using the Building Assessment Rating System. The findings revealed that there are 30 of these defects, primarily related to weather conditions, insect attack, and wear and tear. With a proper methodology adopted in studying defects, there is much to be learned to provide insights to the owner/caretaker in planning to repair and sustain their houses.

Keywords: Timber Traditional House, Rumah Kutai, Defects, Learned

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INTRODUCTION

There are many traditional Malay houses scattered around Malaysia. Although it had been built over decades to centuries, these houses created significant images of the Malaysian built environment heritage. According to M. Nurfaisal et al. (2020), a traditional Malay house portrays the uniqueness of Malay architecture and cultural value to the society. Indeed, it is one of the most valuable treasures that are sustained for future reference universally. According to this, the National Heritage Department Malaysia has outlined the process to investigate historic buildings, which includes architectural research, documentation on measured drawings, and dilapidation survey or building condition assessment with laboratory analysis Harun, 2020). Societies worldwide have recognized the need to preserve their valuable cultural heritage (Mustafa et al. 2020), and decision makers have emphasized heritage preservation as represented by the Sustainable Development Goals (SDGs) 2030. SDG 11 addresses sustainable cities and communities, with the aim to "make cities inclusive, safe, resilient, and sustainable". It provides a comprehensive framework for heritage buildings, particularly Target 11.4, that seeks "to strengthen efforts to protect and safeguard the world's cultural and natural heritage". Heritage preservation also helps to reduce landfill waste, demolition energy use, and resource consumption for new constructions. This is consistent with SDG 12, Target 12.5: "by 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse".

Nevertheless, Seo et al (2009) reported recently, the traditional Malay house has been affected by the rapid modern development and faces the threat of being demolished or transformed into a brick house. Nor Haniza et al. (2007) added that due to Malaysia's climate and location, in the tropics is classified as tropical with high temperatures, high humidity, and heavy rainfall. This will lead to timber defects and deterioration. Thus, the house owner and the professional must ensure that these assets are in good condition and safe for their occupants (C. Ani et al. 2009). One of the methods is by conducting a building condition survey to identify the type of defects, location of the defects, and causes of the defects so that an appropriate solution can be made. This paper aims to identify the nature of timber defects that occurred in one of the traditional Malay houses in Perak, i.e, Rumah Kutai Kampung Selat (RKKS). Three research objectives had been established (i) to identify the types of timber defects, (ii) to determine the causes of the defect's occurrence and (iii) to analyse the overall building condition rating.

LITERATURE REVIEW

Defects and Deterioration of Timber Buildings

Defects are a common phenomenon that occurs on any structure or building (Mohd Khazli et al. 2024; Najihah et al. 2024; Kartina et al. 2018). Defects can

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be defined as a failure or shortcoming in the building's function, performance, statutory or user requirements, and this may occur in its structure, fabric, services, or other facilities (Azni et al. 2025; Carillo, 2006; Peng & Wee, 2001). It occurs not only in the building operational phase but also before and during the construction stage (Lateef et al. 2010) and (Chong et al. 2005). Failure to address defects would most likely contribute to additional rectification costs, hamper the smooth operation of the building, and reduce its service life. In extreme cases, defects may even lead to accidents and disasters (Groblier & Pretorius, 2002).

Traditional Malay houses in Malaysia, famous for their uniqueness in design and aesthetic value, are mainly constructed with timber materials. There is a pressing need to conserve this valuable heritage, as these timber building structures and elements are subjected to decay and deterioration caused by environmental factors. Civil laws and other protective measures are necessary to save these heritage buildings and important timber structures from destruction. Nevertheless, preventive treatment alone does not promise to restore the timber buildings and structure to their former condition, but will at least stop further deterioration. Under proper conditions, timber provides excellent, lasting performance. However, it also faces several potential threats to service life, including fungal activity and insect damage, which can be avoided in numerous ways. Md Azree et al. (2016) explained that timber buildings are also exposed to several potential threats to service life, including fungus, insect damage, and the wear and tear process. In addition, M. Nurfaisal et al. 2020 highlighted other typical timber defects such as timber shakes, twisted, cup, bow, split, peeling off paint, and unwanted plant growth.

According to M. Nurfaisal et al. (2020), Ridout (2000) and S. Johar et al. (2013), these defects can be divided into four main wood deterioration agents, such as:-

a) Biological agents are well known for their catastrophic attacks. These deterioration agents can be classified into two, namely fungi and insects/ small animals. Soft, brown, and white rot are typically grouped into fungi. Meanwhile, beetles, termites, ants, bees, and birds are examples of insects/small animals
b) Physical agents are imperfections and aesthetic defects in the wood itself. It was naturally born, known for its hollow, knots, and cracked features, before being consumed by users
c) Chemical agents are acids that make the wood brittle and wood fibers become separated, resulting in a mass of sharpened filaments detectable on the surface. These defects can usually be found in industrial areas with high pollution
d) Mechanical agents are commonly due to mechanical friction during handling and processing, such as cutting and drying. The combined effects

of light, wind, and water movement produced stresses resulting in small surface checks and cracks

Some of the agents are significantly less damaging and usually affect only the aesthetic value. However, the biological agents and moisture problems are the two most common defects that occur and cause serious wood deterioration (S. Johar et al. 2013). Visual inspection is the easiest and most fundamental method to use to inspect the existing structure. However, this method may not be applicable to the defects that do not appear on the surface. Hence, a non-destructive test will be used to assess the properties of a material, component, or system. Since most of the traditional timber houses use famous local hardwood with fine carpentry skills that are rarely seen today, thus, conserving timber houses is as important as conserving other heritage buildings. According to S. Johar et al. (2013), Harun (2011), Fielden (2000), conservation is a practice that highlights the importance of preserving cultural properties and safeguards the object from destruction, decay, and unintentional changes to prolong the life span of the existing cultural and natural importance.

Although building defects cannot be avoided, it need to be addressed in providing valuable insights to the industry (Haryati, 2016; Wardhana & Hadipriono, 2003; Ilozor et al., 2004; Samuel & Isaac, 2018). Findings from the surveys provided some insights to the owner/caretaker in planning the repair for replacement work to be undertaken to sustain the building. Nur Fadhilah et al. 2022 explored the possibility of building a condition assessment activity towards data creation for a database management system using geographical information. Thus, it will assist government ministries and local authorities to standardize tourism information data as well as facilitate them to monitor and update the latest data to re-boost the tourism industry in Malaysia. By systematically recording and tracking defects, the types, causes, and categories of each defect can be identified. Moreover, recurring defects can also be traced.

Brief Description of Rumah Kutai Kampung Selat

Rumah Kutai Kampung Selat is located at Kampung Selat, Bota, Perak Tengah, Perak Darul Ridzuan. This Kutai house is estimated to be almost 100 years old and was built in the 1920s. This house was built near the Perak River because the river was the main route in the old days.

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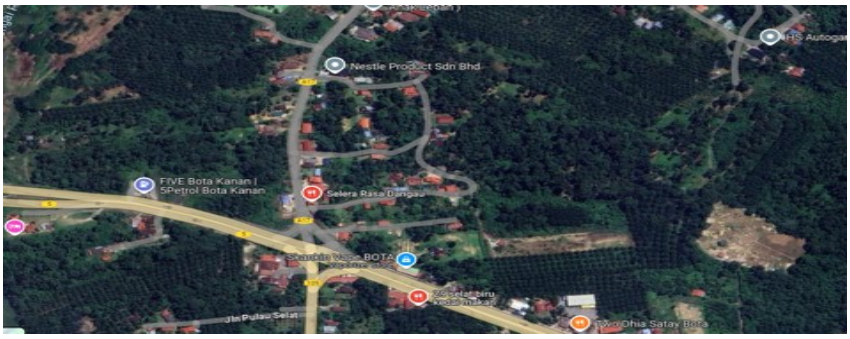


Figure 1: Location of Rumah Kutai Kampung Selat



Figure 2: Front and side elevation of Rumah Kutai Kampung Selat

The structure of RKKS, such as columns and walls, was originally built using the Cengal timber. The floorboard used Balau and Meranti Merah timber. Meanwhile, Kempas timber was used for roof trusses. This house was built with several main basic spaces such as foyer space, porch space, motherhouse, interval house, and kitchen.

RESEARCH METHODOLOGY

A qualitative research approach was adopted for the present study. The crucial stage in this research is to assess the existing condition of the building through a building condition survey. A pro-forma survey was established as a checklist and was used to identify the types of timber building defects, the possible causes, and the location of defects. An inspection was carried out on 20th June 2024 using visual inspection to diagnose building defects for the traditional Malay house and was evaluated using the Building Assessment Rating System (BARIS) score. At the time of the survey, the weather conditions were sunny (28 degrees Celsius).

A few observations and procedures needed to be followed, such as a top-down approach, which starts the inspection from the highest level of the house, i.e roof space. Then, the survey will be moved from the internal building to the external façade with reasonable care. Several significant information on the building background were taken into consideration. Various tools and equipment,

such as a spirit level, digital caliper, moisture meter, laser distance, measuring tape, tapping rod, and L square, were used during the condition survey. The limitation of this research was that it was based only on visual observation without taking into consideration possible concealed and internal decay to timber elements, which would not be detected visually. For a more accurate diagnosis and verification of internal timber condition, non-destructive testing methods can be conducted in future research to strengthen the reliability of defect assessment outcomes.

The analysis was made based on element by element; the column, beams, walls, floors, windows, doors, roof, plinth, and stairs, diagnosing the type of defects and their possible causes. The reason that the ten elements are chosen is based on the severity of the element's condition, which is common defects that occurred to the elements, and the limitation of the inspection is the roof structure that cannot be inspected in detail due to the equipment shortage. The data recorded were then analysed using frequency analysis to measure the frequency of the defect's occurrence.

FINDINGS

Based on the analysis of building defects obtained from the conditional survey, it was found that the RKKS was involved in several defective works. The types and causes of the defect's occurrence are illustrated below. The findings matrix was derived using the Building Assessment Rating System (BARIS), which is the system that is commonly used to calculate and obtain the result of building condition rating, as shown in Table 1 below.

Defects Analysis by Matrix and Element

Defects Analysis by Matrix

Figure 3 depicts the percentage of defects for RKKS according to the matrix classifications as mentioned in CPBS 101: Code of Practice for Building Inspection Report, and evaluated using the BARIS score.

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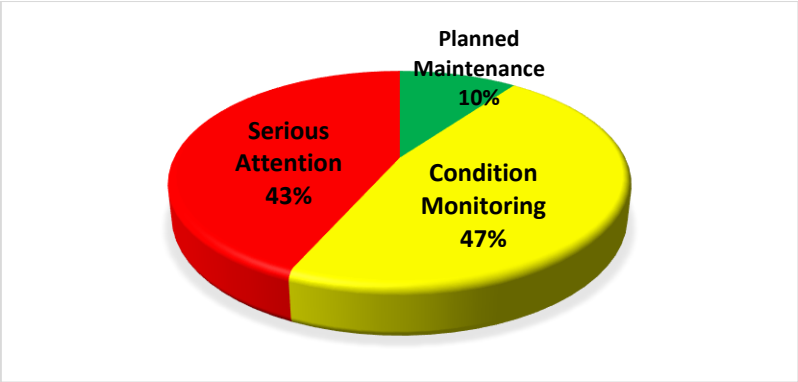


Figure 3: Defects Analysis by Matrix

The majority of the defects occurred under condition monitoring (47%). These defects need to be constantly monitored before they become major defects. The second highest is defects categorised as serious attention and needs urgent actions (43%). The defects under planned maintenance classification are the least defective matrix (10%), and they did not harm the occupants.

Defects Analysis by Element

Figure 4 represents the percentage of defects according to the 10 elements involved in the RKKS.

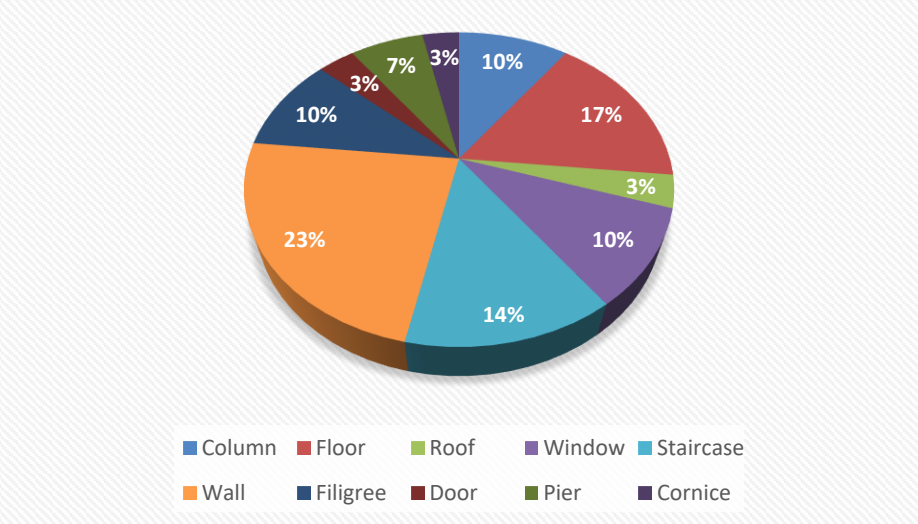


Figure 4: Defects Analysis by Elements

It is found that the wall is the most defective element (23%), followed by floor (17%), staircase (14%), and Others, i.e, window, filigree, and columns (10%). The least defective elements are the roof, door, and cornice, which represent 3% of the defects. Nur Fadhilah et al. (2022) stated that the wall is the most defective timber element in traditional houses. This will be dangerous to the occupants because it will decrease the timber building performance in terms of an aesthetic point of view.
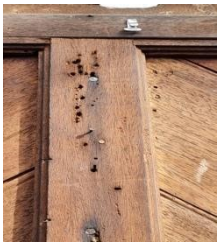
The significant number of wall and floor defects observed in RKKS demonstrates the vulnerability of old timber structures to prolonged tropical exposure, particularly Malaysia's hot-humid climate with heavy rainfall and persistent moisture accumulation. Older Malay houses, particularly those over 70-100 years old, are naturally more vulnerable to biological agents and weather-driven deterioration, and this is in line with findings from traditional Malay buildings in Malacca (Nor Haniza et al. 2007) and Perak (M. Nurfaisal et al. 2020), wherein walls were likewise identified as the most defect-prone element. The findings confirm that climatic stressors and age-related stress remain the primary indicators of degradation trends in traditional timber buildings. Therefore, strengthening conservation practice for Rumah Kutai necessitates systematic preventive maintenance frameworks, rather than reactive repairs, to minimize moisture impact, prevent termite spread, and prolong the longevity of the original timber components.

Type of Defects

It was observed that there are 30 types of defects that occurred in RKKS. The breakdown of the type of defects is illustrated in Figure 5. Table 1.

 Checks on the column surface	 Crack on the timber column	 Crack on the timber column surface

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 Rotten of staircase	 Rotten rafter	 Rotten of timber floor joist
 Broken on the timber staircase tread	 Broken staircase newel	 Broken timber frame on the internal wall
 Loss of timber wall pieces	 Rusting of the lock set	 Discoloration of timber filigree at the internal wall
 Broken concrete on the staircase	 Knotted holes in the wall frames	 Crooked on the timber floor

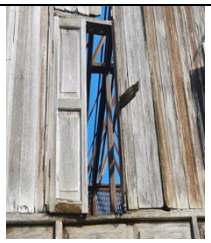
 Broken timber floor joist	 Broken of the external timber cornice	 Broken on top filigree
 Mould growth on the timber floor joist	 Mould growth on the foundation pier	 Fungus attack
 Missing of timber window	 Missing of window panel	 Missing timber floor on the staircase landing

Figure 5: Type of Timber Defects in RKKS

The table above illustrates the type of timber defects manifested in RKKS, particularly at the column, floor, roof, wall, and staircase. These defects were further tabulated and ranked as in Table 1.

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Table 1: Types of Defects

	Type of Defects	Percentage (%)	Rank
1.	Checks on the column surface	4	5
2.	Decay/Rotten of timber floor joist, staircase, carriage, and rafter	10	3
3.	Crack on the timber column, the foundation pier, and the timber column surface	10	3
4.	Missing timber floor on the staircase landing, timber window, and window panel	10	3
5.	Knot holes in the wall frame	3	6
6.	Broken of timber frame on internal wall, external and top filigree, timber floor joist, external timber concrete, timber staircase tread, staircase newel, external timber cornice	30	1
7.	Discoloration of timber filigree	3	6
8.	Rusting of the lockset	3	6
9.	Loss of timber external wall panel	7	4
10.	Crooked on the timber internal floor	3	6
11.	Mould growth on timber foundation pier, external timber wall, timber floor joist, filigree joist	14	2
12.	Fungus attack on the window surface	3	6

Broken is recorded as the most frequent type of defects and mould growth as the second most type of defects (14%). Missing, crack and decay/rotten represent 10%, followed by loose (7%) and checks (4%). Fungus attack, crooked, rusting, discoloration and knot are the five least type of defects (3%) recorded at RKKS. With all the necessary information have been gathered, therefore, the building evaluation using BARIS method as per stated in CPBS101 has be done. Thus, the summary of the result is:

Total Marks (d) x Total of (c)	372
Number of Defects (c)	30
Total Score (d/e)	12
Overall Building Rating	**FAIR**

The FAIR rating indicates that RKKS is still functional, but repair intervention is required to prevent further degradation, particularly since termite-related and weather/moisture-driven defects are already apparent in main structural elements. This is aligned with the historical age of RKKS and the environmental exposure pattern in tropical climates, where wall and floor elements often exhibit early-stage vulnerability.

Causes of Defects

Table 2 presents the causes of defects occurred in RKKS. Among the main causes of the defects are age of material, termite attacks, weather conditions, old material effect, mould growth, checks, wear and tear, human activities, insect attack and crack.

Table 2: Causes of Timber Defects

	Type of Defects	Causes of Defects
1.	Checks on column surface	Age of material
2.	Decay/Rotten of timber floor joist, staircase carriage and rafter	Termite attacks, weather condition, old material effect
3.	Crack on timber column, foundation pier and timber column surface	Age of material, mould growth, checks
4.	Missing of timber floor on staircase landing, timber window and window panel	Wear and tear, human activities, weather condition
5.	Knot holes on wall frame	Insect attack
6.	Broken of timber frame on internal wall, external and top filigree, timber floor joist, external timber concrete, timber staircase tread, staircase newel, external timber cornice	Insect attack, termite attack, weather condition, old material effect, crack
7.	Discoloration of timber filigree	Weather condition
8.	Rusting of lockset	Weather condition
9.	Loose of timber external wall panel	Old material effect, weather condition, wear and tear
10.	Crooked on timber internal floor	Weather condition
11.	Mould growth on timber foundation pier, external timber wall, timber floor joist, filigree joist	Weather condition
12.	Fungus attack on window surface	Weather condition

These defects are mainly due to poor maintenance by homeowner (Kay et al. 2023; Hassanain et al. 2021; Ortiz et al. 2020) and continuous exposure to extreme weather condition (Nur Fadhilah et al. 2022).

CONCLUSION

The research addressed the mentioned objectives by identifying the various types of timber defects identified at RKKS as well as the underlying causes of their occurrence. The most significant defects were damaged timber elements triggered mostly by termite infestation, prolonged weather exposure, material aging, and crack formation. The presence of such defects on main structural elements indicates a significant vulnerability to safety and health hazards. Simultaneously,

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homeowners or caretakers must prioritise constant preventive maintenance, since it has been identified as the primary factor of timber deterioration. Essential repair procedures, particularly for historic buildings, should adhere to a minimal intervention conservation approach. Consequently, local authorities must establish an adequate data management system for traditional Malay houses to monitor performance and track degradation patterns. In addition, the defect mapping outcomes can be used as criteria for curating heritage tourism trails that highlight both cultural value and conservation urgency, thus strengthening tourism planning, resource allocation, and public heritage appreciation.

Notably, this research contributes insights by operationalizing defects diagnosis using the BARIS score matrix along with frequency-based severity classification – an approach rarely applied to timber heritage assessment. This provides a measurable empirical framework for future benchmarking across Rumah Kutai and other Malay timber heritage typologies, enabling conservation stakeholders to compare cases more consistently and make better decisions. This research could be expanded further through advanced statistical modelling and "ripple effect" causal analysis to better trace deteriorating processes. Future research should also integrate non-destructive testing techniques to discover hidden interior damage that visual inspection alone might overlook, improving diagnostic reliability and strengthening long-term heritage conservation strategies.

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THE CONCEPT OF HIJAB IN TRADITIONAL MALAY ARCHITECTURE: SPATIAL ETHICS AND THE AESTHETICS OF PRIVACY IN ISLAM

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Abstract

In Islamic thought, the concept of hijab extends beyond its conventional association with modest attire, encompassing deeper philosophical, metaphysical, and spatial dimensions. As a term signifying a barrier, partition, or screen, hijab functions as both a literal and symbolic boundary that governs visibility, interaction, and accessibility, in line with Islamic ethics. Within the context of Malay architecture, hijab plays a pivotal role in shaping-built environments that seek to harmonize privacy, modesty, and social cohesion. This paper explores how the concept of hijab is manifested in traditional Malay houses and religious structures, focusing on how it reflects a culturally specific spatial ethics grounded in Islamic cosmology. The residence of Tok Abu Bakar Alang Ketak, a prime example of Rumah Limas Bumbung Perak architecture, serves as the central case study to examine the relationship between spatial organization and cultural values. Using a mixed-methods approach that includes site observation, spatial and cultural analysis, and interviews, the study explores how the principles of hijab in Islamic architecture are reflected in Malay architectural traditions. Five key scenarios were identified to demonstrate the parallelism between the concept of hijab, Malay culture, and the spatial organization of traditional Malay architecture, illustrating how these elements coalesce to create an aesthetic and ethical framework for privacy and interaction.

Keywords: Hijab, Spatial Ethics, Privacy, Traditional Malay Architecture, Aesthetic

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INTRODUCTION

Architecture serves as a reflection of both culture and religion, with faith historically playing a central role in shaping the cultural fabric of societies (Özkan, 2018). Faith is not only a guiding force in personal life but also a significant factor in the creation and design of the built environment. In Islam, a home is seen as more than just a place of shelter. As mentioned in Surah An-Nahl 80, *"It is Allah Who made your habitations homes of rest and quiet for you."* This verse highlights the divine blessing of providing homes that offer security and comfort, serving as a sanctuary where individuals can find peace and enjoy various benefits (Ibn Kathir).

A spacious home is considered a source of happiness for a Muslim, as the hadith narrated by Ahmad (15409) from Naafi' ibn 'Abd al-Haarith (may Allah be pleased with him) indicates. The Messenger of Allah (peace and blessings be upon him) said: *"Part of a man's happiness includes a good neighbour, a comfortable mount, and a spacious abode."* This hadith was classed as *saheeh* by al-Albaani in *Saheeh al-Jaami'* (no. 3029). Islam provides a comprehensive framework for how Muslims should live, as it is a complete way of life. Allah says in the Qur'an: *"Serve Allah, and join not any partners with Him; and do good – to parents, kinsfolk, orphans, those in need, neighbours who are near, neighbours who are strangers, the Companion by your side, the wayfarer you meet, and what your right hands possess: For Allah loveth not the arrogant, the vainglorious"* (Qur'an 4:36).

The concept of *neighbour* in Islam extends beyond just the person living next door. The Prophet Muhammad (peace be upon him) taught that a *neighbour* encompasses not only the adjacent household but also those living up to forty houses in all directions—effectively an entire neighbourhood. Numerous hadiths further emphasize the importance of good treatment towards neighbours. For instance, the Prophet (peace be upon him) said: *"Jibril kept on recommending that I treat my neighbours well until I thought that he would order me to treat them as my heirs."* (Reported by Ibn Umar, Hadeeth 104, *Sahih Muslim* 77, *Sahih Bukhari* 6015, *Sunan al-Tirmidhi* 1944).

Islam is a faith that places great emphasis on human interactions (mu'amalah), providing clear guidelines for how individuals should relate to one another. Central to Islamic teachings are the concepts of *ḥabl min Allāh* (the relationship with God) and *ḥabl min al-nās* (the relationship with fellow humans). These two aspects of life are deeply interconnected and must be kept in balance. The connection with God is nurtured through piety, faith, and adherence to both the good and bad aspects of life. On the other hand, the relationship with others is reflected in caring for one's neighbours, fostering cooperation, and helping others within the community.

While the human-to-God relationship focuses on personal obligations to the divine—such as worship, devotion, and the adherence to God's

commands—the human-to-human relationship concerns the fulfillment of social responsibilities. This includes ensuring the rights and needs of others are met, and supporting one another to live together in peace and harmony (Nor 'Azzah Kamri et al., 2015).

In the Malay community, *Adat* (customs), *Petua* (tips, do and don'ts), *Pantang Larang* (taboos) means rules or guidelines that have been practiced for generations in a society through social interactions and have become a tradition in the life of that society. *Adat merisik, adat bertunang, adat perkahwinan, adat meminang, adat bercukur, adat melengggang perut, adat berkunjung* etc. are some of the popular *adat* still being practiced by the Malay. Malay adat is not merely a set of customs but a comprehensive cultural system that shapes how Malays live, relate, and express their identity.

In Malay etiquette, expressions like *jaga mata* (guard your gaze) reflect the idea of avoiding inappropriate looks between men and women. This mirrors the Quranic guidance from Surah An-Nur (24:30–31) that commands believing men and women to lower their gaze and guard their modesty.

In Malay culture, the concept of *adab* (refined manners or etiquette) regarding *hijab and aurat* (modesty and covering of private parts) is deeply rooted in Islamic teachings, but is also shaped by local customs that emphasize modesty, respect, moral, integrity and social decorum. In traditional clothing attire for example, Malay women wear garments such as *baju kurung, kebaya panjang*, or *sarong*, which loosely cover the body and project modesty. Malay men commonly wear *baju Melayu* with a *sampin*, covering from the shoulders to below the knees. Traditionally, Malay women often wore a *selendang* (shawl), *tudung***,** or *kain lepas* when leaving the house — even before the widespread adoption of the Islamic headscarf (tudung). The head is viewed as a symbol of dignity, and covering it is a cultural and religious marker of honor and modesty.

In a traditional Malay house, *Adat* and *Adab* become among the factors that contribute towards the formation of the traditional Malay house architecture. The beauty of a traditional Malay house architecture is that the architecture is a response to both tangible factor such as geographical and climatic conditions. As concluded by Choo, et. al. (2024), a traditional Malay house not only visually attractive with decorative elements, but also a best example of climate responsive architectural design. The design of a Malay house as well is a manifestation of intangible factors such as the cultural and the belief systems of the Malay community. Both the traditions and the religions discussed above carried vast influence on the thought and lifestyle of the Malay society and in shaping the Malay worldview and the shaping of Malay architectural design concept and philosophy. Traditional Malay houses thus embody a harmony between religion, culture, and environment.

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LITERATURE REVIEW

Hijab as a Principle in Spatial Ethics

The concept of *hijab* is widely recognised as a physical form of modesty, typically expressed through clothing. However, in Islamic architectural thought and spatial design, hijab extends beyond fabric to encompass principles of privacy, separation, and moral space. This literature review explores how hijab functions not only as a religious obligation but also as a spatial principle guiding the organisation of traditional Muslim environments, particularly in domestic and communal contexts. Several Islamic scholars have interpreted *hijab* as a metaphysical and ethical concept, not limited to attire. According to Al-Attas (1993), hijab is part of the broader Islamic worldview of *taharah* (purity), *adab* (discipline), and *haya'* (modesty). The Qur'an (Surah An-Nur, 24:31) and Hadeeths advocate for spatial and visual modesty, which has been translated into architectural practices across Islamic cultures.

The concept of *gendered space* is central in studies of Islamic spatial organisation. Traditional Muslim homes in Persian, Arab, and Malay cultures reflect a dual spatial system dividing public (male) and private (female) zones, rooted in Islamic principles of *hijab*, modesty, and privacy (Othman, Aird, & Buys, 2015; Tajvidi, 1987). In Persian and Arab contexts, this is achieved through inward-facing courtyards, high walls, and separate entrances, while in the Malay house it appears in the hierarchical layout of the *serambi*, *anjung*, and *rumah ibu* (Rashid, 2017). Architectural features such as *tebuk tembus* carvings, elevated floors, and layered thresholds act as spatial veils, integrating *adat*, *adab*, and *Sharia*-based ethics to harmonize faith, culture, and social order within the built environment (Ahmed, Alnaim, Falahat, & Sutton, 2024).

In modern Islamic societies, the implementation of hijab as a spatial principle is being revisited, particularly in the context of urban housing, mosque design, and public space planning. Khan (1999) explores how contemporary architects use modern materials and technologies to reinterpret hijab, maintaining privacy without compromising openness or aesthetics. In some Malaysian and Indonesian housing projects, courtyard homes, layered screens, and angled layouts maintain traditional privacy values while adapting to dense urban settings. Islamic architecture across different cultural contexts frequently incorporates the principle of hijab to manage boundaries between public and private spheres.

In Malay architecture, this is reflected in the careful spatial organization of domestic and communal spaces. Traditional Malay houses, for instance, are designed with a hierarchical sequence of spaces—from the public-facing *serambi* (veranda) to the more intimate *rumah ibu* (main house), and ultimately to the inner, private sleeping quarters (*bilik*). Each transition denotes a layer of hijab, regulating access and visibility according to age, gender, kinship, and social roles.

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(Choo et.al, 2020). These spatial gradients are not only practical but also deeply symbolic. They serve to maintain *adab* (etiquette) in interpersonal relations, uphold *aurat* (modesty boundaries), and create zones of psychological and spiritual comfort. The spatial logic of hijab thus fosters a built environment attuned to Islamic ethics, where architecture becomes a mediator between the individual and the collective, the seen and the unseen.

RESEARCH METHODOLOGY

This study adopts a qualitative research methodology grounded in architectural analysis and interpretive cultural inquiry. The primary focus is the traditional Malay house of Tok Abu Bakar Alang Ketak, an exemplary Rumah Limas Bumbung Perak (RLBP) located in Perak, Malaysia. A case study approach was employed to facilitate an in-depth examination of how the concept of hijab is spatially articulated within the built environment. Fieldwork included direct site observations, measured drawings, and photographic documentation to analyse spatial configurations, transitions, and thresholds. Emphasis was placed on identifying spatial hierarchies, circulation patterns, and visual barriers that align with the Islamic ethics of modesty and privacy.

In addition, relevant historical records and architectural literature were reviewed to contextualize the evolution of traditional Malay architectural elements in relation to Islamic thought. Cultural interpretations were further enriched through informal conversations with local heritage custodians and community elders, offering insights into social practices and symbolic meanings embedded in spatial arrangements. Through this combination of spatial analysis and cultural reflection, the research identifies five key architectural scenarios that illustrate the convergence of hijab as a metaphysical and spatial principle in traditional Malay architecture.

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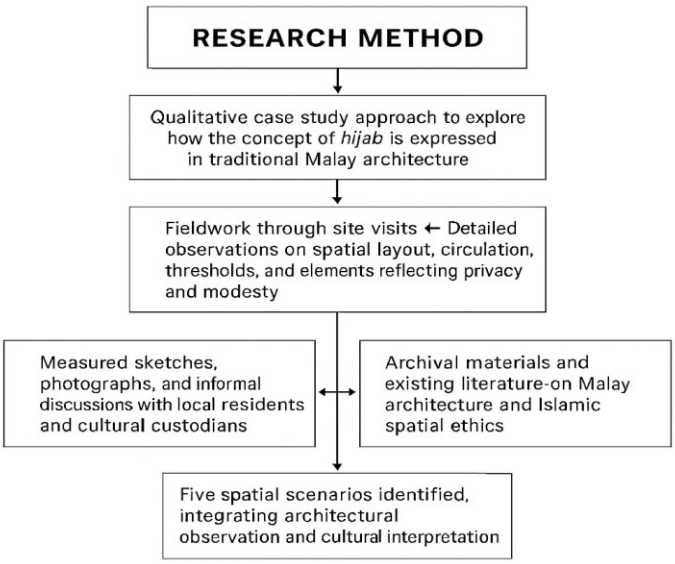


Figure 1: Summary of method used for the research
Source: Author

Case Study on Spatial Organisation and Cultural Values: The Residence of Tok Abu Bakar Alang Ketak (TABAK)

Geographically, this house is located on the bank of Sungai Perak at position 4°20'47.6"N 100°52'35.6"E 4.346545, 100.876559 in Bota Kiri, Mukim Bota, Perak Tengah District, Perak Darul Ridzuan. Rumah Tok Abu Bakar Alang Ketak or TABAK was built in the 1920s. It was built based on an architectural design known as Rumah Limas Bumbung Perak (RLBP). As revealed by Choo et.al. (2020), this type of house is the most common archetype of Rumah Limas found in Perak, particularly in the central regions of Perak within the vicinity of the Perak River. Like other traditional houses, the spatial organization is built with several main basic rooms or space such as the *serambi* (foyer), *anjung* (the porch room), *rumah ibu* (the mother's house/main house), *bilik tidur* (bedroom), *rumah selang* (the middle house) and *dapur* (the kitchen house).



Figure 2: The residence of Tok Abu Bakar Alang Ketak (TABAK)
Source: Centre for Tropical Architecture and Interior (KUTAI)

Anjung is the main space located in front of the house which are suitable as it hosts many important formal events. It is here that the host entertain guests for formal meetings such *merisik, meminang* (engagement) solemnization ceremony, wedding reception, *tahlil* or any religious activity. For wealthy families, Rumah *Anjung* is adorned with decorated windows sill and ventilation holes. For less-familiar guests, this area is also the last boundary before they can enter Rumah Ibu.

The *Rumah Ibu* serves as the principal and most private space within the traditional Malay house, reserved exclusively for the owner's family and close relatives. It functions as the familial core, accommodating a range of domestic and personal activities such as family gatherings, casual conversations, rest, relaxation, and Qurʾanic recitation. During nighttime, this space transforms into a sleeping area, typically designated for the young unmarried women of the household. Positioned deeper within the spatial hierarchy of the house, the Rumah Ibu embodies both privacy and protection, reflecting the Malay community's emphasis on safeguarding the dignity and modesty of its female members

The *Rumah Tengah* or *Rumah Selang* serves as a transitional space linking the *Rumah Ibu* and *Rumah Dapur*, featuring a secondary staircase traditionally used by women. During communal events, female guests enter through this staircase and are received by the host's wife, reflecting the gendered spatial division and the emphasis on modesty and social decorum in Malay domestic architecture.

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Situated at the rear of the house, the *Rumah Dapur* (kitchen) serves as a utilitarian annex dedicated to food preparation, cooking, and dishwashing. Traditionally, a third staircase provides access to this area, emphasizing its functional separation from the more formal or sacred sections of the house. In older houses, washing facilities were often detached from the main structure, situated outdoors for hygienic and practical reasons.

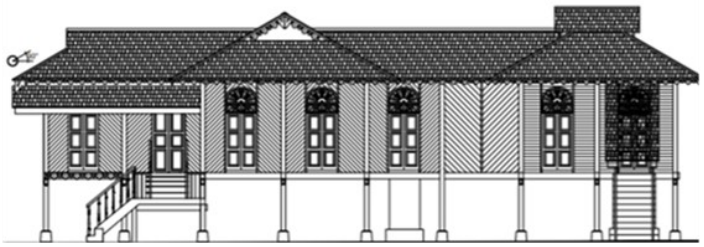


Figure 3: TABAK- Side Elevation
Source: Centre for Tropical Architecture and Interior (KUTAI)



Figure 4: TABAK- Floor plan
Source: Centre for Tropical Architecture and Interior (KUTAI)

Table 1: Diagrammatic Matrix: Gendered Space and Privacy in Rumah Tok Abu Bakar Alang Ketak (TABAK (TABAK)

Spatial Category	**Male-Oriented (Public)**	**Female-Oriented (Private)**	**Shared / Family Spaces**
Spatial Position (Public–Private Hierarchy)	*Anjung* (front porch), *Serambi* (veranda) — the most public interface for formal guests and male gatherings.	*Rumah Ibu* (main core), *Bilik Anak Dara* (daughters' room), *Dapur* (kitchen) — secluded and reserved for family women.	*Rumah Tengah / Rumah Selang* — transitional semi-private zone connecting *Rumah Ibu* and *Rumah Dapur*.
Thresholds (Entry and	Main front staircase used by male guests; doors open toward *Serambi* or	Secondary and rear staircases near *Dapur* for women's movement; screened	Central doorway links private and public areas; movement regulated by

Spatial Category	**Male-Oriented (Public)**	**Female-Oriented (Private)**	**Shared / Family Spaces**
Transition Points)	*Anjung* during events (*merisik*, *meminang*, *kenduri*).	partitions maintain modesty (*hijab ruang*).	*adab masuk rumah* (etiquette of entry).
Circulation (Movement Flow)	Male guests' circulation restricted to frontal zones; symbolic respect to the household's inner sanctity.	Women move between *Rumah Ibu* and *Dapur* without crossing male zones during events.	Shared circulation in daily family use, structured to avoid visual intrusion between unrelated genders.
Visibility (Visual Access and Privacy Control)	Limited visual access into interior via perforated carvings (*tebuk tembus*, *kerawang*); maintains modesty while ventilating space.	Full privacy ensured in sleeping and domestic areas; symbolic veil aligning with *aurat* protection.	Semi-visible areas use tebar layar, jerejak tingkap, and dinding ukir to filter view while allowing airflow.
Activities and Social Function	Formal receptions, *tahlil* recitations, and male gatherings; hospitality and community interface.	Food preparation, women's gatherings, childrearing, Qur'anic recitation; maintaining household sanctity.	Family meals, storytelling, daily rest, and teaching — spaces of unity reflecting *mu'amalah* and familial *adab*.
Underlying Principles (Adat–Adab–Islamic Ethics)	*Adat bertamu* (hospitality), *tertib ruang* (spatial order), and *budi bahasa* (courtesy).	*Adat memelihara maruah* (preserving dignity), *aurat rumah* (domestic modesty), and *adab perempuan rumah*.	*Adab kekeluargaan* (family etiquette), *ukhuwah* (bonding), *ḥabl min Allāh* & *ḥabl min al-nās* (balance between divine and human relations).

Source: Author

FINDINGS: SCENARIOS PARALEL TO CONCEPT OF HIJAB IN ISLAMIC SPATIAL ETHICS

1.Indirect View of Main Entrance

The Malay community places a strong emphasis on politeness and decency when visiting neighbours. In Malay culture, the respect shown to guests is considered a noble value that underpins the practice of hospitality. Similarly, the practice of Islam the prophet (peace be upon him said "Whoever believes in Allah and the Last Day, let him honour his guests." (HR. Bukhari and Muslim) [HR. Bukhari, no. 6018, 6019, 6136, 6475 and Muslim, no. 47]. In Islam the *adab* or etiquette of entering a house as guest was mentioned in a hadeeth. While waiting for permission, do not stand in front of the door. Instead, stand to the right or to the left. The Messenger of Allah (صلى الله عليه وسلم), upon coming to someone's door, avoided facing the door directly. Instead, he would stand to the right or to the left of the door.

The main and secondary entrances of the TABAK house are deliberately designed to prevent direct visual access into the interior spaces. This architectural

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consideration reflects Islamic etiquette governing visitation and hospitality, which emphasizes respect for the host's privacy and domestic sanctity. By ensuring that guests cannot directly view the inside of the house upon entry, the design safeguards the modesty of women and family members, embodying the principles of *adab bertamu* (courtesy in visiting) and the Islamic ethic of preserving *aurat* within the household.

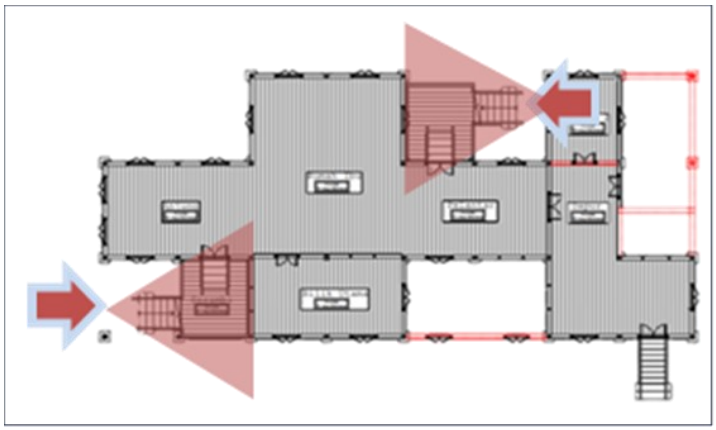


Figure 5: Indirect view of the main entrance.
Source: Centre for Tropical Architecture and Interior (KUTAI)

2.Entrance By Gender

In the Quran contains a balance or equality between men and women. Thus, both men and women have the same rights, especially in the public domain. When comes to gendered spaces, Muslims have linked the concepts of modesty and piety differently for men and women in ways that restrict spaces occupied by women (Akbar, Ahmed et. al., 2024). Most RLBP architectural design provided double entrances. The practice of gender separation for the guest or visitor is a part of tradition in the Malay culture. Main entrance located at the front of the house is meant for the man whilst the secondary entrance located at the *Rumah Selang* is for the women. This is closely related to the practice of the *Adab Kesantunan* or literally means "Polite Manners" in Malay culture. Through this practice, man and woman, old and young, husband and wife, father and son have its own status and sense of respectfulness to each other. *Adab kesantunan* also can be seen in conversation, politeness and manners in behaviour and body gestures.

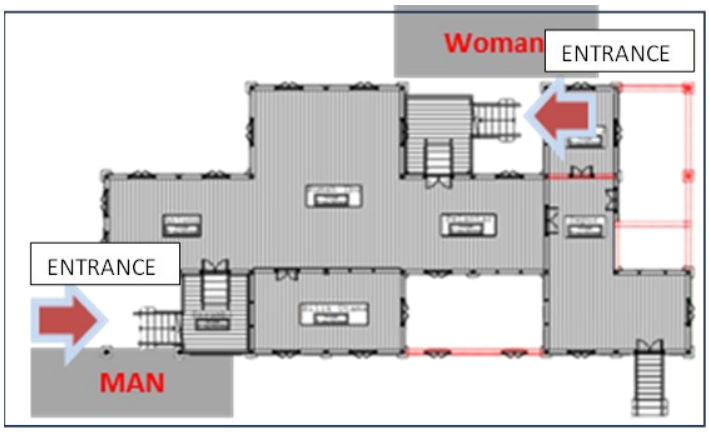


Figure 6: Separate entrance of the house by gender
Source: Author

3. Hospitality and Manners of Receiving Guests

Manners of receiving guests in Islam are values in religion that need to be practiced as receiving guests is a form of hospitality recommended in Islam. Rasulullah SAW said, "Whoever believes in Allah and the Last Day, let him glorify his guests." (Narrated by Bukhari and Muslim). With regards to this matter, there is a scenario that always become a question to the Muslim. How can a Muslim woman be hospitable to her guests in her in-laws where all her relatives are non-Mahram? In Islamic law non-mahram means, it is not *Haram* (prohibited) to marry, with a few exceptions. In the scenario of receiving non-mahram guest in most modern residential design, particularly in flats, apartments and landed houses, there is no space provided that permissible to receive non-mahram guest. The Prophet Muhammad (peace be upon him) emphasized the importance of modesty. It is not permissible for a non-mahram man to enter a house without permission. Rather the Qur'an tells us that a guest must ensure the people of the house are well-aware of their arrival by making themselves known prior to entering. In relation to this, the Malay house overcome this scenario with a space called *Serambi. Serambi* is a semi open space located near the main staircase connecting the ground level with main entrance door to *Anjung.* It is an open space covered partly by 90cm height *Pagar Musang* or balustrade. In the case of non- mahram guest or visitor, the space accommodates the situation well without creating *fitnah* or misunderstood amongst neighbours.

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Figure 7: Hospitality and manners of receiving guests.
Source: Author

4. Zoning Area for Hijab and Privacy

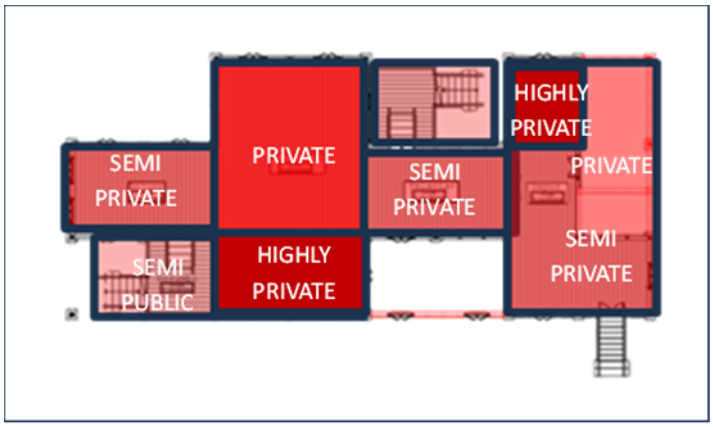


Figure 8: Zoning and hierarchy for hijab and privacy
Source: Author

The Spatial organization of Malay Traditional Architecture is design parallel to the concept of privacy and hijab in Islam. The space is divided through the hierarchy of space between the public (the staircase and the door), semi-public (*serambi*) and private area (the main house) and highly private zone (bedroom).

5. Decorations as Hijab elements

In the traditional Malay house, woodcarvings and decorative elements function as architectural *hijab*, mediating between beauty and modesty through finely crafted forms such as *tebar layar*, *kerawang*, and *jerejak tingkap*. Beyond their aesthetic role, these carvings regulate light, airflow, and visibility—preserving

privacy while maintaining environmental comfort. Symbolically, they embody Islamic principles of *aurat* and *adab*, transforming moral restraint into visual harmony. Carvings with tebuk tembus only appear or placed above eye-level in Malay house. *Tebuk tembus* refers to a **fully cut-through woodcarving technique** where patterns are completely pierced, allowing **light and air to pass through**. It functions both **aesthetically** (creating intricate light patterns) and **symbolically** as a *hijab* element—filtering visibility while maintaining ventilation and privacy, reflecting the Malay principle of **balance between beauty and modesty**. This scenario can be found in TABAK.



Figure 9: Carving with *tebuk tembus* only placed above eye level as a *hijab* element—filtering visibility while maintaining ventilation and privacy, reflecting the Malay principle of balance between beauty and modesty.
Source: Author

DISCUSSIONS

Architectural Elements as Expressions of Hijab

The principle of hijab is deeply woven into traditional Malay architecture, influencing the way spaces are designed to ensure privacy, modesty, and a sense of controlled interaction. For example, latticed screens and perforated panels, like *tepas* or *kelarai,* allow air and light to flow through, while keeping private areas shielded from direct view, especially from the outside or between different levels of a building. Elevated floors further contribute to this sense of separation, not only physically lifting the home from the ground but also symbolizing purity and

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modesty, all while serving practical environmental purposes. Roof overhangs and deep eaves play their part, providing shade and concealment, so the inhabitants can observe the outside world discreetly, without being seen. Even the entryways and thresholds are thoughtfully designed, often asymmetrical or staggered, to prevent any clear line of sight into private areas, reflecting the Islamic value of *haya'* (modesty). All these architectural elements come together to express the idea of hijab—not as a barrier, but to mediate interactions, promoting respect, discretion, and a sense of privacy.

Gendered Spaces and Social Dynamics

The spatial articulation of hijab in Malay architecture is also gender sensitive. In both domestic and religious settings, the organization of space often reflects gendered roles and the need to maintain appropriate separation. In mosques, prayer areas are divided by gender, often using wooden partitions or distinct entry points. In homes, the arrangement of interior spaces ensures that *non-mahram* (unrelated) males do not encounter female inhabitants inappropriately.

However, these separations are not rigidly segregated but flexible and context dependent. The use of movable screens, curtains, and temporary barriers allows spaces to be reconfigured according to the needs of different occasions—such as weddings, feasts, or religious gatherings—highlighting the dynamic nature of hijab as a principle that adapts to social realities.

Beyond Physical Barriers: *Hijab* as an Ethical Construct

Importantly, the concept of *hijab* in Malay architecture should not be reduced to mere physical obstruction. Rather, it represents an ethical orientation that seeks to preserve *fitrah* (natural disposition), cultivate humility, and protect the sanctity of human interactions. It is a principle that encourages thoughtful design, one that prioritizes human dignity, spiritual wellness, and harmonious co-existence with others and the environment.

This holistic view of hijab resonates with the broader Islamic understanding of architecture as a form of *ibadah* (worship), wherein the spatial order reflects divine order. Thus, Malay architecture—through its subtle gradations of privacy, layered thresholds, and symbolic veiling—offers a vernacular articulation of hijab that is both spiritually grounded and culturally nuanced.

The concept of *Ziarah* or visiting is very strong and important in Malay culture. Paying visits to our neighbours, friends or relatives is a part of tradition in Malay community. Islam is a way of life. It is perfect when there are two main interactions: namely *hablun minallah* (human interaction with Allah) and *hablun minannas* (human interaction with human being and environment). Both the elements become the foundation of the Islamic code of ethics (*akhlāq*) and the moral guideline for compliance (Abod, 1991; Mustafar amd Borhan, 2013).

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DISCLOSURE STATEMENT
The concept of hijab in Malay architecture reveals the depth of Islamic influence in the region's-built heritage, extending beyond stylistic elements to shape the ethical and experiential dimensions of space. Through its integration of modesty, privacy, and spiritual consciousness, hijab operates as a guiding principle in the design and use of space, fostering environments that are not only functional but morally resonant. Future studies may explore how this concept can inform contemporary architectural practices in multicultural and urban contexts, offering alternative models of spatial ethics and design rooted in Islamic tradition.

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ADAPTIVE REUSE, COMMUNITY, AND CULTURE: SYMBOLIC INTERACTION AND THE SACRED SPACE OF HERITAGE BUILDINGS IN PALOPO CITY

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Abstract

The buildings of the Luwu Kingdom, including the Post Office, Deputy Mayor's Office, government offices, places of worship, and tombs, hold significant value as heritage architecture in Palopo City. The spatial distribution of these buildings is a defining characteristic of the city's conservative areas. The typology of heritage buildings reflects a distinct architectural identity and shares connections with similar structure elsewhere. Syntactic relationships exist between these heritage buildings, reinforcing their historical and cultural significance. However, the government's efforts to preserve and manage these historical structures, despite their high educational value, remain inadequate. In contrast, the local community actively engages with these heritage buildings, both in their use and in academic or cultural studies. The research employed qualitative methods, adopting symbolic interactionist research paradigm. The findings show that heritage architecture carries meanings derived both from their building themselves and from the people who interact with them. The spatial hierarchy of Palopo City consists of the Tana Bangkala, Lalebata, and Tana Tekko areas, all of which are integral to the city's Historical Urban Landscape (HUL). The Tana Bangkala area contains a site that functions as a profane space for the community. The Lalebata area serves as a governmental space, while the Tana Tekko area is a sacred space characterized by the tombs or mausoleums. The spatial arrangement of these areas reflects a cosmological structure. Additionally, Tana Tekko and its surrounding context share similarities with a Mausoleum in Gowa, while the the kingdom's architectural context is connected to Malay architecture across the archipelago.

Keywords: Adaptive Reuse, Heritage Architecture, Historical Urban Landscape, and Nusantara Architecture

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INTRODUCTION

The concept of cultural landscape integrates perspective on human habitation, emphasizing the interaction between people and their environment. Cultural landscape objects represent a distinct category of heritage and historic sites, reflecting both aesthetics and functional dimensions of human engagement with their surroundings. Palopo, a city in South Sulawesi, has significant historical markers. Like other major cities in Indonesia, it features classic European-style buildings that incorporate the Garden City concept. Cities such as Semarang, Bandung, Malang, and Jakarta adopted this concept during the Dutch colonial era. In contract, Yogyakarta and Surakarta are characterized by the traditional city square layout, distinguishing them from cities influenced by European planning models.

Palopo's urban composition is unique, both in its spatial arrangement and architectural characteristic (Sutrisno et al., 2021). The city's social structure and historical status of its kingdom have remained intact and sustainable. The concept of 'sense of place' is crucial in cultural landscapes, as it contributes to the creation of meaning and identity (Ariannia et al., 2023). The architectural heritage of Palopo's old city blends classical Islamic and European influences, making it significant site for preservation and conservation efforts. In this context, Palopo City presents itself as a viable model for sustaining and maintaining its architectural heritage. The International Council on Monuments and Sites (ICOMOS), a global organization dedicated to the conservation of historical buildings.

In the design of architectural works, the philosophical phenomenon of the crisis of form and meaning presents a unique challenge (Lobo, 2016). Therefore, in accordance with the original spirit of the Athens Charter of 1931 and the Baku Charter of 1976, historic monuments are protected. Both charters emphasize not only the conservation of building as objects but also the broader significance of their surrounding environments. Methodologies and paradigms are essential for understanding the significance of places and buildings in Palopo City. Communities interpret historic cities as a third space – informal, irregular, and voluntary spaces (Ebrahimi et al., 2017). In this regard, symbolic interactionism serves as a paradigm that highlights the interaction between humans and their built environments, as well as the interpersonal interactions with these spaces. Additionally, the Buma Charter considers aspects of aesthetic, historical, scientific, or social value for past, present, or future generations. However, the decision-making process in reusing old buildings is complex and often faces obstacles at the stakeholder level.

LITERATURE REVIEW

Adaptive Reuse

According to Alauddin, the reuse of historic buildings can contribute to energy and resource conservation (Alauddin et al., 2022). The concept, known as green adaptive reuse, serves as a strategy to extend the lifespan of buildings while reducing their carbon footprint (Langston, 2011). Additionally, adaptive reuse plays a crucial role in mitigating global CO_2 emissions as part of a sustainable development strategy (van Laar et al., 2025). The implementation of adaptive reuse involves utilizing existing structural elements, thereby minimizing the demand for new construction materials and reducing waste. Fundamentally, adaptive reuse aims to preserve heritage values, which can be further enriched through architectural intervention (Augustiniok et al., 2025).

Cultural heritage objects are classified into three aspects: ideas, actions, and works (Koentjaraningrat, 2000). The third aspect, works, refers to human-made artifacts, sites, or objects that are tangible, visible, and documentable. Adaptive reuse falls within this category, specifically concerning the repurposing of historic buildings. While human actions and behaviours evolve to accommodate changing needs and functions, the physical structure of the building remains largely unchanged. In contrast, the second aspect, actions or behaviours, pertains the ways in which communities interact with and utilize historical buildings in their activities.

Symbolic Interaction, Community, and Culture

Users and visitors of heritage buildings cultivate a sense of sacredness through their interactions with these structures (Sutrisno et al., 2018). In urban spaces, individuals generate conceptual abstractions through the reproduction of meaning. The old city, therefore, serves as a crucial site for exploring meaning, both as a symbol and as a sign. According to Mead, meaning is derived from the interaction between an organism and its social group (Mead, 2018). Individual gestures emerge in response to interactions with others, giving rise to meaning. While meaning exists inherently in nature, symbols are human constructs passed down through generations.

A community consists of individual or social groups who live and interact within a specific context. Local communities play a vital role in maintaining the balance between ecological conservation and cultural preservation practices, as these two aspects are often interconnected (Zakariya et al., 2025). Meanwhile, buildings serve as medium that connects individuals to the broader community. Talcott Parson asserts that culture represents the highest level of social control (Laurens, 2005).

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RESEARCH METHODOLOGY

According to Chalmers, science is constructed from facts, and its principles are designed to facilitate knowledge acquisition through the study of symbols (Chalmers, 1983). The buildings and spaces of Palopo have distinctive symbolic characteristics, reflecting interconnection between various architectural elements. To uncover these symbols, this study adopted Blumer's methodology of symbolic interactionism, grounded in Schutz's social phenomenology (Crozier et al., 1994). The phenomenological paradigm serves as a philosophical approach to examining the intricate relationships between cities and architecture. The concept of self-evidence in phenomenology emerges from the structured regularity of buildings – their spatial arrangements functions, and materials – which collectively shaped architectural character. Consistent with the phenomenological perspective in architecture, Norberg-Schulz emphasized that architecture exists at the intersection of space and character.



Figure 1: Syntactic relation of research objects in Palopo city
Source: Authors

Researchers determined that the historic building zone serves as a site for symbolic interaction (see figure 1). The selection of buildings was based on the criterion that they were over 50 years old. The snowball sampling method was

used to identify research objects and informants following interviews with community leaders. Researchers conducted in-depth interviews with 15 community leaders who were well-versed in Luwu culture and architecture. A theoretical dialogue was applied during the analysis of research data. Semiological theory was used to interpret and decode space and place (Parsaee et al., 2015).

Interview data were obtained through snowball sampling and subsequently transcribed, coded, and thematically interpreted. The analysis was conducted through an ongoing dialogue between empirical narratives and relevant theoretical frameworks. It focused on uncovering meanings, symbols, and shared interpretations related to Luwu's heritage architecture, applying open coding and theory-driven reflection to interpret cultural narratives and spatial significance. The study acknowledges key limitations, including restricted replicability due to contextual interpretation, potential sampling bias arising from network-based participant selection, and limited generalizability inherent in qualitative and snowball sampling designs, while reflexivity was applied to ensure analytical transparency.

Prior to data collection, informed consent was obtained from all interview participants, and the study was conducted in accordance with applicable ethical standards for qualitative research, ensuring confidentiality, voluntary participation, and responsible data use.

ANALYSIS AND DISCUSSION

Case Study Area: *Lalebata*

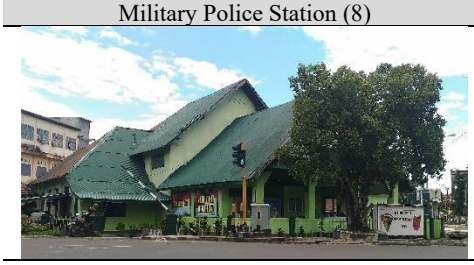
Lalebata is a government-designated area in the centre of Palopo city. It is densely populated and home to many Dutch heritage buildings (see figures 1, 3, and 4 in table 1). The researcher's symbolic interaction with building users was conducted across all heritage building sites. The context of symbolic interaction emerges both among users and between users and objects, whereas a syntactic relationship exists between objects.

Classic European building

The location of classical European buildings shares similarities in form (see Table 1). All research objects are situated in the centre of Palopo City. As heritage buildings, they serve as spaces of human activities. The researchers identified and analysed ten heritage buildings that hold significant historical and social roles in Palopo City and the Tana Luwu region. These ten buildings represent the influence of classical European architecture (refer to figure 6 in table 1), local governance (see figures 3, 4, and 10 in table 1), public service functions (refer to figures 5, 7, and 9 in table 1), religious (refer to figure 11 in table 1), and military symbolism (see figures 1 and 8 in table 1).

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Table 1: Classic European buildings in the city centre (*Lalebata*)

SalassaE (3)	Deputy mayor's office house (4)
	
Post Office (5)	Military Office (1)
	
Military Police Station (8)	Mr. Sabani's Private House (6)
	
Veteran campus (7)	Culture Office (10)
	

Sawerigading Hospital (9)	PNIEL Church (11)
	

Source: Copyright, Sutrisno (2017)

The *Lalebata* area is a government-designated district situated in the central part of Palopo city. Although the area is frequently bustling with activity, it does not experience significant traffic congestion. As one the city's historical centres, *Lalebata* plays a crucial role in facilitating the activities of the Palopo Urban Forum community. These activities receive financial support from the central government through grants provided by the Indonesian fund. Several buildings in the *Lalebata* area, such as the Military Police Station (refer to figure 8 in table 1) and the Deputy Mayor's Office House (refer to figure 4 in table 1), serve not only as administrative offices but also as social hubs. The official residence (see figures 4 and 6 in table 1) remains open to activities organized by students and community organizations. The back terrace and mini hall serve as informal gathering spaces, while the side yard was utilized for various community activities. Additionally, the outer courtyard provides a space for public interaction and student engagement. These spatial adaptations emerged organically, driven by interplay between the availability of space and the evolving needs of community, rather than through formal urban planning.

Table 2: Meaning of symbolic interaction in old buildings

Themes	**Sub-Themes and meaning**
Military/ office buildings	- Primarily serve as residential spaces for users - Function as shared container - Represent exceptional architectural craftsmanship - Stand out as heritage buildings, distinct from their surrounding - Similar architectural styles indicate social status - Grid-shaped city streets serve as a force-breaking strategy - Dams and paddy fields function as a security barrier for the region - Functional repurposing serves as an adaptive strategy for managing state-owned buildings

Source: Author's

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Adaptive reuse between classic European building and the community

Adaptive reuse is demonstrated in various ways across different heritage buildings. Some buildings have undergone significant functional transformation, such as *Sawerigading* Hospital, where certain structures and spaces have been repurposed into modern healthcare facilities. Conversely, buildings such as the Post Office and PNIEL Church have retained the primary functions while adapting to the evolving needs of their users for administrative and religious activities. Efforts to preserve original architectural elements are integrated with spatial adaptations, ensuring the continuity of historical identity amidst the functional changes. This adaptation is facilitated through shared space utilization and functional modifications.

The symbolic interaction between heritage buildings and the community can be analysed through the concept of 'self-organization', a process within complex systems theory where structures and order emerge spontaneously without centralized control. In this context, the communities of the Palopo Urban Forum and the Palopo Heritage Society exhibit adaptive and responsive behaviour in their engagement with heritage buildings. These communities assess how buildings are utilized and maintained, ensuring their sustainability. Furthermore, through the Palopo Urban Forum, which involves professional architects, heritage buildings are occasionally reinterpreted.

Another notable aspect of PNIEL Church is the community's ongoing commitment to maintaining its religious and social functions. Even in the absence of major formal interventions, the physical sustainability and symbolic significance of the church are preserved through active community participation. Thus, includes regular worship, religious holiday celebrations, social gatherings, and early childhood education initiatives such as schools and kindergartens. The preservation of PNIEL Church extends beyond physical conservation, it is sustained through the continuous engagement of residents and the broader community. This demonstrates an effective model of cultural heritage preservation through decentralized governance where the community itself assumes the role of custodian, ensuring the church's enduring relevance and integrity.

The pragmatic meaning of heritage is reflected in the way users perceive the *Kedatuan Luwu* Building, particularly *SalassaE* and *LangkanaE*. The *LangkanaE* building, reconstructed for continued use by Datu Luwu, serves as an architectural reference for other structures in Palopo City and much of the Tana Luwu region. Furthermore, it exhibits syntactic and semantic relationships with buildings in North Luwu Regency (Masamba), Luwu Regency (Belopa), and East Luwu Regency (Sorowako).

The concept of quality of life was reflected in the environment of the Luwu royal palace. The researcher observed the traditional process of crafting

Kawali weapons within the palace grounds, where a community of *Kawali* enthusiasts gathered to showcase their cultural heritage. Notably, in the palace courtyard, a sculpture depicting a hand holding a *badik* was erected as a symbol of Luwu culture in Palopo City. The pragmatic meaning of this cultural practice is embedded in the *badik*-making process. As one informant described:

> "*Badik makers are one family, comprising brothers and sisters from North Kolaka... Some collectors of Badik highly seek after Badik made by women...The mystical element in blacksmith-making activities is said to be that it is not the maker who makes the iron, but rather other elements that work in conjunction with him".* (Informant, 2019)



Figure 2: Community interaction of Luwu Heritage Weapon owners.
Image Copyright, Sutrisno (2017)
Source: Author

Building objects in the syntactic relation of space

The architectural replica of certain building represents two distinct yet interconnected cultures. The *bassesangtempe* (Bastem) house is classified as a typical adaptive structure, blending elements of both *To Riaja* and *To Ugi* architectural styles. Meanwhile, PNIEL Church is a direct representation of the Toraja house. One informant emphasized that the territorial influence of Luwu historically extended into the Toraja region. The parameters of sacred space encompass various aspects, including spatial orientation, centrality, boundaries, symbolism, rituals, and spiritual experiences that transcend the mundane.

Both PNIEL Church and the Old Jami Mosque of Palopo serve as symbols of interfaith harmony representing the coexistence of two religious traditions. While both structures hold historical significance, they belong to different generations contexts. The Old Jami Mosque also exhibits sacred spatial characteristics, particularly in terms of orientation and symbolism. The layout of the mosque adheres to the Qibla direction, reinforcing its spiritual significance. Additionally, the *tumpeng*-shared roof serves as a spiritual symbol in Islam. Local

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religious leaders interpret its layers as representing the Shari'ah, Haqiqa, Tariqa, and Ma'rifa. As one informant explained:

> *"This mosque all has meaning...One door means one god, which means that there is only one God" (Informant, 2019).*

The Old Jami Mosque of Palopo is deeply connected to the historical spread of Islam in the region. Its proximity to the *SalassaE* and *LangkanaE Palaces* further reinforces its historical and cultural significance. Additionally, synchronic and diachronic relationship are reflected in the preservation of historical symbols within the *SalassaE Centre Room* (*Batara Guru* Museum), which serves as a sacred space (refer to figure 5).



Figure 3: Representation of the syntactic and semantic relations between the Palopo culture of South Sulawesi and Kelantan, Malaysia (*Image Copyright, Sutrisno, 2024*)

Syntactic and semantic relationships can be observed in the construction of the Old Jami Mosque of Palopo, a significant heritage site, and a comparable heritage object in Kelantan, Malaysia (see figures 3). This connection is exemplified by the mihrab inside the Old Jami Mosque of Palopo and the mihrab located in the NIK Rasidin Museum, Kelantan, Malaysia. From a diachronic perspective, these architectural elements serve as markers of the historical spread of Islam, particularly as traced through the role of *Dato* Patimang, an Islamic scholar from West Sumatra. The dissemination of Malay Islam through an extensive *ulama* network connected Kelantan with the Bugis-Makassar region. Azra highlights that scholar from Minangkabau, Aceh, and the broader Malay world, including Pattani, established an interconnected scholarly tradition known as the 'network of learning' (Azra, 1994). Oral historical accounts further support this, indicating that Islam in Palopo was introduced from

Minangkabau (Informant, 2018). Additionally, *Dato* Sulaiman played a crucial role in spreading Shafi'i jurisprudence, Sufism, and local adaptations of Islam within the Bugis region, including Tana Luwu (Hamka, 1982). This strong diachronic relationship between Malay culture from Kelantan and Islamic traditions in Palopo reinforces the historical and cultural significance of the Old Jami Mosque of Palopo. As a result of its rich historical background and distinctive architectural features, the Old Jami Mosque of Palopo has been recognized as an iconic architectural work. This designation is further validated by the Ministry of Tourism, Arts, and Culture of Malaysia (MOTAC), which acknowledges the mosque as a heritage landmark due to its historical significance and representation of modern architectural influences.

LokkoE cemetery complex as a sacred area and The *Tana Tekko* as area, historically significant burial site. The term *LokkoE* originates from the Bugis language, meaning 'pyramid'. The *LokkoE* cemetery is traditionally recognized as the resting place of kings (informant, 2017). The *Tana Tekko* region was developed as a buffer zone, strategically positioned outside the *Lalebata* area. A river serves as a natural boundary, separating *Tana Tekko* from *Lalebata*.



Figure 4: Syntactic Relationship between Tombs in Palopo City and Tombs in Gowa Regency, South Sulawesi.
Source: Author

The kings' tombs are located in *Tana Tekko*, specifically situated in the corner of the burial area. The tombs follow a rectangular plan. The *LokkoE* gate is closely connected to the *SalassaE* complex, with *LokkoE* functioning not only as burial site but also as a selected tomb due to the sacred lineage of its ancestors. The tombs in Palopo and Gowa are deeply rooted in the era of Islamic civilization, serving as a symbol of the legitimization of Islam in the region (refer to figures 4). The dome-shaped tombs act as markers of collective memory, preserved and passed down through generations. This connection highlights a regional

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relationship between the Luwu-Bugis and Gowa-Makassar cultures, where local traditions and universal Islamic values intersect and reinforce each other.

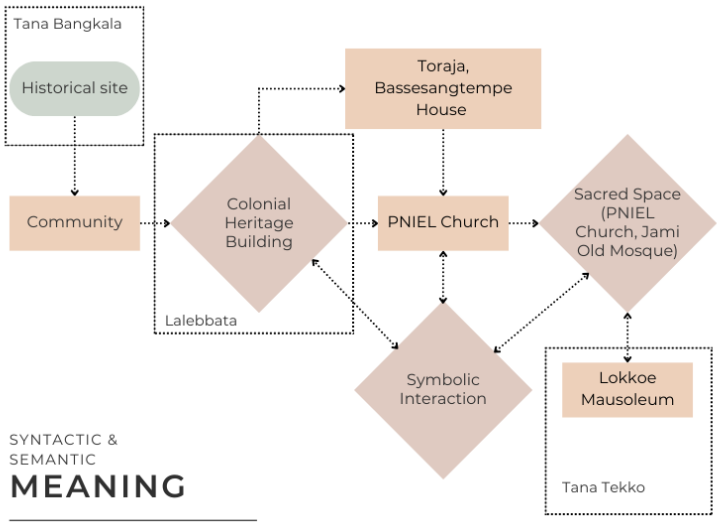


Figure 5: Syntactic and Semantic Meaning of Object Research
(image copyright, Sutrisno, 2025)

Symbols of sacredness are embodied through both space and user activities in the crafting and preservation of heirlooms. The *Kawali*, a traditional weapon resembling a dagger or kris typical of the Bugis people in South Sulawesi, serves not only as a means of defence, a symbol of fertility, or a representation of masculinity but also holds profound symbolic and cultural significance for the indigenous community. Known specifically in Bugis Luwu culture, the *Kawali* represents a strong connection to local cultural heritage (Sutrisno, 2017). Traditional leaders utilize the *Kawali* as a marker of cultural identity, reinforcing their roles and cultural authority. For the community, the *Kawali* is more than just a weapon—it is a cultural artifact that links them to their history, ancestral traditions, and values of honour. The researcher's observations reveal that the *Kedatuan* indigenous community possesses a strong 'sense of belonging' to their local heritage. In this context, the *Kawali* functions as a medium of cultural expression, playing a significant role in enhancing the quality of life by reinforcing cultural identity.

CONCLUSION

Heritage architecture in Palopo City plays a pivotal role in shaping the urban spatial structure, representing historical and cultural values. The typology of

heritage buildings – such as the *Kedatuan Luwu*, post offices, official residences, office buildings, worship buildings, and historical tombs – not only exhibits distinctive architectural characteristics but also established a network of syntactic relations between objects dispersed across the city's conserved areas, between districts, and even across national borders. Adopting the symbolic interactionism paradigm reveals that the meaning of heritage architecture is not fixed or objective. It emerges from the interactions between buildings and their users, as well as from the symbolic constructions that develop within local communities. The community contributes a unique perspective to the discourse on heritage conservation and adaptive reuse, particularly within the context of Southeast Asian and Nusantara architecture. Their local knowledge, cultural practices, and collective activism enrich conservation strategies, ensuring that heritage preservation remains contextually rooted and socially meaningful.

The *Tana Bangkala*, *Lalebata*, and *Tana Tekko* areas collectively form a hierarchical spatial arrangement within the city's historical landscape. These three areas function as profane, administrative, and sacred spaces. The spatial structure of these area reflects a distinctive cosmological order, establishing connections with architectural tradition outside Palopo. This exemplified in the relationship between *Tana Tekko* and the mausoleum typology in Gowa, as well as the influence of Malay architecture on the *Kedatuan* complex and the Old Mosque. Despite the limited attention from the government towards the preservation of heritage objects, the active involvement of community in utilizing, interpreting, and studying these buildings plays a crucial role in sustaining the historical and educational significance of Palopo City's heritage architecture.

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THE DYNAMICS OF TRADITIONAL BUGIS ARCHITECTURE: A STUDY OF SAORAJA SENG IN REGENCY OF SOPPENG

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Abstract

This research analyzes the evolution of Saoraja Seng in Soppeng Regency as a traditional Bugis noble residence that has assimilated colonial and contemporary elements. Notwithstanding alterations in roof design, fenestration, and structural elements, the edifice persists in embodying fundamental Bugis cultural principles through its spatial arrangement and emblematic attributes. The study employs a qualitative methodology that includes field observation, architectural documentation, interviews with local stakeholders, and historical analysis. The data were examined via visual interpretation and juxtaposed with conventional Bugis dwellings. The findings indicate that although colonial features, such the hipped roof and Malay-style windows, were included, symbolic elements—such as the employment of uneven numbers and decorative motifs—persist unchanged. The findings suggest that Saoraja Seng exemplifies a synthesis of adaptation and cultural continuity, demonstrating the endurance of Bugis vernacular architecture in the face of evolving socio-cultural circumstances.

***Keywords*:** symbolism, transformation, saoraja seng

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INTRODUCTION

Traditional Bugis architecture in South Sulawesi provides unique cultural evidence due to its historical and symbolic relevance. The Saoraja, as a Bugis community traditional aristocratic house, serves not only as a residence but also as a status symbol and identity for the whole Bugis community.

In Soppeng Regency, Saoraja Seng presents a compelling case for architectural reform and a rejection of the traditional Bugis home shape. This discrepancy is primarily due to the architectural influences of the Dutch colonial era, which significantly altered both the exterior design and spatial organization of the structure. The alterations reflect the tension and complexity of native Bugis architectural traditions and foreign, particularly colonial, features that characterize and continue to affect the area's built environment.

Saoraja Seng's study demonstrates how the form, structure, and symbolism of traditional Bugis houses reflect changing socio-cultural values. This demonstrates the development of vernacular architecture. Furthermore, this research demonstrates how local traditions change according to context while maintaining their architectural identity, enhancing our understanding of cultural adaptation in Southeast Asia.

This research looks at the process of transformation in the traditional Bugis house, the Saoraja Seng, in Soppeng Regency. The paper's examination of architectural form changes aims to provide insight on the extent to which the historical social, cultural, and political context has affected the route of development for Bugis building practices.

LITERATURE REVIEW

Vernacular architecture embodies cultural identity, shaped by many social, environmental, and material influences (Rapoport, 1969; Oliver, 1997b). (Claude Levi Strauss, 1963) posits that it operates as a system of signals conveying social and cosmic concepts, whereas (Waterson, 1997) highlights its dual role in practical adaptation and symbolic significance. These perspectives highlight vernacular architecture as a dynamic expression of cultural continuity and evolution.

(Rudolfsky, 1964) asserts that colonial influences transform vernacular architecture, leading to hybrid designs that integrate native and foreign elements. (Giddens, 1984) highlights the use of novel materials and designs in colonial architecture, creating an architectural language that persists beyond the colonial era. (Tuan, 1977) and (Relph, 1976) examine how modernization and globalization result in "placelessness," detaching artificial surroundings from their cultural and historical contexts. In contrast, (Fathy, 1986) advocates for sustainable vernacular architecture that integrates tradition with modern needs, thereby preserving cultural identity.

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RESEARCH METHODOLOGY

This study utilizes a diverse analytical framework to investigate the evolution of traditional Bugis architecture, focusing specifically on Saoraja Seng in Soppeng Regency. The study starts with an exhaustive literature review that scrutinizes historical documents, scholarly articles, and prior investigations into Bugis architecture, the effects of colonialism, and architectural evolution across time. Fieldwork include direct observations, architectural assessments, and photographic documentation to examine design aspects and spatial arrangements. Additionally, qualitative insights are garnered through interviews with local politicians, architects, and members of the Bugis community to understand the historical and cultural significance of Saoraja Seng and its progression throughout time.

A comparative analysis is performed to differentiate Saoraja Seng from other traditional Bugis dwellings, situating its unique characteristics within the broader context of Bugis architecture. Additionally, a historical analysis of colonial archives investigates the influence of Dutch colonial administration on architectural methodologies and their expression in Saoraja Seng. An evaluation of the structure's preservation status assesses its current condition and explores conservation strategies in light of modern influences. This scientific method facilitates a thorough comprehension of the architectural development of Saoraja Seng and its wider significance for the conservation of traditional Bugis architecture.

ANALYSIS AND DISCUSSION

Saoraja Seng, located in Galung Village in the Liliriaja District of Soppeng Regency, exemplifies Bugis aristocratic architecture influenced by colonialism. This home is historically linked to the royal family of the Pattojo Kingdom, as its proprietor, Datu Pallawarukka, was the sibling of the twelfth King of Pattojo. Constructed during the Dutch colonial period, Saoraja Seng functioned as both a residence and a symbol of aristocratic heritage and political authority within Bugis culture. The architectural style and arrangement reflect the socio-political dynamics of that age, strengthening the hierarchical systems characteristic of old Bugis aristocracy.

The creation of Saoraja Seng during the colonial era represents a significant transformation in the traditional Bugis architectural style, integrating European influences with native design components. The integration of colonial architectural elements, encompassing modifications in spatial configuration and ornamental details, illustrates the adaptation of indigenous architecture to the foreign influences of Dutch rule. These modifications signify extensive alterations in the social and political landscape of Soppeng, where colonial governance influenced conventional power structures. Thus, Saoraja Seng

operates as both an aristocratic residence and a tangible representation of the cultural and architectural transformations resulting from colonial encounters.

Table 1. The picture of form, elemen and ornament Saoraja Seng

Image		
Description	Position of *tamping* in the front of main house	View of Saoraja Pattojo from the right side
Image		
Description	The roof of Saoraja Seng did not apply timpalaja (symbol of noble house)	View of Saoraja Pattojo from the right side
Image		
Description	Sistem konstruction and Interior of Saoraja Seng	Sisiten construction and nterior Saoraja Seng
Image		
Description	Different level between main house and *tamping*.	Stairs use *parinawang* (beam that divides the two stairs)

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Table 2. The picture Saoraja Seng view from side to side and ornament

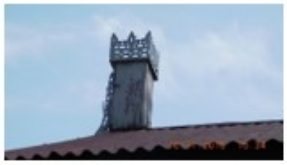
Image		
Description	Applying *parenreng* flower Ornamet in the attic construction	Blooming flower in the end of roof
Image		
Description	*Anjong* like crown, usually just noble house applied anjong in the past time.	Applying ornamentasi in the end of roof, the ornamen applying parenreng and bamboo shoot.
Image		
Description	The roof did not apply sadle roof model like original bugis house	Full Ornament at the end of the roof of the stairs
Image		
Description	Pict. 15. Transformation of roof form in teh saoraja seng. Follow of Europe roof	The view of Saoraja pattojo from the left side.



Figure 1. Bugis-Makassar Traditional House form in South Sulawesi (Gowa Palace) 1883 source: Tropenmuseum, part of the national museum of world culture.

The traditional architecture of the Bugis people is an essential element of cultural heritage, distinguished by its historical importance and profound symbolic implications in South Sulawesi. The Saoraja, a traditional noble dwelling of the Bugis, serves as both a domicile and a symbol of social status and ethnic identity within Bugis culture.

In the Soppeng Regency, the Saoraja Seng exemplifies a remarkable instance of architectural progression, signifying a distinct departure from conventional Bugis home patterns. This modification is mostly ascribed to architectural influences from the Dutch colonial period, which significantly transformed both the outward aesthetics and the interior configuration of the structure. These adjustments underscore the complex interplay between the indigenous architectural traditions of the Bugis and the foreign influences, notably colonial ones, that have shaped the region's built environment.

This research aims to examine the evolution of traditional Bugis architecture through an in-depth investigation of Saoraja Seng in Soppeng Regency. This research seeks to elucidate how historical social, cultural, and political influences have affected the evolution of Bugis architectural traditions through an analysis of design modifications. This research is essential for formulating measures to protect this architectural heritage against the challenges posed by modernity and evolving social contexts.

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Architectural Form of *Saoraja Seng*

The architectural design of Saoraja Seng in Soppeng Regency, built during the Dutch colonial period, exemplifies a notable evolution of traditional Bugis architecture. This progression reflects the impact of colonial aesthetics as well as the wider socio-cultural and political transformations of the era. Understanding these changes necessitates an examination of the structure through the lenses of architectural theory and cultural study.

Acculturation, stemming from multicultural interaction, frequently yields novel architectural forms. In the instance of Saoraja Seng, this transpired through the incorporation of European characteristics into Bugis vernacular forms. As (Oliver, 2006) notes, such transitions generally emerge from interactions with prevailing external influences, leading to alterations in architectural form, materials, and methodologies. This is seen in Saoraja Seng, where the transition from a traditional gable roof to a hipped roof, together with the incorporation of brick and cement, indicates European influence.

Architecture transcends mere physical structure; it embodies social significance and symbolic worth. Saoraja Seng, associated with the Pattojo Dynasty, possesses profound cultural importance. (Amos, 1969) posits that spatial order and structure frequently reflect social hierarchy and cultural identity. The Saoraja Seng remodel exemplifies the adaptation of Bugis nobility's architectural surroundings to preserve symbolic significance throughout colonial governance. The incorporation of Western architectural features signifies cultural resilience and strategic adaptation to existing political conditions.

Modernization throughout the colonial era introduced technological advancements alongside transformations in cultural views of tradition and identity. Saoraja Seng exemplifies this dichotomy by utilizing resilient materials and methods to create a hybrid design that integrates indigenous principles with exterior aesthetics. Instead of obliterating tradition, these modifications redefined it, highlighting an ongoing confrontation between heritage and transformation.

Façade

The architecture of saoraja seng exemplifies a synthesis of native Bugis features and colonial influences, particularly evident in the substitution of the gable roof with a hipped configuration. The integration of indigenous and foreign characteristics exemplifies architectural acculturation, when unique cultural aspects coalesce into a cohesive entity (Oliver, 1997b). The hipped roof, indicative of European influence, serves both aesthetic and functional purposes, according to colonial architectural preferences, while improving airflow facilitated by the ventilation system situated between the roof and the main structure, thus accommodating tropical climatic conditions. These modifications underscore the versatility of Bugis architecture in assimilating foreign influences while maintaining cultural identity via structural innovation.

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The architectural design of Saoraja Seng of modular modules, each equipped with windows that facilitate natural illumination and ventilation essential elements for tropical comfort. One module functions as the primary entry, guaranteeing operational access and spatial harmony. This configuration corresponds with (Rapoport, 1979) notion that architectural form and layout react to environmental requirements and cultural standards. also underscores that features like windows and doors have dual functions, practical and symbolic, illustrating how cultures shape their constructed surroundings in alignment with both climatic conditions and cultural principles. The intentional arrangement of these elements in Saoraja Seng not only improves thermal efficiency but also embodies Bugis principles of transparency and environmental connectivity.

The use of Malay-style windows exemplifies cultural convergence in architecture. According to (Gordon Jr., 1996) Architectural elements function within extensive cultural frameworks and communicate complex meanings. These windows represent historical contacts between Bugis and Malay civilizations, transcending their utilitarian purpose. According to (Lévi-Strauss 1963) that structuralist perspective, this is a sort of cultural appropriation wherein external elements are assimilated without obliterating local identity. The incorporation of three window modules and one entry exemplifies the Bugis traditional preference for odd numbers, which are seen as emblems of spiritual equilibrium and safeguarding (Abidah, 2016). These design choices highlight the persistence of cultural values after architectural modification.

(Claude Levi Strauss, 1963) posits that architecture, like other cultural products, operates as a symbolic system that mirrors society's structures and ideas. The repeated utilisation of uneven numbers in saoraja seng reinforces this view since it encapsulates the Bugis cosmological principles of harmony and equilibrium. The existence of three windows and one entry is intentional—it signifies the profound conviction that spatial arrangement embodies social significance and identity.

(Rapoport, 1969) contends that vernacular architecture directly reflects cultural values, but (Oliver, 1997a) emphasizes the significance of spirituality and cultural context in influencing traditional designs. (Pelras, 1996) observes that the inclination towards odd numbers pervades several facets of Bugis life, reflecting their cosmological perspective. Consequently, Saoraja Seng amalgamates utilitarian aspects with symbolic significance, where each architectural element enhances a larger cultural story.

In Bugis cosmology, the home reflects the human body, with each component possessing distinct symbolic significance. The roof represents the "head," linked to knowledge and power; the central living area, or *ale bola*, functions as the "body," where everyday activities occur; and the *kolong*, or elevated understructure, depicts the "feet," providing support for the dwelling while serving as a social area. At Saoraja Seng, the *kolong* (ground) serves as a

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dynamic environment for social and ceremonial activities, functioning not as an absence but as an essential platform for engagement. The stairway connecting this area to the *ale bola* (body of house) above functions as a geographical and metaphorical transition between public and private domains.

(Lévi-Strauss, 1963) views the divisions of head, body, and feet as symbols of social hierarchy and cosmic order. Rapoport's vernacular theory elucidates how these spatial patterns fulfill cultural values and environmental requirements. The integration of these viewpoints reveals that Bugis architecture, as demonstrated by Saoraja Seng, is a cohesive amalgamation of physical form and cultural significance.

Architectural Elements of *Saoraja Seng*: Symbolism and Functionality

The roof, windows, and stairway of Saoraja Seng effortlessly integrate functionality and symbolism. The hipped roof, inspired by colonial architecture, improves ventilation appropriate for tropical regions. Simultaneously, windows integrated into structural modules enhance ventilation and embody the Bugis affinity for odd numbers, which signify balance and safety. The stairway, connecting the *kolong* (ground) with *ale bola* (main living area), enhances spatial hierarchy and cultural stratification. These traits collectively illustrate the dual role of architectural elements as functional components and cultural symbols.

A significant divergence from conventional Bugis homes is the lack of *timpalaja* decorative roof features commonly seen at the periphery of aristocratic dwellings. In Bugis tradition, *timpalaja* denote social standing and are organized in odd numbers (1, 3, 5, etc.) to physically convey hierarchical disparities. Their existence typically signifies the social status of the inhabitants, therefore strengthening existing socioeconomic hierarchies.

The exclusion of *timpalaja* in Saoraja Seng, a structure constructed during the Dutch colonial era, signifies changes in social dynamics and architectural standards. The retention of several traditional elements, along with the lack of these decorations, indicates an adaptation to the colonial aesthetic that frequently omitted indigenous marks. This omission highlights a negotiated equilibrium—preserving Bugis architectural integrity while conforming to enforced standards.

Although devoid of *timpalaja*, Saoraja Seng persists in exemplifying fundamental Bugis architectural tenets. The modified roof structure and specific design alterations illustrate a process of cultural adaptation, wherein external influences are incorporated without obliterating historic significance. This architectural progression demonstrates how cultural identity may endure via reinterpretation, even throughout periods of transition.

The Malay-style windows, including 11 ventilation slats and 9 horizontal bars, emphasize a deliberate adherence to Bugis numerological symbolism. These odd-numbered configurations—esteemed for their spiritual

significance—embody harmony, protection, and cosmic equilibrium. According to (Abidah, 2016), these patterns are fundamentally embedded in Bugis cosmology and fulfill roles that extend beyond mere functionality, incorporating spiritual meaning and environmental balance.

(Oliver, 1997a) underscores the significance of symbolic numerical usage in vernacular architecture, highlighting how constructed forms include belief systems. Saoraja Seng's window design serves as a medium for conveying cultural values through spatial arrangement. (G Roger, 1992) contends that architecture ought to enhance cultural identity. Saoraja Seng's symbolic portrayal of these entrances illustrates the intersection of practical necessities and lasting traditions.

Staircases in Bugis architecture serve not just as connections but also as symbols of transitions between public and private domains, reflecting social hierarchy. (Abidah, 2016) indicates that wealthy residences often had 13 stairs as a symbol of nobility, but Saoraja Seng is made of nine steps and added *parinawang* beam to divide the stairs into two parts so that it does not resemble ordinary people's houses, which use nine steps. The preservation of the culturally significant uneven number, alongside the diminished count, suggests a contextual modification potentially attributable to evolving societal values or colonial impact.

At Saoraja Seng, the staircase maintains its symbolic significance despite this diminishment. Status-indicating blocks remain positioned, maintaining the visual hierarchy. (Claude Levi Strauss, 1963) characterizes these aspects as components of an overarching cultural code, whilst (Rapoport, 1969) and (Oliver, 1997b) underscore the manner in which architectural transformations mirror changing social structures. The altered staircase exemplifies selective continuity, respecting history while adapting to contemporary surroundings.

(Turner et al., 1969) elucidate that architectural elements, such as stairs, represent transitions and social functions. The staircase, along with its status-indicating beam, delineates a sharp separation between public and private areas, so cementing class divisions into the physical arrangement. The steps of Saoraja Seng illustrate a synthesis of adaptation and continuity. Although the quantity of steps has diminished, symbolic markers persist, preserving the Bugis cultural framework. This corroborates (Alexander Christopher et al., 1977), who promote designs that embody both social ideals and functionality, and (Sahlins, 1972), who associates structural forms with socio-economic processes. (Relph, 1976) and (Bloch, 1992) emphasize the significance of vernacular architecture in preserving identity and belief systems. Consequently, even in the face of transformation, conventional symbols persist inside the architectural structure.

(Lefebvre, 1991) asserts that architectural space is influenced by cultural dynamics, power systems, and historical transformations. The staircase in Saoraja Seng, modified to comply with contemporary space norms while

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preserving symbolic elements, exemplifies how architecture may embody persistent social hierarchies across changing constructed landscapes. Beyond serving as a method of vertical circulation, it embodies cultural hierarchy and reinforces the enduring nature of Bugis spatial values over time.

Ornamental Elements in Saoraja Seng: Symbolism and Cultural Significance

The architectural characteristics of Saoraja Seng include decorative elements that provide both aesthetic and symbolic functions, reflecting the cultural, ethical, and spiritual qualities inherent in Bugis history. These components are not only ornamental; they articulate the Bugis worldview and identity, serving as essential connections between traditional beliefs and modern architectural expression.

(Waterson, 1997) emphasizes the significance of the *anjong* in Bugis architecture, a decorative feature frequently adorned with floral and animal patterns. Traditionally, the anjong serves as a spiritual protector against malevolent powers (antidoti), underscoring the notion that architectural shapes are profoundly connected to metaphysical significance and ceremonial importance.

The decorative elements along the roof edge of Saoraja Seng exhibit three principal symbols that signify fundamental components of Bugis cosmology: the *pucuk rebung* (bamboo shoot), segi empat lawasoji (*lawasoji* square), and *bunga parenrengi* (parenrengi flower). The bamboo shoot represents the cyclical essence of existence and the lasting impact of an individual's societal contributions. The *lawasoji* square, symbolizing the four cardinal directions, encapsulates fundamental ethical principles—integrity, equity, sagacity, and valor—integral to Bugis moral philosophy. The parenrengi flower, commonly shown as a climbing plant, symbolizes beauty, prosperity, and morality, implying a conviction in the honorable perpetuation of the Bugis bloodline through generations.

According to (Turner et al., 1969), these symbolic representations reinforce conventional Bugis ethics. This method aligns with (Baharuddin et al., 2022) promotion of risk-managed heritage conservation and (Wan Ali et al., 2023) focus on culturally attuned architectural solutions. Despite the architectural modifications imposed by colonial influence, the persistent presence of traditional motifs such as *pucuk rebung* and *bunga parenrengi* underscores the continued significance of these cultural icons. Their longevity underscores the significance of heritage protection, which preserves not just physical structures but also the intrinsic values associated with them.

(Oliver, 1997a) emphasizes that vernacular architecture conveys local traditions and spiritual beliefs through symbolic design. In Saoraja Seng, the incorporation of *pucuk rebung* and *segi empat lawasoji* illustrates how architectural elements go beyond utilitarian requirements to embody identity and

continuity. This multifaceted symbolism reinforces traditional norms in the face of current change.

From a phenomenological standpoint, architecture serves as a conduit for human feeling and significance. (Pallasmaa Juhani, 2024) contends that spatial and visual components communicate lived experiences. The symbolic elements of the Saoraja Seng project embody concepts of optimism, morality, and continuity, enhancing both psychological and spiritual ties between people and their constructed surroundings.

The ornamental combination of bamboo stalk, *lawasoji* rectangular, and parenrengi flower embodies fundamental Bugis principles: the life cycle, ethical integrity, and lasting prosperity. Although the overall roof design deviates from conventional Bugis typology due to colonial influences (Waterson, 1997; Oliver, 1997a; Abidah, 2016), these symbolic adornments maintain the structure's cultural integrity. (Bloch, 1992) posits that architectural components frequently mirror social structures and ideological constructs, whereas (Relph, 1976) contends that architecture is crucial in preserving identity throughout temporal spans. (Claude Levi Strauss, 1963) views these themes as components of an extensive cultural sign system, whereas (Sahlins, 1972) links them to socio-symbolic and economic frameworks. (Kalsum et al., 2024) assert that regional identity is influenced by roof designs and ornamental features. Saoraja Seng exemplifies a robust style of vernacular architecture, adept at conserving Bugis values in the face of changing historical and environmental conditions.

CONCLUSION

This research demonstrates that Saoraja Seng in Soppeng Regency exemplifies the evolution of traditional Bugis architecture, which maintains cultural values despite colonial and contemporary influences. The results indicate that architectural features, such the hipped roof, Malay-style windows, and stairs with an odd number of steps, continue to embody the social identity and symbolic values of the Bugis group. Despite the exclusion of specific traditional elements like as the timpalaja, the structure nonetheless embodies social hierarchy, cosmological equilibrium, and the relationship between physical space and cultural significance. The discourse confirms that Saoraja Seng serves both as an aristocratic dwelling and as a representation of Bugis cultural tenacity amid evolving circumstances.

A Bugis house built during the Dutch colonial period. The shape of this house exhibits significant differences compared to other Bugis houses. The Saoraja Seng house, for example, is a building type found only in Soppeng Regency and not in other Bugis regions. Its unique shape and structure make this house a distinctive representation of local architectural adaptations to colonial influences, while also enriching the treasury of vernacular architecture in the Asian region.

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Therefore, conservation and documentation efforts for the Saoraja Seng house are necessary to maintain its authentic form and historical value. This preservation is crucial not only for preserving the cultural heritage of Bugis architecture but also as a source of knowledge and learning for future generations in understanding the dynamics of traditional architectural transformation in Indonesia.

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LUWU PALACE AND THE PLANNING OF CULTURAL LANDSCAPES: REFLECTIONS OF BUGIS SOCIO-SPATIAL ORDER

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Abstract

The Luwu Palace serves as a cultural emblem of the Bugis people, representing their traditional social hierarchy and political power. This study seeks to analyze the historical and physical evolution of the palace and its function in preserving Bugis identity in the context of colonial impact and contemporary development. The research utilizes a qualitative-descriptive methodology, incorporating literature review, visual analysis, and field observation. Data were gathered from historical documents, archival records, and direct observations. Research demonstrates that despite alterations in the palace's structure and purpose, its fundamental cultural values persist. The creation of the Langkanae replica and the adaptive repurposing of the palace into a museum demonstrate continuous endeavors to reinterpret and safeguard the Bugis cultural environment and identity in a modern setting.

Keywords: Luwu Palace, Bugis identity, Cultural landscape, Spatial transformation, Heritage preservation

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INTRODUCTION

A cultural landscape is not only composed of physical elements; it is also influenced by social, historical, and symbolic frameworks that indicate how a community understands space and organizes its lives within it. In Bugis culture, social structures, belief systems, and daily activities are closely linked to hierarchical and cosmological understandings of space.

The Luwu Palace, or *Langkanae*, is a clear example of how space can function as a political and symbolic center for the Luwu Kingdom. The Bugis people's socio-spatial logic is demonstrated by its architectural design and location in the Palopo region. Every component of the space, from the building's orientation to its layout, reflects inherited cultural values and meanings.

The Luwu Palace is not only a historical building. It serves not only as a geographical landmark and center for customary practices, but also has a significant impact on the settlement patterns of the surrounding area. It is crucial to understand how this palace influences the broader cultural context. Spatial design strategies that seek to maintain and integrate local traditions into modern planning are essential.

This reserach examines the Luwu Palace as a representation of Bugis socio-spatial principles and explains how these principles can serve as guidelines for building a sustainable cultural landscape. To support a planning approach that bridges heritage continuity with modern spatial change, this study investigates the relationship between spatial order, cultural symbolism, and architectural design. (see Figure 1).

The object study just one, the Luwu Palace (*Langkanae)* so the results cannot fully describe the various forms, functions, and architectural dynamics of other traditional Bugis palaces. This single method limits the generalizability of the results to broader cultural and spatial contexts, especially since each palace has a different historical setting, environmental conditions, and symbolic value. Furthermore, interpretations of changes in the palace's form and function rely on secondary sources and local interviews due to the limited amount of historical data and architectural documentation. This can introduce subjective bias into the analysis.

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Figure 1. Kingdom luwu palace built by Colonial

LITERATURE REVIEW

(Pelras, 1996) offers a comprehensive analysis of the Bugis people's social system, culture, and cosmology, encompassing their perceptions of space and settlement configurations. He elucidates how traditional Bugis mansions and palaces embody the social order and spiritual principles inherent in Bugis civilization. Pelras's findings provide an essential basis for understanding the Luwu Palace, which serves as both a political emblem and an architectural manifestation of the Bugis cosmological and social order.

(Nas, 2012) examines the importance of symbolic and cultural legacy in the development of traditional towns in Indonesia. He underscores the pivotal function of symbolic edifices, such as palaces or royal courts, in organizing spatial orientation and influencing the cultural landscape of a society. This viewpoint is crucial for examining the role and significance of the Luwu Palace in the urban context of Palopo, along with its consequences for heritage-oriented spatial design.

(Waterson, 2009) although focusing on Toraja society, offers a valuable comparative perspective on how social structures and customary rites are manifested in spatial arrangements and architectural forms. Waterson highlights the importance of the interconnectedness between cultural landscapes, spirituality, and local power—a dynamic that is also evident in the context of Luwu and the architecture of *Langkanae* as a socio-spatial symbol of Bugis identity.

(Tjahjono, 1998) provides an extensive examination of traditional Indonesian architecture, encompassing the residences and palaces of ethnic groups in Sulawesi. And depicts architecture as a manifestation of cultural identity and a tool of authority. The Luwu Palace serves as a pivotal element in

the arrangement of the Bugis cultural environment, functioning as a visual embodiment of a meticulously organized socio-political hierarchy.

RESEARCH METHODOLOGY

This study utilizes a qualitative methodology using a case study approach, concentrating on the Luwu Palace (*langkanae*) as the primary subject of examination. This methodology was used to provide a comprehensive examination of the interplay between the palace's architectural design, Bugis cultural principles, and the development of a cultural landscape that embodies the local socio-spatial hierarchy. Data were gathered via direct observation of the palace's physical attributes and its surrounding environment, comprehensive interviews with traditional leaders, cultural experts, and urban planners, alongside a literature review and the examination of historical documents, including colonial archives, antiquated maps, and photographic records. A triangulation method was employed to validate the data through the integration of several information sources.

Thematic and contextual data analysis was conducted, elucidating the interconnections among spatial form, social organization, and the symbolic significances inherent in the spatial arrangement of the Luwu Palace. A spatial morphological technique was utilized to discover temporal landscape variations and evaluate how these alterations either uphold or conceal traditional Bugis values. This project aims to enhance cultural landscape planning based on local expertise and strengthen spatial identity within sustainable regional development.

ANALYSIS AND DISCUSSION

The geographical and historical evolution of the Luwu Palace illustrates the dynamic interaction of power, culture, and space within the socio-spatial framework of Bugis society. The palace, originally founded at Malangke—a strategically significant area that functioned as the first center of the Luwu Kingdom—was positioned according to Bugis cosmology, indicating that the site selection was deliberate and not random. It encapsulated the ideas of ecological, social, and spiritual equilibrium. The transfer of the royal throne to Palopo signified a reconfiguration of the political landscape, indicating changes in settlement patterns and social activity centers. The previous palace location in Malangke is now home to a post office, a symbolic substitute that signifies the obliteration of traditional authority's physical manifestation and the conversion of a once-sacred area into a secular, bureaucratic environment.

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Figure 2. Distance between Malangke to Palopo

The Dutch's incineration of the ancient palace constituted a significant disruption in Luwu's cultural environment. This action was not only physical; it was profoundly symbolic, embodying a colonial endeavor to disrupt the continuity of local governance and obliterate Bugis architectural identity. The stone edifice, constructed by the Dutch, symbolized colonial supremacy; nevertheless, it was subsequently repurposed as a royal house and cultural museum, evolving into a hybrid environment that integrates aspects of both the former and contemporary regimes. This progression illustrates adaptive processes and identity negotiation within dynamic spatial settings in cultural landscape design.

The erection of a *langkanae* replica adjacent to the colonial stone palace enhances the palace's significance as a symbolic nucleus within the Bugis cultural milieu. The reproduction transcends mere visual portrayal of the past by reinstating the cosmological significance, social hierarchy, and traditional values that the original *langkanae* originally embodied. The interplay between colonial architecture and traditional rebuilding forms a complex cultural environment, abundant in story, where memory, identity, and socio-spatial systems persist within the urban fabric of Palopo. The Luwu Palace is not just an architectural relic; it serves as a cultural reference that consistently mirrors and influences the Bugis socio-spatial structure within the wider frameworks of history, colonialism, and modern heritage conservation. A map depicting the extent of the Luwu Kingdom’s domain can be seen in Figure 3.

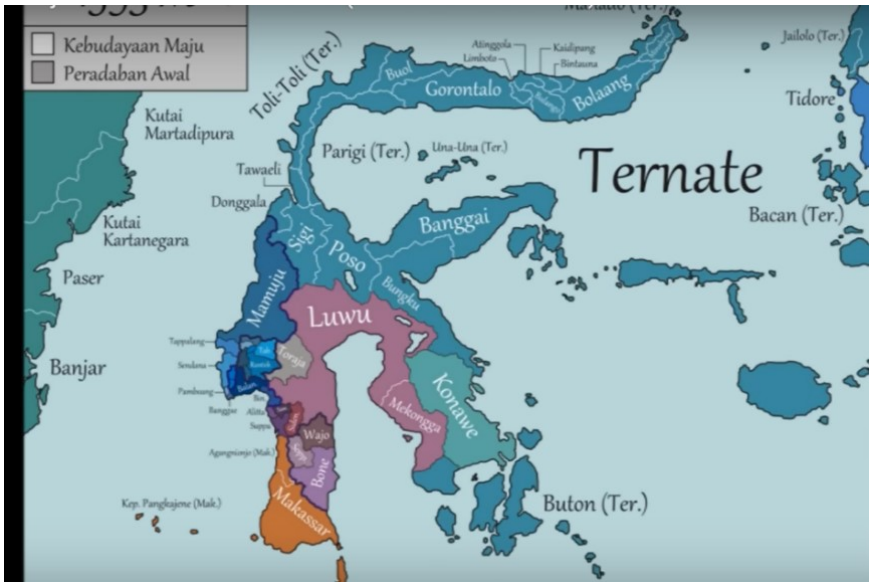


Figure 3. Map Kingdom of Luwu Area in year 1600

History of the Luwu Kingdom

Kingdom of Luwu History[1]	
Batara Lattu	Batara Lattu ruled for 20 years and is estimated to have reigned around the year 948 AD
Batara Guru (the year 900s)	According to *I La Galigo*, the Luwu Kingdom was once ruled by a king named Batara Guru. *I La Galigo* further explains that the Luwu Kingdom existed during the era of the Srivijaya Empire
Isumpurusiang (the year 1268)	According to the *Nagarakretagama*, written by Prapanca in 1364 during the era of Gajah Mada, the Luwu Kingdom was noted in the year 1268. At that time, the king of Luwu was Simpurusiang (the third king of Luwu).
The 14th century	From 1495 to 1520 (Dewa Raja), the kingdom held significant power on the southwest and southeast peninsulas,
	conducting military campaigns against neighboring kingdoms, Wajo and Sidenreng.
The 16th century	On the 4th or 5th of February, 1605, Datu Luwu, La Patiwareq Daeng Pareqbung, became the first ruler from the southern region of Sulawesi to embrace Islam
	The king changed his name and adopted the title Sultan Muhammad Wali Mu'z'hir (or Muzahir) al-Din
	The power of Luwu began to wane in the 16th century due to the rising strength of agrarian kingdoms from the south, and its military defeats are documented in the *Tawarik Bone*
	In 1620, the Luwu Kingdom relocated its capital from Malangke to a new capital, Palopo. At that time, the population of Malangke was approximately 15,000 people
The 19th century	James Brooke noted that in the 1830s, Luwu was the oldest Bugis kingdom

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The 20th Century	In 1905, the Dutch landed in the Luwu region
	In 1920, the Dutch constructed Langkanae using stone materials after burning the original wooden structure. It now serves as a museum
	The burning of Langkanae by the Dutch symbolised that the Luwu Kingdom was now under Dutch administration
	1. The governance system of Luwu is divided into two levels of administration: 2. High-level governance is directly held by the Dutch authorities. 3. Low-level governance is managed by the Swapraja
	The territory of the Luwu Kingdom was subsequently divided at the discretion and for the benefit of the Dutch into two *Afdelingen* and one district: 1. **Poso** was separated and established as an *Afdeling*. 2. **Pitumpanua** was designated as a district and incorporated into the jurisdiction of Wajo. 3. **Luwu** was also established as an *Afdeling* with its administrative seat in Palopo
	Subsequently, the Luwu *Afdeling* was divided into five *Onder Afdelingen,* namely: 1. *Onder Afdeling Palopo*, with its capital in Palopo. 2. *Onder Afdeling Makale*, with its capital in Makale. 3. *Onder Afdeling Masamba*, with its capital in Masamba. 4. *Onder Afdeling Malili*, with its capital in Malili. 5. *Onder Afdeling Mekongga*, with its capital in Kolaka.
[1] *interview results with closed Family kingdom of Luwu, in February 2024*	



Figure 4. Facade of *Langkanae*



Figure 5. Modul of Main House

Photograph; Andi Abidah 2024 FebruaryPhotograph; Andi Abidah 2024 February

The Luwu Kingdom, a significant force in Sulawesi, exerted considerable political, economic, and cultural influence, mostly owing to its dominance over trading routes in Bone Bay. It served as a significant center for

the dissemination of Bugis religion and culture (Pelras, 1996). The royal palace, *Langkanae,* epitomizes the kingdom's magnificence and status.

At its zenith, the Luwu Kingdom was instrumental in unifying many ethnic groups throughout Sulawesi and cultivating diplomatic contacts with other kingdoms in the archipelago. Nonetheless, its influence started to diminish with the emergence of Dutch colonial authority in the 19th century (Andaya, 1981)

Notwithstanding its fall, the Luwu Kingdom has endured as a political and cultural institution. The royal bloodline persists, with a currently acknowledged king, safeguarding the traditions and cultural legacy of Luwu.

The Luwu Palace's architecture reflects Bugis culture, mythology, and hierarchy.

The design of the Luwu Palace (*langkanae*) distinctly embodies the cosmology and social hierarchy of Bugis culture through its symbolically significant vertical and horizontal architectural arrangement. The elevated, stratified roof, the principal central hall, and the elevated underfloor space represent the Bugis tripartite cosmology perspective of the upper world, middle world, and underworld, grounded in ideas regarding the connection among humans, ancestors, and the cosmos. (Pelras, 1996) asserts that the architecture of the Bugis home directly mirrors the spiritual and social hierarchy inherent in indigenous mythology. Moreover, the spatial arrangement within the palace, including the *lontang isaliweng* for public activities, the *lontang ritangnga* for the family head, and the *lontang rilaleng* allocated for women and elder family members, exemplifies a delineation of roles predicated on age, gender, and social status, as articulated by (Abidah, 2016).

Within cultural landscapes, the palace's location and orientation function as a symbolic focal point that structures settlement patterns and public spaces in the city of Palopo. The research conducted by (Raqena et al., 2020) emphasizes the significance of architectural heritage qualities, including form integrity, spatial-environmental connectedness, and the continuation of cultural meaning, in influencing local community identity. The demolition of the ancient Luwu Palace by the Dutch and its later restoration in stone indicated a transition in cultural supremacy. Nonetheless, the converted edifice, which subsequently functioned as a royal residence and cultural museum, exemplifies a local adaptation to new circumstances while retaining its symbolic and cultural significance. This phenomenon corresponds with the notion of adaptive reuse heritage articulated by (Raqena et al., 2020), which advocates for the conservation of cultural values via the contextual repurposing of historical sites.

The Luwu Palace serves not only as an architectural structure but also as a significant reference within the cultural milieu, actively mirroring and influencing the Bugis socio-spatial hierarchy. The palace exemplifies how cultural landscape planning can effectively incorporate local heritage by

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synthesizing cosmological values, social structure, and customary symbolism in spatial form and configuration, thereby preserving its physical form and sustaining the embedded cultural values, social structures, and collective memory.

The cultural context of the Luwu Palace's historical and physical history shows how it protected Bugis identity during colonial crises and modern development.

The Luwu Palace's historical and physical evolution illuminates Bugis power, culture, and identity shifts. The palace's move from Malangke to Palopo was a spatial adaptation to shifting political, geographical, and socio-cultural conditions as a political center and cosmological emblem. This movement shows that traditional places are not permanent in cultural landscape design. According to (Rapoport, 1969) , traditional architectural forms and location are always influenced by belief, social practises, and power relations.

Colonial interference, particularly the Dutch destruction of the ancient palace and its stone rebuilding, was meant to break the spatial narrative and undercut the Luwu Kingdom's symbolic authority. However, such efforts failed to break Bugis culture. Instead, they show cultural resilience as communities adapt to cultural legacy. (Ashworth et al., 2007) note that community-driven reinterpretation and symbolic resistance typically maintain cultural heritage. The creation of a *langkanae* castle replica and the usage of the colonial-era stone edifice as the royal house and museum indicate a process of negotiating identity in a mixed geographical setting.

The palace's importance in sustaining Bugis identity may also be understood through (Sauer, 1925) the cultural landscape, which is the complex link between human activity and the environment molded by historical and symbolic processes. The Luwu Palace is a socio-spatial anchor in Bugis society. The direction, proximity to other communities, and space utilization enhance social order and conventional authority. Its Bugis sacred significance and geographical prominence have persisted while its physical form changed.

In current development, Luwu Palace remains a symbol of the past and present. Heritage as a process (Harvery, 1990) is a dynamic social construct that each generation reinterprets. Replicating *langkanae* and turning the palace into a museum show how traditional aspects may be incorporated into modern urban design without losing their cultural significance.

The spatial and historical transformation of Luwu Palace demonstrates that traditional architecture is a living narrative that reflects social structures, challenges colonial domination, and adapts to modernity. The changes to the palace demonstrate the ability of traditional architecture to endure and change without losing its cultural significance, as well as the political and social

developments of Bugis society. Consequently, Luwu Palace serves as a representation of cultural power, connecting the present and the past.

The palace's design plays a crucial role in maintaining Bugis identity within a cultural context by preserving the symbolic and cultural values embodied in its structure. By reinforcing cultural values into tangible spaces, this effort strengthens the social cohesion of the local community. It creates a symbolic continuity between modern life and ancestral heritage. Consequently, Luwu Palace is not only a historical relic but also plays an active role in building and maintaining Bugis cultural identity amidst changing times.

CONCLUSION

The Luwu Palace (*langkanae*) has undergone significant geographical and physical changes. These changes demonstrate its significant role in the history and culture of the Bugis people. The palace was originally located in Malangke, the political center of the early Luwu Kingdom. The kingdom's strategy shifted dramatically when the palace moved from Malangke to Palopo. This shift demonstrates how political and economic changes over the years influenced the Bugis center of power.

The palace complex underwent significant physical transformation during the colonial period, when the Luwu palace (*langkanae*) was destroyed by fire and rebuilt using stone. This change in materials demonstrates the colonial influence on the kingdom. Therefore, the Luwu Palace serves as a representation of the fusion of local traditions and colonial influences, transforming the Bugis architectural landscape.

The cultural and symbolic value of the Luwu Palace has not been lost, despite its numerous transformations. Today, the royal family occupies the building as a residence and cultural museum. The Luwu Palace remains central to the Luwu people's cultural identity, with its dual role demonstrating the continuity between historical and social functions. By fulfilling these functions, the Luwu Palace continues to be a living space connecting the Bugis past, present, and future.

As part of efforts to preserve cultural heritage, a replica of the *Langkanae* Palace in Palopo City has been rebuilt adjacent to the colonial-era Luwu Palace. This reconstruction aims to educate the younger generation about culture and honor the kingdom's architectural heritage. To reflect the balance between symbolic and functional functions in community life, the layout of the palace and surrounding buildings adheres to the traditional Bugis socio-spatial structure.

Furthermore, this research enhances our understanding of how traditional architecture adapts to social, political, and material changes. This process of adaptation demonstrates the ability of Bugis culture to adapt to the challenges of modernity without losing its identity. The architecture of the Luwu

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Palace demonstrates the continuity of traditional values in the context of changing times by blending old and new elements.

More broadly, the findings of this research contribute to the study of vernacular architecture in Southeast Asia, particularly in understanding how traditional centers of power display cultural identity and architectural strategies amidst colonial and modern influences. The study of Luwu Palace shows that the architecture is a representation of the value system, symbolism of power, and cultural adaptation that developed during the history of Bugis society.

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THERMAL COMFORT ADAPTATION IN OFFICE BUILDING PLANNING: A STRATEGY FOR SUSTAINABLE URBAN DEVELOPMENT IN BIREUEN

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Abstract

In tropical urban areas, thermal comfort is a critical consideration in the planning and design of office buildings, particularly in efforts to enhance energy efficiency and promote sustainable development. This study investigates how behavioural, physiological and psychological adaptations to thermal conditions among office users in Bireuen Regency can inform more responsive and sustainable building design strategies. A quantitative descriptive method was applied, supported by digital thermal simulations. Data were collected from 500 respondents across three government office buildings: the Central Government Office, the PUPR Office, and the Universitas Almuslim Rectorate. The parameters examined included ventilation, clothing adjustments, and the utilisation of air conditioning. The findings indicate that 80% of respondents actively modified their room conditions, while 85% relied on air conditioning when experiencing overheating. Approximately 65% of respondents considered the ideal temperature range to be 16°C–20°C – significantly lower than the theoretical optimum of 25°C. Furthermore, 60% of respondents were unaware of the energy implications of their thermal preferences. Notably, the entire sample expressed a willingness to adopt energy-conserving behaviours. The study concludes that user adaptation to thermal conditions plays a crucial role in shaping effective indoor climate strategies and provides valuable insights for planners to support sustainable urban policies.

Keywords: thermal comfort, adaptation, office building, energy efficiency, sustainable planning

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INTRODUCTION

Thermal comfort is a crucial aspect of creating a healthy and productive building environment, especially in office buildings that operate for extended periods. Most buildings rely on air conditioning (AC) systems to achieve optimal thermal conditions, which significantly contribute to overall energy consumption. Electricity use for air conditioning systems is estimated to account for 50% to 60% of a building's total electricity consumption (Setiawan et al., 2024). Conventional HVAC systems are typically designed without adequate consideration of local climate conditions and contextual thermal comfort, which can result in excessive energy use (Nematchoua et al., 2014). This approach emphasizes individuals' capacity to adapt to thermal environmental conditions through physiological, behavioural, and psychological mechanisms (de Dear & Brager, 2002; Nicol & Humphreys, 2002). to adapt to thermal environmental conditions through physiological, behavioural, and psychological mechanisms. a vital role in minimizing heat gain (Singh et al., 2017). These architectural factors contribute significantly to adaptive thermal comfort by promoting natural ventilation and reducing dependence on mechanical cooling systems. By aligning building features with local climatic conditions, occupants are better able to acclimate to indoor environments, thereby enhancing overall thermal adaptability.

The adaptive approach is especially relevant in hot and humid climates, as it helps reduce reliance on artificial cooling systems such as air conditioning. Consequently, adaptive thermal comfort has become a major focus in research seeking to improve energy efficiency and promote climate-responsive building design. These architectural factors contribute significantly to adaptive thermal comfort by promoting natural ventilation and reducing dependence on mechanical cooling systems. By aligning building features with local climatic conditions, occupants are better able to acclimate to indoor environments, thereby enhancing overall thermal adaptability.

Adaptive models relate indoor temperature to outdoor temperature, based on the assumption that individuals will respond to environmental changes in order to achieve thermal comfort. This approach is derived from field studies and is particularly applicable to free-running buildings, where occupants have greater opportunities to adapt. However, in office environments, the potential for adaptation is often constrained by organizational culture and the use of shared spaces (Lamsal et al., 2023a). Thermal adaptation is generally categorized into three levels: (1) behavioural adaptation, such as adjusting clothing or using thermal aids (Arsad et al., 2023); (2) physiological adaptation, which includes factors such as expectations, past experiences, duration of exposure, and the level of control over the environment (Alta Integra, 2022); and (3) psychological adaptation, which refers to an individual's perception of comfort shaped by previous experiences and expectations (Alta Integra, 2022).

In Indonesia, thermal comfort standards are regulated under SNI 03-6572-2001, with defines the optimal comfort temperatures range as 22.8–25.8°C, with a relative humidity of 40–50%, and air velocity between 0.15–0.25 m/s. Meanwhile, the Predicted Mean Vote (PMV) index, as outlined in ISO 7730, is commonly used to assess thermal sensation on a scale ranging from -3 (cold) to +3 (hot), taking into account six environmental and individual parameters.

Empirical findings indicate that thermal adaptation through clothing adjustment typically occurs at temperature extremes, with peak adaptation observed at cooler temperatures. With the recorded comfort temperature was 27.3°C, the preferred temperature among occupants was lower, at 24.5°C. Furthermore, fan usage increased significantly at 31°C – reaching approximately 50% - but was nearly absent when temperatures dropped below 22.5°C. These findings underscore the importance of incorporating user-adaptive responses into the thermal design of energy-efficient, climate-responsive buildings (Singh et al., 2017). These architectural factors contribute significantly to adaptive thermal comfort by promoting natural ventilation and reducing dependence on mechanical cooling systems. By aligning building features with local climatic conditions, occupants are better able to acclimate to indoor environments, thereby enhancing overall thermal adaptability.

This study emphasizes the urgency of implementing two key strategies in managing thermal energy in buildings: reducing the energy consumption of air conditioning (HVAC) systems and analyzing the influence of behavioural, physiological, and psychological adaptations on shifts in thermal comfort zones, along with their implications for potential energy savings in office environments. This study focuses specifically on three forms of thermal adaptation – behavioural, physiological, and psychological – in the context of enhancing energy efficiency. The study was conducted at three office buildings in Bireuen Regency: the Bireuen Regency Government Headquarters, the Public Works and Spatial Planning (PUPR) Office, and the Rectorate Office of Universitas Almuslim (Umuslim) Bireuen. The findings are expected to contribute significantly to the design of energy-efficient office buildings by promoting an tailored to local climate conditions.

LITERATURE REVIEW

Adaptive Thermal Comfort

The adaptive approach to thermal comfort emphasizes the interaction between the individuals and their thermal environment, assuming that humans actively respond to changes in thermal conditions to improve their comfort levels (Lamsal et al., 2023b). This approach emphasizes the importance of the user adaptation to their surroundings and suggests that field studies more accurately reflect comfort conditions than laboratory tests. Research indicates that comfortable temperatures typically fall within ±2°C of thermal comfort standards, and

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providing occupants with control over their environment can further expand this comfort range (Nicol & Humphreys, 2002).

The indoor thermal comfort temperature range and occupants' adaptive behaviour are significantly influenced by factors such as climate conditions, ventilation type, building type, and age. Elderly individuals tend to have a wider thermal comfort tolerance compared to other age groups, while children show a narrower tolerance (Neira-Zambrano et al., 2023). Studies in Indonesia have revealed differences in thermal adaptive behaviour among office workers, factory workers, and home occupants, highlighting the role of gender, social norms, and culture in shaping AC usage preferences and clothing insulation. The results indicate that women often wear thicker clothing due to the cultural norms and demonstrate a weaker correlation between AC preferences and adaptive behaviour compared to men (Apriliyanthi et al., 2023).

Thermal conditions, indoor air quality, and energy consumption in office buildings are significantly influenced by climate variations, building design, and occupant adaptive behaviour. Discrepancies between actual temperatures and comfort standards often lead to thermal discomfort, while ventilation and air conditioning strategies play a major role in energy consumption. Thus, an affective design approach – one that considers local climate conditions and promote occupant participation in adaptive behaviour – is essential for achieving both comfort and energy efficiency (Arsad et al., 2023). Thermal comfort is defined as "a state of mind that expresses satisfaction with the thermal environment". Adaptive behaviour can be categorized into three levels:

1. *Behavioral adaptation* – Conscious adjustments made by occupants to achieve optimal thermal comfort, such as modifying clothing, using fans, or adjusting thermostats (Arsad et al., 2023).
2. *Physiological adaptation* – The body's natural responses to thermal conditions, influenced by factors such as acclimatization, exposure duration, perceived control, and environmental stimuli (Alta Integra, 2022).
3. Psychological adaptation: Shifts in perceived comfort due to expectations, past experiences, and contextual factors (Alta Integra, 2022).

These three forms of adaptation occur simultaneously, making it difficult to isolate the individuals effects of each (Nicol et al., 2012). Several adaptive comfort equations have been developed, both as part of international standards such as ASHRAE 55 and EN 15251, and for specific climate regions (Nicol & Humphreys, 2010). However, the comparative trends in the slopes of adaptive models across countries are not yet fully understood. Therefore, further literature review is needed to clarify the effects of outdoor temperature and clothing levels on comfort temperatures (Nicol et al., 2012; Singh et al., 2017).

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The adaptive principle

Principles of thermal comfort adaptation, as described in the updated *CIBSE Guide A: Environmental Design* (2021), emphasize the importance of the dynamic relationship between occupants and their environments. The adaptive comfort approach acknowledges that individuals respond to thermal stimuli through physiological, behavioral, and psychological mechanisms. Physiologically, the human body continuously makes internal adjustments to maintain thermal equilibrium, such as regulating blood flow or producing sweat. Behaviourally, occupants may respond – either consciously or subconsciously – by adjusting clothing, using blinds or curtains, opening or closing windows, or activating heating or cooling devices. Psychologically, thermal perception is influenced by personal expectations, perceived control, energy cost concerns, and cultural factors. The adaptive model is based on the principle that when individuals experience thermal discomfort due to environmental changes, they instinctively take actions to restore comfort. *CIBSE Guide A* (2021) highlights that access to personal environmental controls, such as operable windows, can significantly enhance perceived thermal comfort. This model also facilitates the evaluation of thermal comfort in naturally ventilated buildings, where occupant behavior plays a critical role. The greater the control individuals have over their environment, the broader their acceptable thermal range becomes, and the less likely they are to report discomfort. This supports the use of adaptive comfort models in climate-responsive design and in interpreting cross-cultural and cross-climate comfort data (Nicol & Humphreys, 2002).

Indoor and outdoor thermal conditions

The quality of the thermal environment in office buildings is crucial, as thermal comfort is closely linked to worker productivity. Thermal comfort is influenced by factors such as climate, geography, and the surrounding environment. Indoor thermal conditions are significantly affected by outdoor climate, particularly in naturally ventilated buildings. Naturally ventilated buildings typically maintain a comfortable indoor temperature range between 17.6°C and 31.2°C. In contrast, air-conditioned buildings tend to maintain more stable indoor temperatures, generally ranging from 22°C to 27.9°C, regardless of external weather conditions. However, even in air-conditioned buildings, the outdoor temperature can still influence thermal sensation and perceived comfort, especially when transitioning from outside to inside. The corresponding outdoor temperature range associated with these indoor conditions is between 6.7°C and 38°C (Lamsal et al., 2023b; Lisa et al., 2021; Munandar, Aris, Muliani, Zuraihan, 2023).

Personal Characteristics

Respondent information was directly obtained through questionnaires distributed to employees at the Public Works Office, the Bireuen Regency Government

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Headquarters, and the Universitas Almuslim Administration Headquarters. The personal data collected included age, gender, and length of service. A total of 500 valid samples were successfully collected from these three offices in Bireuen Regency, consisting of 250 male and 250 female respondents of productive age. An overview of respondents' age and place of work is presented in Table 1.

Table 1: Respondents' characteristics

Number of subjects	Total	Public works Office	Regency Government HQ	Universitas Almuslim Administration HQ
Age, yr	18 – 55			
Male	250	70	160	20
Female	250	50	160	40
Total	500			

Building characteristics

This section discusses the characteristics of both the workplace and residential buildings occupied by the respondents. The information collected includes the type of building – whether air conditioned (AC) or naturally ventilated (NV) – as well as the respondents' adaptive behaviours in each context. These behaviours include the intensity of AC usage (measured in hours per day), use of electric or portable fans, window-opening habits, and other ventilation practices. In addition, their thermal comfort levels in two distinct environments: their workplace and their residence. Understanding the unique characteristics of both office and residential environments is essential, as thermal habits developed in the home can significantly influence an individual's expectations and behavioural responses in the workplace. These building characteristics directly affect office energy consumption and indoor comfort conditions; for example, offices with sealed façades and limited ventilation require greater mechanical cooling energy, whereas buildings designed with natural ventilation can maintain comfort with lower energy demand. By evaluating adaptive comfort strategies across both environments, this study highlights the interplay between environmental control, energy demand, and thermal satisfaction within the workplace context.

RESEARCH METHODOLOGY

The research employed a quantitative descriptive method, involving a field survey on (Nicol & Humphreys, 2002). Data were collected using structured questionnaires and measurement instruments. The instruments utilised in this study covered a range of parameters designed to assess climate-related metrics, ventilation models, building typologies, architectural designs, and the age demographics of the respondents. The questionnaires also addressed clothing adjustments and the use of air conditioning devices, including fans and fixed AC

units. In addition to empirical data, a quantitative simulation approach was applied to assess the influence of climate on . Building simulation were conducted using digital modelling tools to analyze the effects of climate on thermal comfort, allowing data input based on location, building orientation, architectural design, construction materials, weather conditions, temperature, texture, and surface area. This study used AndrewMarsh.com software for sun analysis through 3D Sun Path modelling, while climate and weather data were sourced from climate.onebuilding.org. Wind analysis was carried out using WRPLot software.

A series of simulation measurements were conducted using the CBE Thermal Comfort Tool to evaluate comfort levels in accordance with the standards set by ASHRAE-55. The Predicted Mean Vote (PMV) model was then applied to quantify thermal sensation and overall comfort levels. Thermal comfort is defined as a subjective state of satisfaction with the thermal environment, which can be assessed through the principles of heat balance and individual thermal sensation (Tartarini et al., 2020). The Predicted Mean Vote (PMV) model was then applied to quantify thermal sensation and overall comfort levels. The Predicted Mean Vote (PMV) model was then applied to quantify thermal sensation and overall comfort levels. Thermal comfort is defined as a subjective state of satisfaction with the thermal environment, which can be assessed through the principles of heat balance and individual thermal sensation.

ANALYSIS AND DISCUSSION

CBE Thermal Comfort

The Predicted Mean Vote (PMV) model is a thermal comfort model based on the principle of heat balance and experimental data collected in a controlled climate chamber. The CBE Thermal Comfort Tool uses thermal comfort calculations in accordance with ANSI/ASHRAE Standard 55, ISO 7730, and EN 16798-1. (Tartarini et al., 2020; see Figure 2). The Predicted Mean Vote (PMV) model was then applied to quantify thermal sensation and overall comfort levels. Thermal comfort is defined as a subjective state of satisfaction with the thermal environment, which can be assessed through the principles of heat balance and individual thermal sensation.

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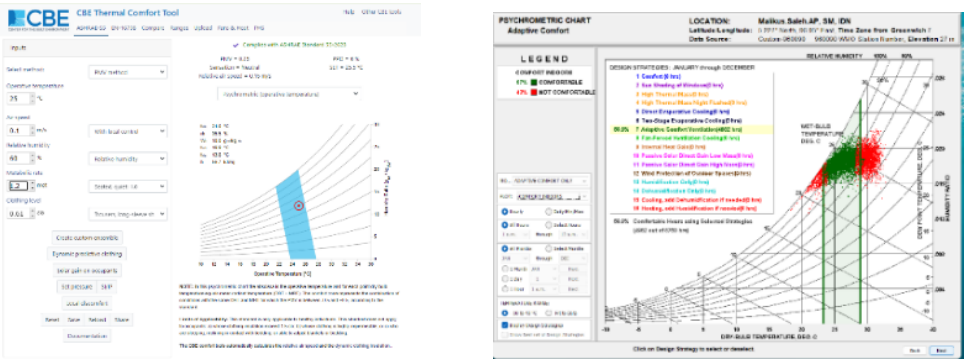


Figure 2: Thermal Comfort Scale based on the CBE Thermal Comfort Tool

Factors that determine heat gain and loss include metabolic rate, clothing insulation, air temperature, mean radiant temperature, air velocity, and relative humidity (see Figure 3).

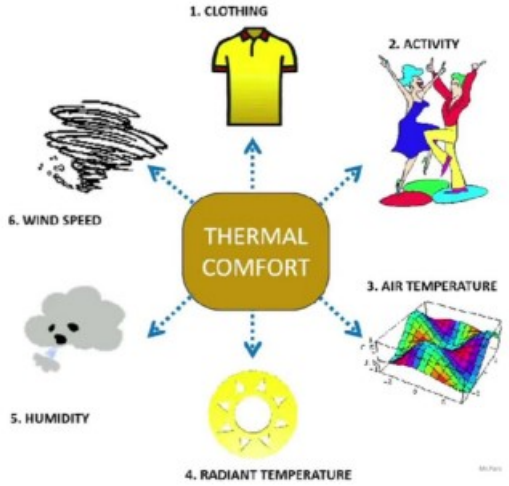


Figure 3: Thermal comfort factors, **Figure 4:** Psychrometric Chart

The CBE thermal comfort analysis of office buildings in Bireuen Regency determined that the optimal indoor temperature for office spaces is 25°C. This corresponds with an operative temperature of 25°C, air velocity of 0.1 m/s, relative humidity of 60%, a metabolic rate of 1.2 met, and a clothing insulation level of 0.61 clo. These findings are supported by research conducted on three sites: the PUPR Building, the Rectorate Office of Universitas Almuslim, and the Regency Government Headquarters Building. For air-conditioned office buildings, thermal comfort requires the use of an air conditioning (AC) unit in the

room. Furthermore, 65% of for temperatures ranging from 16°C to 20°C. Survey results indicate that 20% of respondents felt comfortable at temperatures between 20°C and 22°C, while 15% reported comfort at 22°C to 25°C. These findings are based on the psychrometric chart (Figure 4). The temperature range considered to meet the adaptive comfort criteria falls between 24 °C and 28 °C.

Building characteristics

This section discusses the characteristics of both the workplace and residential buildings occupied by the respondents. The information collected includes the type of building – whether air conditioned (AC) or naturally ventilated (NV) – as well as the respondents' adaptive behaviours in each context. These behaviours include the intensity of AC usage (measured in hours per day), use of electric or portable fans, window-opening habits, and other ventilation practices. In addition, respondents were asked to evaluate their thermal comfort levels in two distinct environments: their workplace and their residence. Understanding the unique characteristics of both office and residential environments is essential, as thermal habits developed in the home can significantly influence an individual's expectations and behavioural responses in the workplace.

Sun and wind factors are closely related to building orientation and the orientation of openings (Figure 5). Building orientation impacts protection against solar radiation – for example, a facade facing south or north can reduce exposure to direct sunlight (Kalangi Judy O., 2016).

Case Study I: Bireuen Regency Government Headquarters

The Bireuen Regency Government Headquarters is located at coordinates 5°12'26.72"N and 96°43'35.18"E. The building is oriented to the south and designed with an open layout featuring a corridor that surrounds the structure, serving as a circulation path between rooms. Artificial ventilation is applied only in enclosed office spaces, while the open corridors rely on natural ventilation. The building's spatial arrangement follows a linear pattern aligned with the sun's path, and its largest facades are oriented according to prevailing wind directions to enhance cross-ventilation. The direction and placement of openings on all facades play a crucial role in maintaining thermal comfort. According to the survey, 85% of respondents stated that the orientation and location of the building affected the amount of sunlight entering the rooms. Excessive sunlight led to increased indoor temperatures and glare, making occupants uncomfortable, especially during working hours. In response, 85% of respondents preferred rooms with lower light intensity to avoid visual strain and overheating. These findings demonstrate that building orientation, solar exposure, and ventilation design significantly influence thermal comfort (Ariffin, 2015). Proper alignment with wind direction promotes passive cooling through natural ventilation, while controlling solar penetration helps maintain acceptable indoor temperatures and

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visual comfort (Majid et al., 2018). Therefore, architectural design decisions—such as building orientation and façade openness—are essential for achieving thermal comfort in tropical climates. This finding relates to the study's objective by showing that visual discomfort due to excessive sunlight contributes to overall thermal dissatisfaction, influencing adaptive behaviour and energy use preferences.



Figure 4: Building characteristics

Case Study II: Office of Public Works and Spatial Planning, Bireuen Regency
The Office of Public Works and Spatial Planning of Bireuen Regency is located at coordinates 5°11'59.02"N and 96°42'7.86"E. The architectural design of the building is enclosed, relying exclusively on artificial ventilation systems for indoor air circulation. The building is orientated toward the east, with a longitudinal spatial layout running from east to west (Figure 6). The fenestration on all sides of the edifice follows the shape and flow of the structure. Survey results indicated that a significant proportion of respondents 85% believed that the building's orientation and placement had a substantial impact on the amount for sunlight entering the rooms. for rooms with lower light intensity to avoid glare during working hours. This discomfort was attributed to excessive solar exposure. The building's configuration, combined with its sealed construction and reliance on artificial ventilation, limits opportunities for passive cooling and increase dependence on mechanical systems to regulate indoor temperature (Jamaludin et al., 2016).

Furthermore, high levels of solar radiation have been shown to cause overheating and visual discomfort, both of which negatively affect thermal comfort. Therefore, it is imperative to understand the interplay between spatial design, solar exposure, and ventilation strategies to ensure optimal thermal comfort in tropical environments. This finding relates to the study's objective by showing that visual discomfort due to excessive sunlight contributes to overall thermal dissatisfaction, influencing adaptive behaviour and energy use preferences.



Figure 5: Building characteristics

Case Study III: Rectorate Office of Universitas Almuslim

The Rectorate Office of Universitas Almuslim is located at coordinate 5°11'39.19"N and 96°47'15.21"E. The architectural design of the building is based on a semi-open concept. The air circulation system integrates a closed ventilation system within the workspaces, complemented by an open-air system in the corridor. The building is oriented to the north, with a symmetrical and linear layout directed along the west-south axis (Figure 7). The apertures surrounding the building have been carefully positioned to align with its geometric configuration. Survey results indicated that a significant proportion of respondents (95%) believed the architectural design – including the orientation and layout – had a noticeable impact on the amount of sunlight entering the interior spaces. Furthermore, 85% of for rooms with low light intensity, motivated by a desire to reduce glare during work activities. These findings suggest that visual discomfort caused by excessive sunlight directly influences workspace preferences. Excessive solar gain in workspaces has been shown to increase indoor temperatures and glare, leading to overheating and discomfort among occupants. In buildings with semi-open designs, effective management of sunlight exposure is essential to maintain thermal balance. It is therefore evident that appropriate building orientation, strategic placement of openings, and well-planned ventilation are crucial for achieving thermal comfort, particularly in tropical climates.



Figure 6: Building characteristics

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Behavioral Adaptation

Behavioural adaptation is the most significant contributor to the adaptive thermal comfort model. The patterns of behavioural adaptation and the application of environmental controls in residential buildings vary depending on the season and climate condition (Yadeta et al., 2023). Examples of behavioural adaptations to regulate the indoor thermal environment include openings window, adjusting clothing insulation, and using fans or air conditioners (Arsad et al., 2023). Building orientation – such as facing towards or away from the sun – as well as the location and number of ventilation openings, also influence thermal comfort (Sarinda et al., 2017).

Typical examples of behavioral adaptation for energy conservation include opening or closing windows, adjusting curtains, turning fans or air conditioners on or off, and regulating AC temperature settings. Another common practice is switching off lights and electronic devices when they are not in use. These behaviors are supported by research findings that highlight the significant influence of behavioural adaptation on thermal comfort.

A significant proportion of respondents, approximately 80%, reported regularly adjusting indoor conditions throughout the day in response to changes in the external environment. Such adaptive actions allow occupants to maintain a thermally comfortable indoor climate by responding to variables such as solar radiation, humidity, and outdoor air temperature. By modifying environmental factors including airflow and temperature, residents can effectively mitigate discomfort caused by excessive heat or cold. It can thus be concluded that behavioural adaptations play a critical role in achieving and maintaining optimal thermal comfort in buildings.

Psychological Adaptation

Psychological adaptation refers to a state of mind in which individuals feel satisfied or comfortable with the thermal environment. It involves changes in a person's mindset, attitude, and behaviour in response to new situations or conditions. In the context of energy conservation, psychological adaptation includes the mental processes that enable individuals to alter their habits and lifestyle to become more sustainable. Survey results revealed that 100% of respondents actively engage in energy conservation practices both at home and in the office. They understand the reasons behind these efforts, are motivated to conserve energy, and also seek to influence others to adopt energy-saving behaviours.

Ethical Statement: All respondents participated voluntarily and provided informed consent. The study complied with ethical research standards for survey-based studies established by Universitas Almuslim.

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CONCLUSION

Thermal comfort adaptation results from human interaction with the thermal environment, which is influenced by climate, geographic location, and building characteristics. This study identifies three main forms of adaptation: physiological, behavioural, and psychological. Physiological adaptation is reflected in occupants' ability to respond to thermal conditions based on past experiences. Approximately 50% of respondents reported feeling too hot or too cold in the office, and 85% of them indicated they would turn on the air conditioner to adjust the indoor temperature. However, 60% of respondents were unaware that inappropriate indoor temperatures could impact energy consumption, although 65% believed the ideal indoor temperature to be between 16°C and 20°C. In terms of behavioural adaptation, the majority of respondents (80%) actively adjusted room conditions to align with outdoor environments and practiced energy-saving habits, such as turning off air conditioners and lights when not in use. Psychological adaptation was evident in respondents' awareness and commitment to energy conservation: all respondents (100%) demonstrated motivation, understanding, and a willingness to influence others in adopting energy-efficient behaviours. These findings highlight the importance of integrating strategies into office building design – especially in tropical climates – as a key component of sustainable development and energy efficiency initiatives.

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HISTORIC URBAN GREEN SPACES AND ELDERLY RESILIENCE: INSIGHTS FROM TAIPING LAKE GARDENS A PLACE IN AGEING

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Abstract

Historic urban green spaces play a key role in promoting elderly resilience and active ageing, yet their potential remains underexplored in Malaysia. Taiping Lake Gardens, the nation's oldest public park, offers a unique environment where nature and heritage converge, presenting opportunities to enhance elderly well-being. This study investigates how such spaces, particularly Taiping Lake Gardens, support the physical, mental, and social resilience of the elderly. Adopt a mixed-methods approach, the study explores usage patterns, accessibility, and perceived benefits among elderly visitors. The objectives are: (1) to examine the relationship between the use of historic green spaces and elderly resilience in terms of physical activity, psychological well-being, and social interaction; (2) to assess the accessibility, safety, and inclusivity of Taiping Lake Gardens for active ageing; and (3) to develop design and policy recommendations for elderly-friendly improvements. Findings reveal that the park facilitates daily mobility through walkable paths, supports mental wellness via nostalgic and restorative landscapes, and encourages social interaction in communal spaces. However, barriers such as uneven pathways, limited shaded seating, and safety concerns reduce its effectiveness. The study proposes improvements based on universal design and ageing-friendly policies, including participatory planning and targeted programmes. It offers practical insights for optimising historic green spaces to support healthy and resilient ageing in Malaysia.

Keywords: Elderly Resilience; Active Ageing; Historic Urban Green Spaces; Taiping Lake Gardens; Well-being

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INTRODUCTION

Urban green spaces play a fundamental role in enhancing the well-being of ageing populations by providing opportunities for physical activity, social interaction, and psychological relaxation. As urbanisation intensifies, the preservation and adaptive use of historic parks become increasingly important in maintaining a high quality of life for the elderly. Taiping Lake Gardens, established in 1880, is Malaysia's oldest public park and serves as a unique example of a historic urban green space that seamlessly integrates natural landscapes, cultural heritage, and community engagement.

However, while such spaces are widely recognised for their recreational and ecological values, their specific contributions to elderly resilience and active ageing remain underexplored. Many historic parks have not been systematically assessed for their role in fostering resilience among elderly individuals. Given Malaysia's rapidly ageing population, understanding how Taiping Lake Gardens supports active ageing is essential for informing future planning strategies and policy development. This study aims to evaluate how historic urban green spaces, specifically Taiping Lake Gardens, contribute to the physical, mental, and social resilience of elderly users by assessing their usage patterns, accessibility, and perceived benefits through a mixed-methods approach. To achieve these aims, several key objectives are outlined: (i) to examine the relationship between the use of historic urban green spaces and elderly resilience across physical activity, psychological well-being, and social engagement; (ii) to assess the accessibility, safety, and inclusivity of Taiping Lake Gardens in facilitating active ageing among the elderly; and (iii) to develop strategic design and policy recommendations for improving the role of historic parks in promoting healthy and resilient ageing.

To address these objectives, the research seeks to answer the following questions: (i) How do elderly individuals engage with Taiping Lake Gardens to support their physical, social, and mental well-being (ii) What spatial and environmental characteristics of the park contribute to elderly resilience and active ageing and (iii) What design and policy interventions can enhance the usability and accessibility of Taiping Lake Gardens for the ageing population. By addressing these questions, this study contributes to the broader discourse on urban ageing, landscape resilience, and cultural heritage. It uniquely contributes to the growing body of literature on heritage landscapes and elderly resilience by contextualising these dynamics within Malaysia's urban planning framework. While prior studies have examined green space benefits for ageing populations, few have explored how historic parks such as Taiping Lake Gardens simultaneously serve as heritage assets and therapeutic landscapes. The findings provide planning insights for integrating cultural identity with age-friendly design in Malaysia's urban environments.

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LITERATURE REVIEW

The Role of Urban Green Spaces in Elderly Well-Being

Urban green spaces play a pivotal role in enhancing the health and well-being of ageing populations in Perak. Exposure to natural environments has been shown to foster physical activity, reduce stress, and promote social engagement among the elderly. A systematic review by Ali et al. (2020) highlights the significant influence of green space characteristics on the subjective well-being of elderly individuals.

In Malaysia, several studies have examined the psychological and physiological benefits of urban green spaces. Mohammed Shobri (2024) and Mokhtar et al. (2018) found that both Taman Botani Perdana and Jalan Bukit Bintang in Kuala Lumpur contributed positively to the mental health of visitors. Similarly, Sazali et al. (2021) explored the role of urban green open spaces in fostering health resilience among the elderly, emphasising the need for quality environments to support healthy ageing. Service quality also plays a role in elderly engagement and well-being. Research by Sazali et al. (2022) in Penang revealed that satisfaction with park facilities directly influenced the health and lifestyle resilience of the elderly users, suggesting that well-maintained and accessible green spaces encourage active ageing. While existing literature underscores the benefits of green spaces for elderly well-being, limited attention has been given to historic green spaces. Further research is needed to examine how these culturally significant landscapes support cognitive function, mobility, and social interaction. Insights from such studies can inform inclusive urban planning strategies that promote resilience and quality of life among the ageing population.



Figure 1: Nostalgic landscapes in Taiping Lake Gardens strengthen memory and identity, enhancing elderly users' psychological health

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Elderly Resilience and Active Ageing

Resilience among the elderly refers to their ability to adapt and maintain well-being despite age-related challenges. Recent research highlights social engagement, physical health, and psychological well-being as essential components of successful ageing. Urban green spaces contribute significantly by offering settings that support outdoor activity, social interaction, and cognitive stimulation. When designed with age-friendly infrastructures, such as accessible paths, adequate seating, and safety measures, these spaces enhance the quality of life for the elderly. In Malaysia, studies have begun exploring the built environment's role in promoting active ageing. Jumadi et al. (2019) examined elderly Muslims' housing environments, revealing the importance of supportive surroundings for physical, social, and psychological well-being. Similarly, Ismail et al. (2023) investigated preferred retirement village features, stressing the need for age-friendly designs tailored to elderly needs. Ali et al. (2020) introduced the Seniors' Outdoor Survey (SOS), an environmental audit tool evaluating green space elements like fascination, being away, extent, and compatibility, which influence attention restoration among the elderly.



Figure 2: Communal spaces promote social interaction, reinforcing social resilience and community bonding

Accessibility and Inclusivity of Public Parks for the Elderly

Accessibility is a critical factor in ensuring that urban green spaces effectively support elderly users. Recent studies have highlighted the importance of designing parks that accommodate diverse mobility needs, including wheelchair-accessible paths, well-maintained walking trails, and shaded seating areas. For instance, Ibrahim et al. (2024) found that natural environments and greenery significantly enhance urban residents' psychological perceptions of walkability that improving visual quality, thermal comfort, safety, and perceived walking

distance. These factors collectively promote walking accessibility, underscoring the crucial role of green spaces in urban planning and public health.

In the Malaysian context, several studies have highlighted the accessibility challenges faced by the elderly in urban environments. Wazani et al. (2021), for example, investigated mobility issues in George Town, Penang, and found that narrow sidewalks, uneven surfaces, and physical barriers on pathways obstruct safe and easy movement. Although the study focused on persons with disabilities, the findings are equally applicable to the elderly population, who often encounter similar challenges when navigating outdoor spaces. In the case of Taiping Lake Gardens, evaluating these accessibility elements provides valuable insight into whether the park meets the needs of its ageing visitors. Improving infrastructure to include age-friendly features, such as flat, unobstructed walkways, sufficient rest areas, and clear safety signage, can significantly enhance the elderly's park experience (Jing and Misni, 2024). Ultimately, ensuring physical accessibility in urban green spaces contributes to healthier, more inclusive environments that support active and resilient ageing in Malaysia.



Figure 3: Featuring mature trees and lakeside seating in Taiping Lake Garden are ideal for rest breaks, promoting comfort and prolonged outdoor engagement for the elderly

Cultural and Emotional Significance of Historic Green Spaces

Historic urban green spaces are vital cultural landscapes that offer ecological, recreational, and symbolic value—particularly for elderly populations. These spaces often carry layers of collective memory, intergenerational attachment, and place identity, which contribute significantly to the emotional resilience and mental well-being of the elderly (Wang, 2024; Ruchi & Kumar, 2024). However, in Malaysia, the cultural and emotional potential of these spaces remains largely underexplored and underutilised in both policy and design.

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Taiping Lake Gardens, as the oldest public park in the country, exemplifies these challenges. Despite its heritage status, it suffers from insufficient maintenance, inaccessible infrastructure, and a lack of age-friendly amenities. These reflect broader national issues, such as weak heritage protection policies, fragmented management, and a disconnect between planning and cultural values. Studies in Malaysia (Mohd Yusof & Mat Yasin, 2024) and globally (Bell et al., 2014; Tanikaga et al., 2021) highlight how neglect or insensitive interventions can lead to the erosion of social and historical functions in historic gardens. Yan et al. (2023) and Yan & Geng (2024) emphasise that the elderly often form deep emotional bonds with landscapes tied to formative life experiences. When poorly managed, these spaces risk becoming irrelevant or inaccessible, undermining their restorative potential.

International case studies from Japan and the UK demonstrate how heritage gardens, when well-preserved and inclusively designed, can act as therapeutic landscapes, supporting memory recall, emotional reflection, and healthy ageing. To date, such integration is limited in Malaysia. Thus, Taiping Lake Gardens presents a critical opportunity to reimagine historic landscapes not just as preserved relics, but as adaptive, inclusive spaces that address the evolving emotional and social needs of ageing populations.

Research Gap and Theoretical Framework: Bronfenbrenner's Social-Ecological Theory

While numerous studies have explored the benefits of urban green spaces for elderly populations, there remains a paucity of research specifically examining the role of historic green spaces in fostering elderly resilience within the Malaysian context. Much of the existing literature tends to focus on generic urban parks, often overlooking culturally and historically significant landscapes such as Taiping Lake Gardens (Mohd Yusof & Mat Yasin, 2024). As one of the oldest public gardens in Malaysia, Taiping Lake Gardens embodies not only ecological value but also deep socio-cultural meaning that may influence elderly users' sense of place, identity, and well-being.

Recent research highlights the importance of integrating natural environments into age-friendly strategies and retirement care settings. For instance, Ali et al. (2022) investigated elderly preferences and requirements for green garden spaces at RSK Taiping, Perak, and revealed the role of therapeutic landscapes in promoting active ageing and enhancing quality of life. Similarly, Mohammed Shobri (2024) highlighted the mental health benefits of urban parks, advocating for designs that are responsive to the cognitive and emotional needs of elderly users. Despite these insights, there remains a research gap in understanding how the interaction between elderly individuals and historically meaningful green spaces supports resilience, defined as the capacity to adapt and maintain well-being amidst physical, social, and psychological changes

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associated with ageing. To address this gap, the present study adopts Bronfenbrenner's Theory (1979) as its guiding theoretical framework. This model provides a comprehensive lens to examine how multiple layers of environmental systems, from immediate settings such as home and park (microsystem), to community networks (mesosystem), policy and planning frameworks (exosystem), and broader cultural values (macrosystem); influence the experiences and resilience of the elderly. By situating elderly individuals within this multi-layered ecological system, the framework enables a nuanced understanding of how personal, social, and environmental interactions converge to shape elderly well-being in historic urban green spaces. Specifically, the study will explore how features of Taiping Lake Gardens support physical activity, social engagement, emotional connection, and place attachment, thereby contributing to a more resilient ageing process.

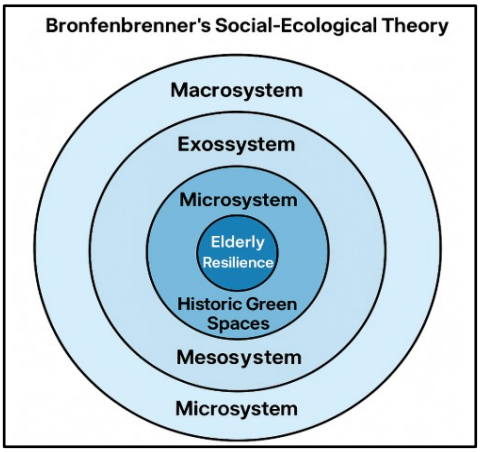


Figure 4: Theoretical Framework of Bronfenbrenner's Social-Ecological Theory to Elderly Resilience in Historic Green Spaces

Integrating perspectives from environmental psychology, social gerontology, and landscape architecture, this research contributes to the development of age-inclusive green space design and planning. It also aims to inform policies that support ageing in place through the preservation and enhancement of culturally significant urban landscapes.

METHODOLOGY

Research Design

This research has adopted a mixed-methods approach, integrating both quantitative and qualitative data collection techniques. Quantitative data were gathered through structured surveys distributed to elderly individuals (aged 55 and above) who frequent Taiping Lake Gardens. The survey aimed to capture

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patterns of engagement, perceived benefits, and environmental preferences. Simultaneously, qualitative observations were conducted on-site to document behavioural patterns, spatial interactions, and environmental qualities experienced by elderly users. This dual approach will ensure a comprehensive understanding of how elderly visitors engage with the park, what environmental features contribute to their resilience, and what gaps exist in terms of inclusive and age-sensitive design. However, the study acknowledges certain limitations, including the reliance on self-reported data, which may be subject to bias, and the site-specific nature of the research, which may limit the generalisability of findings to other historic urban green spaces.

Site Study

Taiping Lake Gardens, established in the 1880s, is Malaysia's first public park, renowned for its scenic landscapes, colonial heritage, and mature rain trees. Located in the heart of Taiping, Perak, it serves as a vital urban green space for local communities, especially the elderly. Its tranquil environment, accessibility, and cultural significance make it an ideal case study for examining how historic urban parks can support elderly well-being, resilience, and active ageing through daily interaction, emotional attachment, and inclusive environmental features.

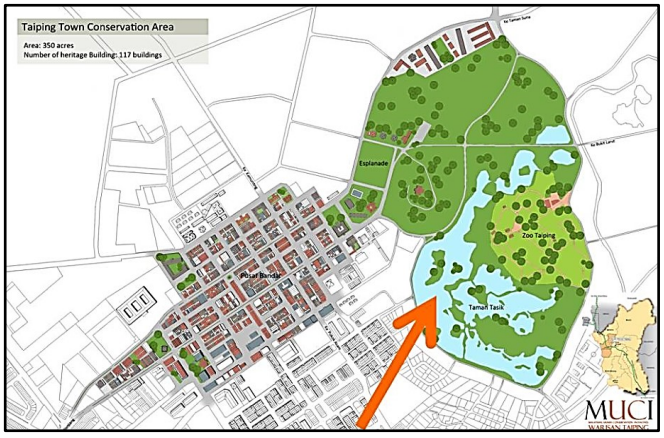


Figure 5: The Base Map of Taiping Lake Garden
Source: https://www.mptaiping.gov.my/index.php/en/taiping-heritage-trail

Sampling Criteria and Sample Size

Participants were selected based on specific criteria to ensure relevance to the study objectives. Firstly, all participants were required to be aged 55 years and above. Secondly, they had to be regular visitors to Taiping Lake Gardens, with a minimum visitation frequency of once per week. Lastly, participants needed to be both willing and able to respond to the survey questions to ensure meaningful and reliable data collection. A purposive sampling method was employed to

identify respondents who met these criteria. A total of 50 elderly respondents participated in the survey, providing adequate data for descriptive statistical analysis. In addition, systematic on-site observations were conducted over one week, covering both weekdays and weekends, to capture variations in park usage patterns and user behaviour. While the use of purposive sampling and a relatively small sample size (n = 50) limits the generalisability of the findings beyond the Taiping Lake Gardens context, this approach was appropriate for exploratory research focusing on a specific demographic group within a defined setting. Future studies employing larger and randomised samples across multiple heritage parks are recommended to enhance representativeness and strengthen the validity of comparative analyses.

This research was conducted in accordance with established ethical guidelines for studies involving human participants. All respondents were clearly informed of the study's objectives and procedures, and their participation was entirely voluntary. Informed consent was obtained before data collection, and all responses were treated with strict confidentiality and used solely for academic purposes.

Conceptual Framework

Guided by three complementary theories, Person–Person-Environment Fit Theory, Place Attachment Theory, and Social Ecology Theory, the research framework posits that elderly resilience is shaped by a dynamic interplay of physical, emotional, and socio-environmental factors. The framework comprises of three interrelated domains: (i) User Engagement: Investigates the frequency of visits, types of activities performed, and perceived health and emotional benefits; (ii) Environmental Attributes: Examines the spatial and sensory characteristics of the park such as comfort, accessibility, natural features, and heritage value; and how they influence resilience and active ageing; and (iii) Design and Policy Implications: Identifies barriers to accessibility and usability and proposes strategic interventions for improving inclusivity and well-being outcomes. This framework (see Figure 6) illustrates how elderly individuals' well-being is supported through fit with the environment, emotional bonds to meaningful places, and social context, reinforcing the importance of designing with both human and ecological systems in mind.

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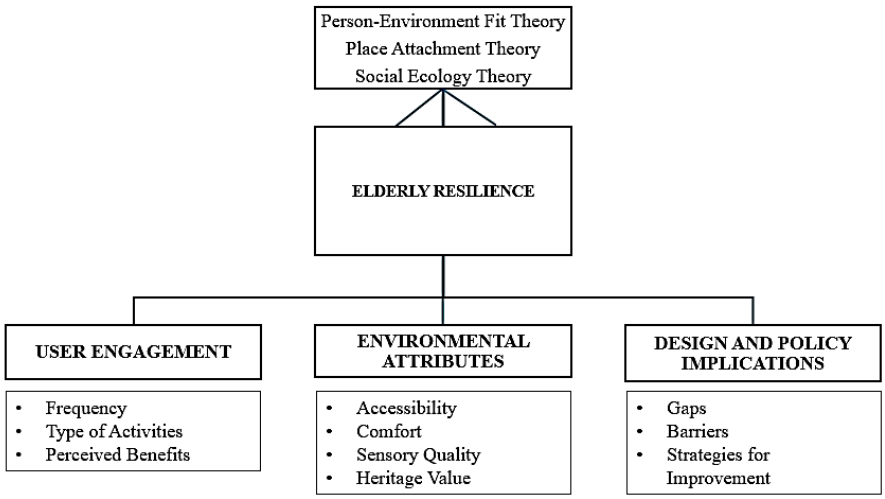


Figure 6: The Conceptual Framework for Elderly Resilience

FINDING & DISCUSSION

Elderly Engagement with Taiping Lake Gardens

The SPSS analysis reveals that 78% of respondents were aged 55 and above, affirming Taiping Lake Gardens' role as a significant public space for the elderly in Taiping. Notably, 62% of the respondents have reported that they visit the park daily, while 28% did so weekly (refer to Table 2), indicating that the park is deeply embedded in the everyday lives of the elderly. The most common activities included walking (65%), socialising (48%), and relaxing or meditating (42%), reflecting a strong relationship between routine park engagement and elderly well-being across physical, social, and mental domains. These patterns align with Objective 1, which examines how elderly users engage with the park to support resilience and healthy ageing.

Importantly, this level of engagement is not merely functional but symbolic. As Taiping is one of Malaysia's oldest towns, many elderly respondents have longstanding personal histories linked to the city and its landscapes. The continuity of place and memory, especially among lifelong residents, strengthens their attachment to Taiping Lake Gardens as a space of familiarity, identity, and emotional security. This connection underscores the relationship between the age of the user and the historic city, highlighting how the elderly uniquely value and benefit from heritage environments.

Gender distribution (55% female) supports Wang (2024), who observed that elderly women tend to seek green spaces for emotional support and communal interaction. Additionally, the fact that 72% of respondents live within a 5 km radius highlights the importance of accessibility in sustaining routine park

use, as also discussed by Sugiyama et al. (2008, 2018). These findings are consistent with the Person–Environment Fit Theory (Zhang et al., 2024), which posits that congruence between users' capabilities and environmental attributes fosters positive health outcomes. With its walkable paths, tranquil settings, and cultural familiarity, Taiping Lake Gardens provides an age-appropriate environment that supports autonomy, mobility, and social engagement—critical components of elderly resilience in a historic urban context.

Environmental Attributes and Elderly Resilience

While a full psychometric analysis awaits future research, the current SPSS results and qualitative observations offer meaningful insights into how environmental features of Taiping Lake Gardens support elderly resilience. These findings directly address objective 2, which seeks to identify the key environmental attributes that foster well-being among the elderly park users. Respondents identified several valued features: a) shaded walkways and seating were appreciated by 70% of respondents, enhancing physical comfort during walks and rest; b) heritage trees and scenic beauty, noted by 63%, evoked a sense of nostalgia and pride in local history; and c) cleanliness and perceived safety, mentioned by 58%, contributed to a peaceful and reassuring environment *(refer to Table 2).*

These responses strongly reflect Place Attachment Theory, which posits that emotional connections to meaningful and familiar environments reinforce personal identity and psychological stability (Lewicka, 2011). The colonial-era landscape elements, mature tree canopies, and historic layout of Taiping Lake Gardens contribute to this sense of rootedness and continuity, an especially crucial factors for elderly individuals facing life transitions such as retirement, bereavement, or social isolation (Julaihi et al., 2022). Further, these findings are also grounded in Social Ecology Theory (Bronfenbrenner, 1979), which recognises the dynamic interplay between individuals, their social systems, and the built environment. The park functions not just as a backdrop for leisure but as a social ecosystem, where communal activities such as routine morning walks, family picnics, and casual peer interactions, reinforce social ties and support networks. Such interactions help the elderly maintain a sense of inclusion, agency, and emotional strength (Ruchi, 2024).

In summary, the environmental characteristics of Taiping Lake Gardens are not merely aesthetic but are deeply functional in sustaining emotional well-being and social connection. These attributes form the environmental scaffolding necessary for elderly resilience, illustrating the significance of maintaining historic, accessible, and emotionally meaningful green spaces within urban contexts.

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Design and Policy Recommendations for Age-Friendly Interventions

In addressing objective 3, field observations and qualitative feedback from elderly respondents revealed several design-related limitations that hinder full and equitable use of Taiping Lake Gardens. These include uneven and slippery pathways, limited availability of shaded seating, inadequate lighting during early morning and evening hours, and insufficient signage that is legible for ageing eyes. These design gaps highlight the need to apply universal design principles, which emphasise accessibility, inclusivity, and safety across all age groups and abilities. Key recommendations include (Refer to Table 1):

Table 1: Key Recommendations for Age-Friendly Interventions

Recommendation	Rationale
Non-slip, even walking paths	Reduces fall risk, enhances safety
Resting points every 50–100 metres	Supports physical endurance
Shaded seating and readable signage	Enhances comfort and wayfinding
Elder-friendly exercise and interaction areas	Promotes active ageing and memory reinforcement

These physical upgrades should be supported by policy interventions that embed ageing-in-place principles into local planning strategies. This includes conducting periodic participatory environmental audits involving elderly users to assess usability and gather feedback on park infrastructure and services. Additionally, intergenerational programmes, such as storytelling walks or memory-sharing circles, can be implemented to foster social inclusion and community cohesion. These initiatives encourage knowledge exchange, foster empathy between generations, and reinforce the emotional significance of place for elderly participants (refer to Table 2). By embedding such practices into planning and maintenance strategies, local authorities can ensure that parks remain relevant, restorative, and inclusive spaces that promote healthy ageing and resilience across generations.

Table 2: Summary of Key Findings from Elderly Engagement at Taiping Lake Gardens

Category	Item	Details / Percentage (%)	Implication / Recommendation
Visitation Patterns	Age of Respondents	78% aged 55 and above	Confirms primary elderly user base
	Frequency of Visits	62% daily, 28% weekly	Indicates high dependency and integration into daily routines
	Proximity to Park	72% live within 5 km	Highlights the importance of accessibility for the elderly

Category	Item	Details / Percentage (%)	Implication / Recommendation
	Gender Breakdown	55% female	Consistent with studies showing that elderly women seek communal green spaces
	Main Activities	65% walking, 48% socialising, 42% relaxing	Demonstrates multidimensional health benefits (physical, mental, social)
Environmental Attributes	Shaded Seating & Walkways	70%	Supports comfort and thermal protection
	Heritage & Scenic Quality	63%	Tied to place attachment and emotional resilience
	Clean & Safe Environment	58%	Critical for the elderly to feel secure and relaxed
Design & Policy Recommendations	Common Barriers	Uneven paths, limited shade, poor lighting, weak signage	Identified through field observation and aligned with age-friendly principles
	Design Solutions	Flat walkways, rest stops, shaded seats, clear signage	Align with universal design & WHO age-friendly city guidelines
	Policy Actions	Community audits, ageing-in-place policy, and intergenerational events	Enhance inclusion and park co-ownership by the elderly

The recommendations are aligned with the Age-Friendly Cities Framework, which advocates for public spaces that support active ageing through accessibility, safety, and social participation. Moreover, incorporating heritage-sensitive design ensures that Taiping Lake Gardens retains its historical character while evolving to meet the diverse needs of its users. By bridging environmental design with inclusive policy, these interventions ensure that the park continues to serve not only as a recreational space but as a platform for resilience-building, intergenerational exchange, and ageing with dignity. While the current study focuses primarily on descriptive analysis to capture behavioural and perceptual patterns, future research could incorporate inferential statistical tests (e.g., chi-square or t-tests) to strengthen the interpretation of correlations between demographic factors and elderly resilience indicators.

CONCLUSION

This study set out to evaluate the role of Taiping Lake Gardens as a historic urban green space in supporting elderly resilience within the context of an ageing Malaysian society. Through a mixed-methods approach, the research

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demonstrated that the park serves not only as a recreational environment but also as a living cultural landscape, deeply embedded in the daily routines and emotional lives of the elderly. Findings revealed that 82% of respondents experienced improved mood and reduced stress after park visits, 76% engaged in regular physical activity, and 68% expressed a strong emotional attachment linked to personal and collective memories. Observational data reinforced these outcomes, with frequent social interactions observed in accessible, shaded areas.

By integrating the Person–Environment Fit Theory, Place Attachment, and Bronfenbrenner's Social-Ecological Theory, this study provides a comprehensive framework for understanding the intersection of environment, ageing, and heritage. It contributes to both landscape architecture and gerontology by highlighting the unique role of historic green spaces in promoting holistic well-being among the elderly. To improve the situation, the research recommends that planners and policymakers prioritise:

(1) age-friendly infrastructure,
(2) inclusive programmes tailored to senior needs, and
(3) participatory planning approaches that involve the elderly users directly.

Future research could explore comparative studies across multiple heritage parks, the longitudinal impact of historic landscapes on cognitive health, and the integration of digital technologies (e.g., smart benches, AR interpretation tools) to further enhance engagement. In summary, this research offers a distinctive contribution to heritage landscape studies by situating elderly resilience within Malaysia's socio-cultural and planning context. By bridging environmental gerontology with heritage conservation, it advances a context-sensitive model for planning inclusive and restorative historic green spaces. Taiping Lake Gardens, in this light, provides a tested and transferable model for designing therapeutic and culturally grounded environments that respond to demographic change while preserving collective memory and identity.

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EVALUATING KELARAI ASLI IN HERITAGE CONSERVATION AS A CULTURAL ASSET OR CONSTRAINT

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Abstract

The objective of this study is to examine the relationship between heritage conservation and restoration constraints. The heritage building in question is the Ihsaniah Iskandariah Mosque in Perak that is earmarked for repair. The exterior walls of the mosque are adorned with Kelarai Asli woven bamboo weaves panels that have deteriorated over time. Four laboratory experiments are conducted to determine their existing conditions. The tensile test results reveal moderate strength (2.1–2.4 kN), indicating structural viability. Adhesion tests (ASTM D4541) discover 100% failure in adhesion of the coating, while water absorption tests (ASTM D570) expose high rates of saturation (55%–65%), raising concerns over moisture resistance. SEM analysis however, confirms a dense fiber structure, giving it sustained mechanical durability. This study concludes that Kelarai Asli is indeed a cultural asset worthy of preservation based on the fortified nature of the bamboo weaves and overall structural integrity and durability. The problematic paint work and coating, adhesion and moisture retention issues could be addressed using modern treatment solutions and technical expertise. Such a prominent heritage site should be preserved that show the creativity and craftsmanship of an era before the advent of modern technology. This study provides some useful guidelines, discussion and rationale for future investigations concerning preservation of vernacular elements in Malaysian heritage sites and their restoration practices.

Keywords: Kelarai Asli, Heritage Conservation, Mosque, Bamboo Panel

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INTRODUCTION

Heritage buildings, acknowledged as vital assets for local development, particularly in the realm of tourism and cultural enrichment, require conservation efforts aligned with urban regeneration initiatives (Nik Hashim et al.., 2024). The incorporation of traditional skills into heritage conservation has been a growing topic of research interest. In this regard, kelarai asli, traditional Malay bamboo weaving art, provides a unique bridge between vernacular design, local identity and cultural sustainability. Cultural representations such as traditional weaving methods are much more than ornamental, they have symbolic meanings that are tied to community identity

Kelarai is defined as checkered weave patterns, a craft work that has been passed down from generation to generation in Malay culture and people in Southeast Asia. Kelarai Asli in this study is well known for its complex geometric motifs in bamboo weaving. Mat weaves are used in traditional buildings not only for its practical function but also reflects local skills as well as cultural identity. On the one hand, kelarai supports intangible heritage, strengthening local identity and community participation (Ahmad, 2006). On the other hand, its practical limitations in terms of vulnerability to environmental degradation, lack of skilled craftsmen, and high maintenance costs pose major challenges to long-term conservation initiatives (Ismail, 2018).

A prominent example of its usage is found in the Masjid Ihsaniah Iskandariah in Perak, Malaysia, where the walls are decorated with colourful kelarai designs. Applying this to Masjid Ihsaniah Iskandariah's conservation and usage of kelarai, one could claim that the materials and design choices contribute to the preservation of its "sense of place". If kelarai is removed or replaced with alternative modern materials, the mosque risks becoming placeless or timeless. Despite being culturally important and more cost-effective, kelarai panels might require more frequent repairs and maintenance, particularly in termite-prone and humid climates such as Malaysia. Cost-effectiveness balanced with long performance on a project such as rehabilitating the Old Mosque Kuala Dal is absolutely paramount. (Syed Abdul Haris Syed Mustapa et al., 2024)

Although kelarai is savored for its environmental and cultural value, it is also susceptible to environmental elements like unpredictable rain and temperature fluctuations, which also cause the material to degrade over time (Wan Faida Wan Mohd Azmi et al., 2025). Since parts of the Masjid Ihsaniah Iskandarariah were found to be defective in 2008 some restoration efforts have been made, yet more deterioration persisted. Presently, the mosque is only used for occasional religious events, leading to reduced community involvement. Its underutilization limits its potential as a heritage and educational hub, and without consistent programming, the site risks further disconnection from the community. Revitalizing its use would stand to recapture its relevance and importance to

culture and tradition. Hence, this research challenge lies in the dualistic nature of Kelarai Asli in heritage conservation, both as a cultural asset appeal as well as a form of restoration constraint.

KELARAI ASLI DEFECTS AND CONSERVATION

Challenges to building conservation projects pose significant risk and uncertainty, especially if the building has undergone several interventions such as building extensions or physical alterations (Harun, 2020). According to Nik Hashim et al. (2024), conservation involves physical actions directed at safeguarding the fabric and materials of heritage buildings. It includes prevention of degradation and extending the life of the buildings in terms of maintaining their original structural, architectural and aesthetic values. Preserving original materials or structures is one of the main goals of the conservation. Thus, time-honored materials such as Kelarai asli that were once widely used in traditional Malay houses are worthy of preservation.

However, Kelarai asli knowledge and practice are on the decline, as are the numbers of traditional Malay houses in Malaysian culture today. Rural-urban migration, modernisation, and lifestyle changes have led to the progressive abandonment and disappearance of these traditional dwellings. This loss has resulted in the deterioration of traditional construction expertise and material technology, such as kelarai, which was historically utilised as a distinguishing feature in aristocratic and royal buildings (Taufik Shahidi et al., 2022; Yunos et al., 2010). It is essential to properly manage and maintain these heritage buildings; if not done so, we risk losing the historic townscape of the country one after another (Abdul Latip et al., 2018).

Zolkafli et al. (2019) have analyzed thirty-six (36) heritage buildings in peninsular Malayisa including religious buildings. They added that among the value enhancement and prevention of decay of heritage good maintenance work is the most important. Indeed, prevention is of course better than cure. Long periods of exposure to sunlight, as well as a lack of continuous restoration attempts, have caused substantial deterioration in many of the remaining panels in this Perak Mosque that are architectural specimens featuring Kelarai asli. As has been found, paint deterioration and physical degradation are common, especially in older buildings with infrequent maintenance (Taufik Shahidi et al., 2022). Weather has a considerable impact on such flaws. High precipitation, rainfall, and sun radiation in Malaysia's tropical environment encourage weathering activities, especially when no protection such as waterproofing or UV protection is given (Syed Mustapa et al., 2024; Nor Atiah et al., 2011). The problem is also made worse where more than a single coat of paint has been used without stripping away the old coating (Ahzahar et al., 2012; Hashim et al., 2019). Choice of proper materials is important. Choosing materials that are unsuitable

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for local climates can lead to durability issues and structural problems (Khalid et al., 2024). Therefore, it is crucial to understand the characteristics of Kelarai Asli before proceeding with conservation and maintenance methods. Failure in specifying suitable materials whether it is the original materials or substitution are the main design flaws (Khalid et al., 2024). The question here lies in whether native Kelarai is considered to be an important cultural asset and should continue to be integrated into contemporary conservation to preserve as symbolic artifacts. or is it a major constraint, due to its high maintenance cost and extent of deterioration effects.

MASJID IHSANIAH ISKANDARIAH

In essence, heritage mosques should all be preserved because they show the creativity and craftsmanship of the locals during an era before modern technology. A heritage masjid is one that has been passed down to the current generation and will continue to be transmitted down to the following generations (Abd Rahim et al., 2022). Hence, a heritage mosque like Masjid Ihsaniah Iskandariah is one example of a valuable building that is worth preserving in terms of cultural identity and that fosters community pride.

Masjid Ihsaniah Iskandariah is identified by the Department of National Heritage for conservation due to its unique architectural characteristics, deep cultural roots, and historical significance to the Malay-Muslim community in Perak. The history of this particular Mosque goes way back in 1936, as commissioned by Sultan Idris Murshidul'adzam Shah (Harun et al., 2008). This mosque is not only a religious structure but also a symbol of traditional Malay craftsmanship and royal patronage, making it an important representation of both tangible and intangible heritage. Although the mosque has not been used since 1976, it is still attracting the eager attention of both local and foreign visitors.

One of the defining features that has caught public attention is the mosque's distinctive usage of Kelarai asli that is a traditional bamboo weaving technique on its external walls. This decorative element is now rare and visually striking, reflecting local artisanal knowledge, vernacular building practices, and Malay aesthetic values. Such craftsmanship is increasingly endangered, and its preservation aligns with the department's mission to safeguard indigenous heritage expressions. Unfortunately, the current condition of its Kelarai asli (as shown in Figure 1.0) has drastically deteriorated.

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Figure 1.0: Current condition of the Kelarai walls of Ihsaniah Iskandariah Mosque, Padang Rengas
(Source: Syed Mustapa et al., 2024)

The rehabilitation of the Ihsaniah Iskandariah Mosque is thus a unique opportunity in preserving a valuable cultural landmark while fostering economic growth and social cohesion. From an economic standpoint, rehabilitation can play a crucial role in boosting local tourism and entrepreneurship opportunities. According to Wan Faida Wan Mohd Azmi et al. (2024), by transforming the mosque into an educational and cultural center, the project has the potential to draw visitors and create opportunities for local businesses and entrepreneurs to explore and thrive.

METHODOLOGY

Masjid Ihsaniah Iskandariah is one of the many buildings chosen for conservation by the Department of Heritage. The mosque is selected for this case study based on the uniqueness of the design characteristics that relate to the origin, and traditional custom and culture of the Malay people. The mode adopted is a qualitative method that studies and evaluates the current conditions and generates results for implementation and guidelines for future studies.

This study adopts a laboratory-based approach to evaluate whether Kelarai asli which is a potential cultural asset is problematic for heritage conservation. Figure 2.0 shows the four different scientific tests that are conducted on selected kelarai asli panels to assess their physical, mechanical, and structural performances in accordance with standard testing procedures.

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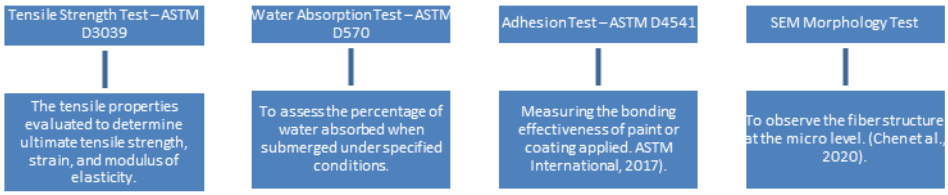


Figure 2.0: List of Scientific tests conducted on selected kelarai asli panels

The tests are conducted in a controlled environment, and each test involved two panel samples. Results are compared descriptively and interpreted against performance criteria typical for outdoor tropical applications. Admittedly there are some limitations in this study, namely only a small sample size of panels are collected and no long-term exposure trials are conducted. These constrains may limit the generalizability of the results. It is recommended that future studies should incorporate extensive field tests and including protective treatment evaluation.

DATA ANALYSIS

The data collected from each test are recorded and analyzed descriptively to compare the performance of the samples. The analysis evaluates optimal strength, moisture resistance, and surface adaptability.

Test 1: ASTM D3039 – Tensile Test

The tensile test, conducted in accordance with ASTM D3039, is designed to assess the tensile properties of materials, particularly their ability to resist axial loading until the point of failure. This test is essential in evaluating the mechanical performance of materials used in heritage conservation, especially those subject to environmental stressors. The material is tested under controlled load until failure to simulate its durability and structural reliability when used in architectural applications (ASTM International, 2017). For this study, natural kelarai asli panels are subjected to tensile loading to simulate real-life conditions where such materials would experience stress in structural applications. The results demonstrated notable tensile strength values, with Sample 1 recording a maximum load of 2.1 kN and Sample 2 recording 1.6 kN. These findings suggest that natural kelarai possesses considerable resistance to stretching forces before rupture.

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Figure 3.0: Before and After ASTM D3039 Testing

Shown in Figure 3.0, before testing, the Kelarai asli strips appeared relatively undistorted and intact. After the tensile test, the specimens displayed visible elongation and tearing patterns along the fibers, confirming that axial tensile force had been applied. While the bamboo strips remained largely intact, some fraying at the ends and surface cracking are observed—consistent with expected tensile failure in natural materials. The fiber alignment remained clearly visible, illustrating the direction of stress application and showcasing the woven structure's capacity to distribute tensile forces.

Test 2: ASTM D570 – Standard Water Absorption Test

Results from the ASTM D570 water absorption test show that Kelarai asli, while culturally significant, is not naturally moisture-resistant. Effective conservation will require innovative material treatments or protective interventions to mitigate the effects of high water absorption, especially in tropical climates like Malaysia. Both samples have absorbed over 50% of their original weight, with Sample 2 reaching 62.5%. This indicates that Kelarai asli is highly hygroscopic, absorbing significant moisture when exposed to water. Such high water absorption suggests that the Kelarai is vulnerable to dimensional changes, warping, and degradation, especially when used in outdoor structures or environments with high humidity or rainfall. In heritage conservation, this highlights a major maintenance challenge, that is if untreated or uncoated, Kelarai panels may swell, soften, or decay due to prolonged exposure to moisture. This makes the material less suitable for structural or long-term external applications unless properly sealed or protected.

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Table 1.0: Standard Water Absorption Test Results

Specimen		Weight Before (g)	Weight After (g)	Water Absorption Percentage (%)
Kelarai Asli	Sample 1	2.1	3.3	57.14
	Sample 2	1.6	2.6	62.5

Test 3: ASTM D4541 – Adhesion Test

The ASTM D4541 test is then employed to assess the adhesion strength of paint applied to the material surface. This test measures the pull-off strength required to detach a coating (e.g., paint) from its substrate (e.g., kelarai) shown in Figure 4.0. It helps to assess the durability and bonding quality of coatings under stress and is critical in predicting paint performance in real environmental conditions.

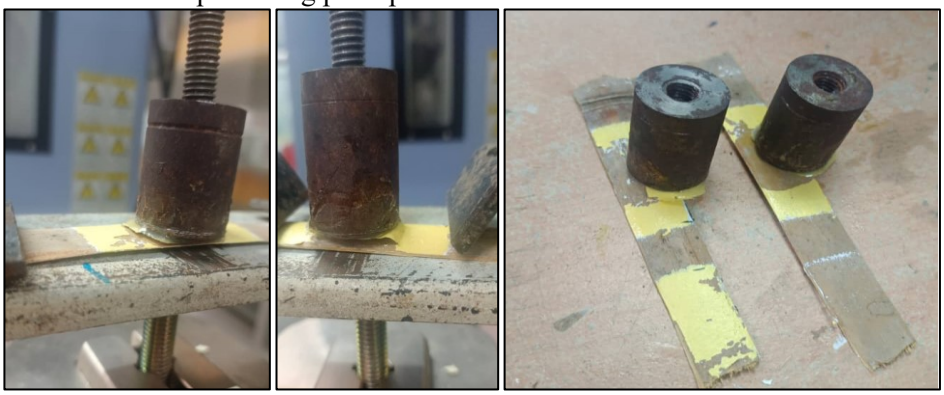


Figure 4.0: Adhesion Test Images

Table 2.0 displays the pull-off test results that show both Sample 1 and Sample 2 experienced 100% adhesive failure, indicating that the failure occurred entirely at the interface between the adhesive and the Kelarai Asli surface. No cohesive failure within the substrate or adhesive layer is detected. Sample 2 exhibits a significantly higher pull-off force (48.43 N) compared to Sample 1 (14.06 N), suggesting better adhesive strength. However, the consistent occurrence of adhesive failure across both samples highlights a potential weakness in the bonding interface, possibly due to inadequate surface preparation or incompatibility between the adhesive and the Kelarai Asli material.

Table 2.0: Adhesion Test Results

Speciment	Pull-Off Force (N)	Failure		
		Adhesion (%)	Cohesive (%)	Adhesive Failure (Glue)
Sample 1	14.06	100	0	0
Sample 2	48.43	100	0	0

Test 4: Scanning Electron Microscopy (SEM) – Morphology Analysis
Furthermore, a Scanning Electron Microscopy (SEM) test is performed to analyze the microstructural properties of the material. The SEM images shown in Figure 5.0 reveals a **compact and continuous fiber network**, contributing to the overall mechanical strength and surface cohesion of the material. The presence of well-distributed microfibers and minimal voids within the structure have enhanced both its tensile performance and durability. These microstructural characteristics further support the material's effectiveness in conservation applications, where strength and endurance are critical over time. Additionally, the detailed morphology analysis confirms the material's natural composition and texture, which are vital in preserving the authenticity of cultural heritage components.



Figure 5.0: Scanning Electron Microscopy (SEM) Test Results

DISCUSSION

The results obtained from the various tests on Kelarai Asli provide insightful implications for its application in heritage conservation. These findings not only reflect the material's mechanical and physical properties but also emphasize its suitability and limitations when integrated into conservation practices.

The findings indicate that Kelarai Asli possesses significant structural integrity and is a promising candidate for use in heritage restoration projects where strength and durability are critical. Its ability to withstand considerable mechanical stress suggests that it can be efficiently applied in structural components that must endure environmental loads or other external factors commonly affecting cultural monuments. Its strength ensures that it can maintain its functional integrity over time, provided it is properly preserved. The fibrous texture of the kelarai, combined with the traditional weaving technique, contributes to a mechanically robust material capable of withstanding considerable stress.

In terms of water absorption, the high capacity of Kelarai Asli ranging from 40% to 80% of its weight reveals its susceptibility to moisture. While this

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trait can be advantageous for materials used in environments where moisture retention is desirable, it can pose a risk in areas subjected to high humidity or exposure to direct water contact.

With regards Paint Adhesion Kelarai Asli passes the test of maintaining a robust bond with surface coatings, suggesting that it is compatible with modern restoration practices. Despite a minor failure rate (10%), this result confirms the material's utility for aesthetic and protective finishes in heritage conservation. The adhesion strength is especially important for retaining the visual appeal and protecting the material from environmental damage, such as weathering or UV.

Lastly, the SEM analysis reveals a highly compact and fibrous internal structure, which contributes to the material's overall strength and durability. This structural feature is crucial for ensuring the long-term stability of Kelarai Asli, particularly when exposed to environmental stresses or physical wear. The dense arrangement of fibers within the material not only contributes to its mechanical performance but also adds to its resistance to cracking or structural degradation over time. Furthermore, the SEM findings confirm the authenticity of traditional craftsmanship, as the material’s internal structure reflects the practices and techniques used in its original creation, contributing to its cultural value.

The results from this study provide a comprehensive understanding of Kelarai Asli’s potential and limitations within heritage conservation. The mechanical reliability demonstrated by the high tensile strength affirms that Kelarai Asli can be repurposed for structural restoration projects, particularly where durability is required. However, its water absorption properties necessitate careful handling and treatment, especially for projects exposed to environmental conditions that may lead to moisture accumulation. The material's good paint adhesion further enhances its suitability for conservation works, as it supports the application of protective coatings without significantly affecting the material's integrity.

Ultimately, the SEM findings offer valuable insight into the material’s structure, underscoring the authenticity and quality of traditional materials used in heritage sites. This combination of strength, moisture sensitivity, adhesion properties, and structural integrity positions Kelarai Asli as a material that balances both functional and cultural significance, making it an essential element in the preservation of Malaysia’s heritage.

CONCLUSION

This study underscores the importance of preserving Kelarai Asli as a cultural asset. Beyond its physical performance, it represents traditional craftsmanship, indigenous knowledge, and aesthetic values. It would be a major loss to the country if Kelarai Asli is not preserved. Scientifically, based on evaluating its properties, Kelarai Asli can be sustainably integrated into future heritage

restoration efforts. The presence of fibers and fibres in natural kelarai provides exceptional density and contributes significantly to the overall strength of the material and gives the kelarai a strong and durable structure.

Additionally, Kelarai Asli contributes to both material conservation science and the promotion of cultural identity in architectural heritage. However, a few suggestions or methods of maintenance is in need in order to preserve this traditionally structures. One of the suggestions is the need for better surface preparation of the Kelarai Asli weaving. Methods such as cleaning, sanding, or priming before painting may prolong the conservation efforts. Additionally, results showed 100% adhesive failure for both samples however, the strength of adhesion varied significantly, suggesting that surface preparation and bonding methods are critical for successful conservation work. Future conservation techniques may focus on improving surface treatment and testing different adhesives to achieve stronger and more consistent bonding. Additionally, the potential for swelling, mold growth, or degradation for Kelarai Asli surfaces can be resolved with application of water-resistant coatings or the integration of protective membranes to preserve the material's integrity in outdoor or humid environments especially in Malaysia.

This study acknowledges that future research should focus on conducting comparative testing between untreated and treated Kelarai materials to gauge the effectiveness of various conservation treatments, such as waterproof coatings or anti-fungal applications, in enhancing durability and longevity. Additionally, researchers are encouraged to explore alternative or substitute materials that replicate its visual and cultural aesthetics but offer improved resistance to environmental factors, especially for use in outdoor or high-moisture settings. It is also recommended that future studies investigate user and community perceptions of restored Kelarai weave elements to assess public acceptance, cultural relevance, and the social value of conservation efforts. Understanding community perspectives can guide more inclusive and meaningful heritage preservation strategies.

As claimed in Zolkafli et al., (2019), in order to protect these heritage buildings, maintenance works need to be properly and regularly carried out without affecting their original value. In conclusion, this paper supports the notion that Kelarai Asli antiquity holds significant cultural value and can enrich heritage conservation efforts when approached thoughtfully. However, unresolved tensions between symbolism and practicality imply that its role and contribution must be carefully evaluated to ensure that it contributes to meaningful cultural preservation rather than superficial restoration.

In conclusion, this study contributes to the discourse on vernacular conservation by integrating scientific evaluation of Kelarai Asli's physical

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performance with its cultural significance, offering a holistic framework for material-based heritage preservation in Malaysia.

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SMART MAPPING AND MONITORING: UAV AND GIS-BASED PLANNING FOR THE CONSERVATION OF DIPTEROCARPUS SEMIVESTITUS IN UITM CAWANGAN PERAK

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Abstract

The survival of *Dipterocarpus Semivestitus*, a vulnerable tropical tree species native to Malaysia's lowland dipterocarp forests, is increasingly threatened by peri-urban expansion and habitat fragmentation. As an ecologically significant indicator species, its decline reflects broader environmental stress. This study aims to support the conservation of *Dipterocarpus Semivestitus* by applying geospatial technologies within a planning context. Specifically, the research objectives are to: (i) map the spatial distribution of existing stands, (ii) assess population density and habitat conditions, and (iii) detect landscape-level threats using UAV imagery and GIS analysis. High-resolution data enables accurate, non-invasive monitoring and reveals areas under ecological pressure. The results inform planners, conservationists, and arborists by identifying critical habitat zones and recommending spatial interventions such as buffer areas and green corridors for the protection of *Dipterocarpus Semivestitus*. This study demonstrates how technology-enhanced ecological data can guide integrated, evidence-based planning approaches, contributing to more resilient and sustainable peri-urban development aligned with broader environmental management goals.

Keywords: *Dipterocarpus Semivestitus*, Endangered, GIS, Preservation, UAV.

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INTRODUCTION

Dipterocarpus semivestitus, an endangered tropical tree species, plays a vital role in maintaining biodiversity and ecological balance in Southeast Asian Forest ecosystems. *Dipterocarpus Semivestitus*, a keystone species, is currently facing unprecedented threats that jeopardize its persistence, including habitat degradation and climate-induced changes (Smith et al., 2018; Jones & Wang, 2020). The imperative to conserve this species and safeguard the biodiversity within its ecosystems necessitates innovative and efficient approaches. *Dipterocarpus Semivestitus*, recognized as a key species in forest ecosystems, plays a pivotal role in upholding biodiversity and ecological equilibrium (Smith et al., 2018). The accurate identification and mapping of its distribution are imperative for the formulation of effective conservation strategies and sustainable forest management practices (Jones & Wang, 2020).

Preserving the natural habitat is fundamental to *Dipterocarpus Semivestitus* conservation. This involves establishing protected areas, implementing sustainable forestry practices, and minimizing land-use changes (Sodhi et al., 2010). However, due to deforestation and habitat fragmentation, *Dipterocarpus Semivestitus* has been designated as an endangered species, with the hazards of population decrease and genetic erosion (Slik et al., 2018). Monitoring *Dipterocarpus Semivestitus* populations is crucial for assessing the species' conservation status. Techniques such as remote sensing and Unmanned Aerial Vehicle (UAV) technology provide valuable tools for monitoring the spatial distribution of *Dipterocarpus Semivestitus*. (Franklin & Miller, 2019).

Traditional ground surveys have long been used in ecological assessments, but they present several limitations, particularly when applied to large or remote forested areas. These methods are often labor-intensive and time-consuming, requiring extensive manpower and multiple site visits especially in challenging terrains such as dense tropical forests (Brown & Stevens, 2019). For instance, locating and documenting individual trees like *Dipterocarpus Semivestitus* demands considerable effort and may still result in limited spatial coverage. Moreover, repeated human intrusion into sensitive habitats can inadvertently disturb wildlife or damage fragile ecosystems. These challenges underscore the value of modern, non-intrusive technologies such as UAV-based remote sensing and GIS analysis, which enable efficient, accurate, and minimally disruptive data collection across broader landscapes.

Given the limitations of traditional methods, the integration of UAV technology emerges as a promising and innovative alternative. UAVs equipped with high-resolution cameras facilitate the acquisition of detailed aerial imagery, enabling a more nuanced understanding of *Dipterocarpus Semivestitus* habitats and distribution patterns (Johnson et al., 2021). This technological approach not only expedites the data collection process but also enhances the accuracy and

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efficiency of species identification (Chen et al., 2019). Building on these advantages, this study integrates UAV technology with Geographic Information Systems (GIS) to assess the spatial distribution of *Dipterocarpus Semivestitus* in the peri-urban forest landscape of UiTM Perak Branch, Seri Iskandar. The novelty of this study lies in its methodological contribution specifically, applying high-resolution UAV imagery to detect and map *Dipterocarpus Semivestitus* populations non-invasively, a technique not previously used for this species in this landscape.

The aim of this study is to develop an accurate and efficient method for identifying and mapping *Dipterocarpus Semivestitus* within a fragmented peri-urban ecosystem using UAV and GIS technologies. The findings are expected to contribute to biodiversity-sensitive land-use planning and support conservation strategies in similarly urbanizing landscapes. Beyond academic contributions, the results of this research hold practical relevance for sustainable forest management. By providing precise spatial information and insights into the species' habitat preferences, the study offers a valuable tool for guiding conservation priorities and maintaining biodiversity at both local and regional scales (IUCN, 2020). This work aligns with contemporary advancements in ecological monitoring by adopting a holistic, technology-driven approach. The integration of UAV technology and advanced geospatial analysis demonstrates the potential for innovative, scalable solutions in biodiversity conservation and forest ecosystem management bridging scientific research with real-world environmental planning needs.

LITERATURE REVIEW

Numerous studies have emphasized the importance of conserving dipterocarp species due to their ecological significance and vulnerability to anthropogenic threats (Smith et al., 2018; Slik et al., 2018). Conventional ground surveys have long been used for forest monitoring (Brown & Stevens, 2019), but these methods are often constrained by accessibility issues and limited spatial coverage. Recent advances in remote sensing, particularly UAV-based monitoring, offer improved efficiency and spatial accuracy (Johnson et al., 2021; Chen et al., 2019). However, there remains a research gap in applying these tools specifically to monitor *Dipterocarpus Semivestitus* in peri-urban tropical forests. This study builds upon previous UAV-based conservation research by focusing on a rarely studied endangered species and integrating spatial analysis to evaluate habitat fragmentation and edge pressures.

Preserving Endangered *Dipterocarpus Semivestitus* Species

Preservation efforts for endangered species such as *Dipterocarpus Semivestitus* frequently necessitate comprehensive plans that combine current technologies

and conservation approaches. The preservation of *Dipterocarpus Semivestitus* is critical not just for sustaining biodiversity but also for supporting the livelihoods of local communities that rely on these forests. Protecting *Dipterocarpus Semivestitus* involves employing various conservation approaches, such as managing protected areas, involving local communities in forest management, and implementing sustainable forestry practices (Blaser et al., 2011 and Saharudin et al. 2024).

Protected areas are vital for preserving the habitats of endangered species by offering legal protection from activities like logging, mining, and encroachment (Brun et al., 2015 and Blanton et al. 2024). Community-based Forest management involves local communities in conservation efforts and enables them to sustainably manage their natural resources. Sustainable forest management practices, like carefully choosing which trees to log and planting new trees, can ease the strain on natural forests and aid in the revival of *Dipterocarpus semivestitus* populations (Chaudhary et al., 2018).

GIS-Based Approach for *Dipterocarpus Semivestitus* Mapping

Mapping the distribution of *Dipterocarpus Semivestitus* is necessary to pinpoint its remaining habitat and prioritize conservation efforts. Remote sensing technologies like satellite imagery and geographic information systems (GIS) are commonly employed for this purpose, aiding in the mapping of forest cover and tracking alterations in land use (Irini, 2021). Imagery provides detailed snapshots of large areas, allowing researchers to identify suitable habitats for *Dipterocarpus Semivestitus* and monitor any alterations over time. GIS software plays a critical role in identifying and delineating conservation priority zones by integrating multiple spatial datasets, such as vegetation distribution, terrain morphology, and anthropogenic pressures. This spatial approach facilitates strategic decision-making for biodiversity protection and ecosystem management (Abdullah et. al, 2021 and Abdullah et. al, 2024). These tools offer useful information about where *Dipterocarpus Semivestitus* is found, assisting conservationists in focusing their efforts more efficiently.

Therefore, UAVs combined with GIS have emerged as useful instruments for ecological monitoring and preservation planning (Anderson & Gaston, 2013). UAV-GIS techniques provide several advantages, including high spatial resolution, cost-effectiveness, and the capacity to visit remote or inaccessible places (Turner et al. 2015). Employing a UAV-GIS method for the preservation of *Dipterocarpus Semivestitus* at Universiti Teknologi MARA (UiTM) Seri Iskandar may provide various advantages. Firstly, it enables efficient and precise mapping of *Dipterocarpus Semivestitus* populations on campus and in the surrounding area. High-resolution photography obtained by

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UAVs allows for the identification and monitoring of individual trees, facilitating population surveys and distribution evaluations (Lin et al., 2015).

In addition to conservation applications, GIS also supports species-specific ecological assessments. By overlaying variables such as topography, land cover, and soil characteristics, researchers can model the habitat suitability and ecological preferences of *Dipterocarpus Semivestitus,* aiding in the understanding of its spatial distribution and environmental dependencies (Lillesand et al., 2015). Furthermore, GIS technology supports habitat restoration efforts by identifying suitable sites for reforestation and ecological enhancement. By overlaying habitat suitability models with land use and land cover data, conservation practitioners can prioritize intervention areas and allocate resources more efficiently (Li et al., 2023).

MATERIAL AND METHOD

UiTM Perak Branch is one of the branches of Universiti Teknologi MARA established in Perak, Malaysia. It is administered by a Rector and is responsible for two UiTM campuses in Perak, namely Seri Iskandar and Tapah. The study area encompasses the forest area around UiTM Seri Iskandar, Perak. It covers an area of 25 hectares equivalent to 250,000 square meters located at latitude 4° 21' 30.98"N and longitude 100° 57' 9.70" E (Figure 1). This study's methodology is divided into three stages: data collection, data processing and the presentation of findings.

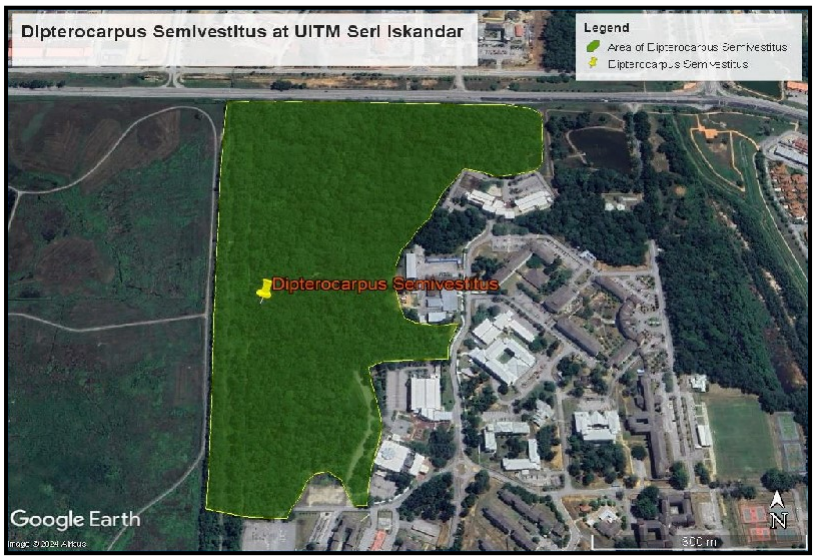


Figure 1: Study Area Located at UiTM Seri Iskandar, Perak
Sources: Google Earth Pro, 2024

UAV-Based (Aerial Imaging) Data Acquisition for *Dipterocarpus Semivestitus*

The data acquisition process using UAV for *Dipterocarpus Semivestitus* preservation at UiTM Seri Iskandar includes precisely scheduled flights to capture aerial photographs over the targeted locations. Mission planning for UAV-based data acquisition involves several critical steps to ensure the success and safety of aerial imaging operations. First, the flight area and altitude required to capture the desired aerial imagery are carefully determined, considering factors such as the required resolution, the size of the study area, and the flight altitude. The data acquisition for this area was conducted using a DJI Mavic Pro camera mounted on a UAV, which operated through the DJI GS Pro (Ground Station Pro) iPad app for drone operations. Due to the large area to cover and limitations in UAV battery capacity, data acquisition flights were conducted twice during this study. Each flight covered the whole study area to locate the designated *Dipterocarpus Semivestitus* protection area. Figure 2 illustrates the UAV flight planning conducted prior to data acquisition. The flight altitude for data acquisition in this study was set at 80 meters above ground level, considering a 70% front overlap and a 70% side overlap.

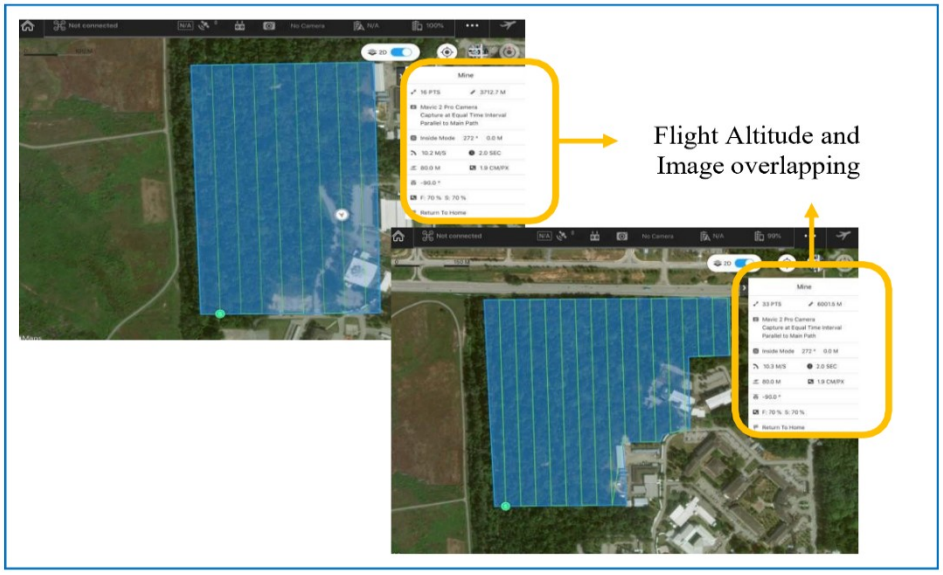


Figure 2: Designing Flight Planning before Flight Mission

The image resolution acquired during data collection depends on the flight configuration settings established prior to the mission. The flight altitude set for data acquisition affects the Ground Sample Distance (GSD) value, whereas a lower GSD value results in higher spatial resolution. In this study, the UAV

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flight paths covered distances of approximately 3,713 m and 6,001 m, corresponding to total surveyed areas of 11.47 ha and 16.90 ha, respectively (Figure 3).

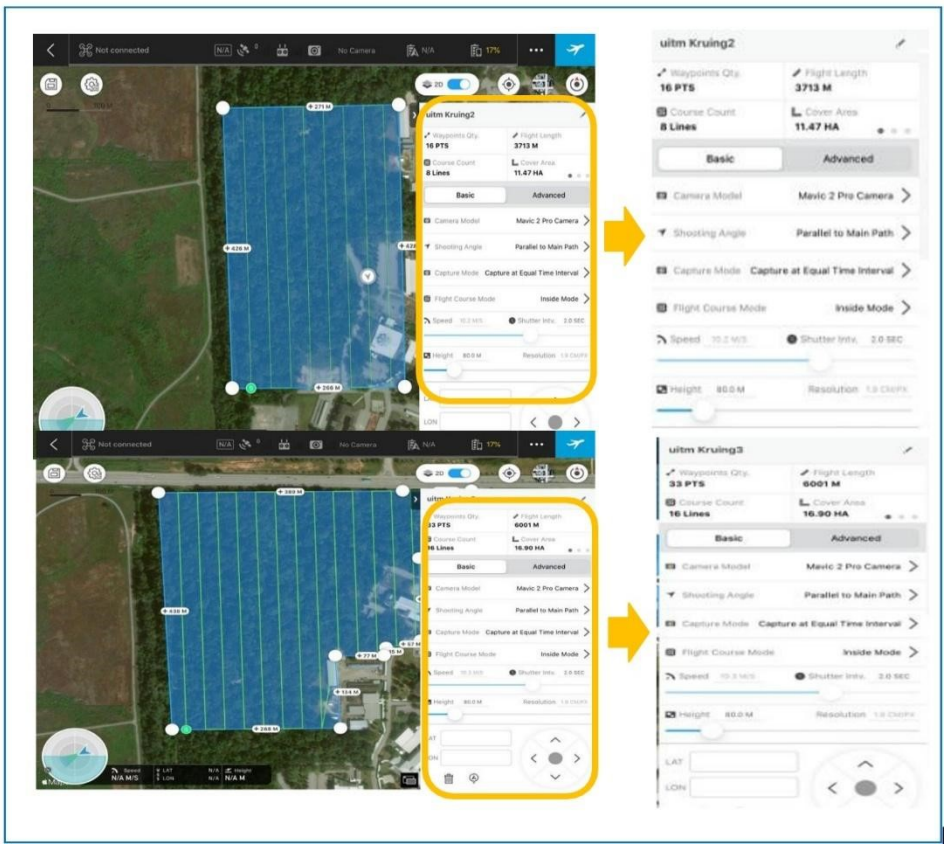


Figure 3: UAV flight paths and coverage areas within the UiTM Seri Iskandar forest zone.

Geospatial Distribution of D. Semivestitus GPS field observations

Field observations and GPS coordinates of Dipterocarpus semivestitus were recorded using the SWMap application. The collected data were then used to generate a geospatial distribution map illustrating the tree's spatial location within the study area (Figure 4). Gathering field data is critical for understanding *Dipterocarpus Semivestitus* ecological dynamics and distribution patterns.

The SWMap application was chosen for this purpose, utilising current technological breakthroughs. This introduction describes the process of utilising the SWMap application to gather accurate information about where

Dipterocarpus Semivestitus is located, how many of them exist, and the types of habitats they prefer.

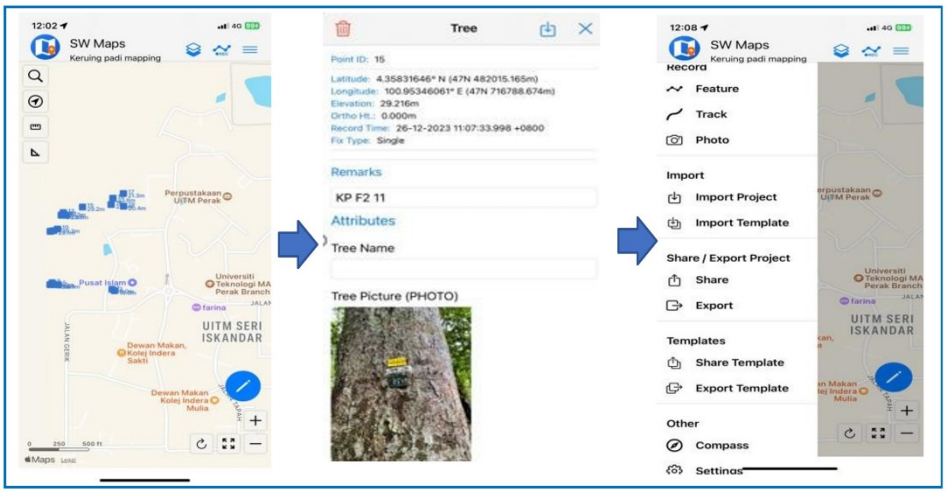


Figure 4: Geospatial distribution map of Dipterocarpus semivestitus created based on field observations and GPS coordinates collected using the SWMap application.

This introduction delineates the methodology for utilizing SWMap to collect precise data on the distribution, population size, and preferred locations of *Dipterocarpus Semivestitus*. It will be conducted across various regions to obtain a comprehensive overview. The goal of using SWMap during fieldwork is to simplify data collection, guarantee its accuracy, and generate useful maps for conservation planning. Each location of *Dipterocarpus semivestitus* captured using the SWMap application will be exported using the shapefile format. Each location of *Dipterocarpus Semivestitus* captured using the SWMap application will be exported in the shapefile format. All collected data will be imported into ArcGIS Pro to develop a geospatial database.

Processing Dipterocarpus Semivestitus Image Data

In this study, the utilization of Agisoft Metashape Professional software for processing image data of *Dipterocarpus Semivestitus* involves employing this photogrammetric tool. Agisoft Metashape is widely known for its capability to generate precise 3D models and orthomosaics using aerial imagery obtained from drones or similar platforms. Figure 5 illustrates the step of importing all aerial photographs captured during the UAV flight into Agisoft Metashape software for subsequent processing. The next step involves aligning the imported images to establish common tie points and generate a sparse point cloud representing the study area's surface.

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Generating a dense point cloud from UAV images entails using drone-captured images to reconstruct a 3D representation of the terrain or objects on the ground. Initially, the point cloud generated from these images might be sparse, meaning it contains relatively few points and lacks detail. The next step is the formation of a Digital Surface Model (DSM) for this *Dipterocarpus Semivestitus* area, which is formed from dense point cloud data representing ground elevations and any features on the ground.

Generating an orthophoto from UAV images for *Dipterocarpus Semivestitus* involves stitching together individual images captured by the drone to create a single composite image that accurately represents the study area. Each image taken by the UAV covers a specific portion of the area, and they overlap to ensure comprehensive coverage. By aligning these images and correcting for distortions caused by terrain and camera perspective, a seamless and georeferenced orthomosaic is created. Overlaying existing distribution data or using classification methods on the orthomosaic allows for identifying where *Dipterocarpus Semivestitus* is located and how many trees there are in the study area. This process also helps in separating *Dipterocarpus Semivestitus* from other types of plants or land cover.

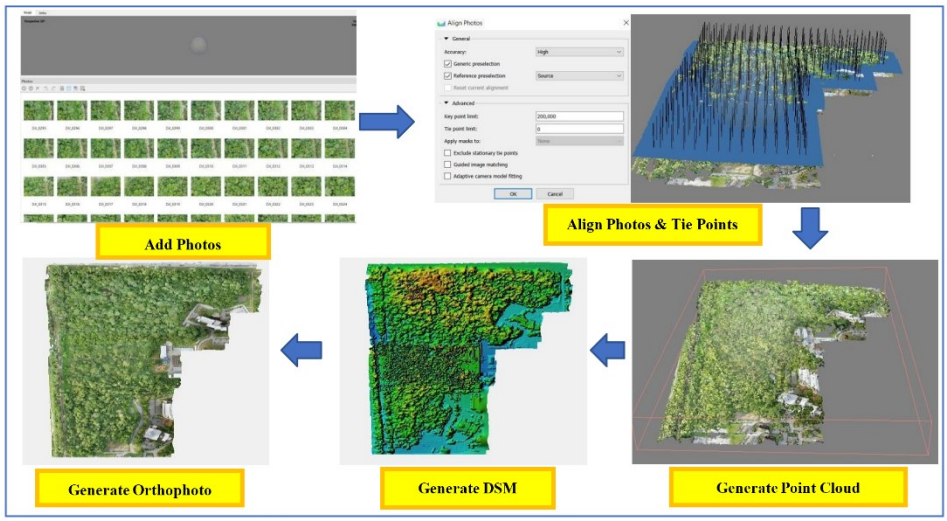


Figure 5: Image Processing for using *Dipterocarpus semivestitus* Agisoft Metashape Software

Distribution of *Dipterocarpus Semivestitus* using ArcGIS Pro Software

The distribution of *Dipterocarpus Semivestitus* can be analyzed using ArcGIS Pro software. ArcGIS Pro is a widely used GIS software that allows for the visualization, analysis, and interpretation of spatial data. With ArcGIS Pro, researchers can import spatial data layers containing information on the occurrence or presence of *Dipterocarpus Semivestitus*, such as field survey data, imagery, or species distribution models. This study employs ArcGIS Pro to map and visualize the distribution of *Dipterocarpus Semivestitus* in the vicinity of UiTM Seri Iskandar.

The generated orthophoto of *Dipterocarpus Semivestitus* is imported into ArcGIS Pro, where it is visualized and mapped based on the collected spatial data. ArcGIS Pro, a widely used GIS software, provides advanced capabilities for mapping, spatial analysis, and geographic data visualization. By utilising this software, the location of *Dipterocarpus Semivestitus* can be overlaid onto a map of the UiTM Seri Iskandar area, providing a clear depiction of their distribution concerning the surrounding landscape. This mapping method supports spatial analysis and decision-making, aiding stakeholders in gaining a deeper understanding of the spatial patterns and connections among *Dipterocarpus Semivestitus* in the study area. Figure 6 presents the mapped distribution of *Dipterocarpus Semivestitus,* based on field-collected data integrated into ArcGIS Pro for database development.

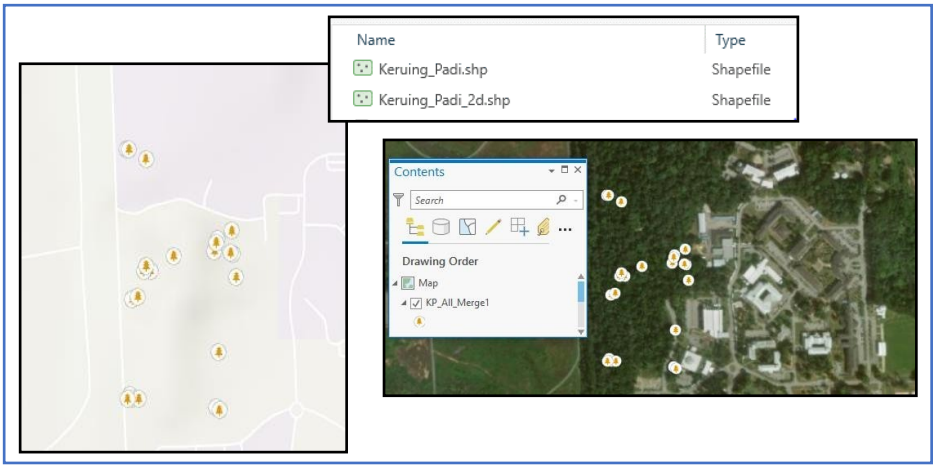


Figure 6: Spatial Distribution of *Dipterocarpus Semivestitus* Based on GPS Field Observations

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RESULT AND DISCUSSION

The novelty of this study lies in the application of UAV-GIS methods for the conservation of a single Dipterocarpus semivestitus tree located within the peri-urban campus of UiTM Seri Iskandar. While most UAV-GIS studies in Malaysia focus on large, forested areas or ecosystem mapping, this research demonstrates the potential of UAV-based spatial analysis for the micro-level conservation of rare and isolated species. This approach introduces a spatially informed method to integrate biodiversity protection and green infrastructure management within urban development strategies.

The spatial distribution of Dipterocarpus semivestitus was analyzed using high-resolution UAV imagery captured by a DJI Mavic 2 Pro equipped with a 20-megapixel Hasselblad camera. The flights were conducted at altitudes of approximately 60–100 meters, producing imagery with a ground sampling distance (GSD) of 3–5 cm, which was sufficient to identify and map individual tree crowns. The UAV images were then processed and georeferenced in ArcGIS Pro. In addition to mapping tree locations, land use and canopy cover layers with a spatial resolution of 10 meters were integrated to evaluate environmental pressures within the study area. The quality and resolution of these datasets provided a reliable basis for detecting spatial patterns and assessing potential landscape-level threats to the species.

Beyond visualization, GIS analysis was conducted to detect landscape-level threats, including fragmentation patterns, proximity to land use changes, and habitat disturbances. By overlaying tree locations with land use and canopy cover data, the study identifies areas under ecological pressure thereby directly addressing Objective 3. The spatial distribution mapping of *Dipterocarpus Semivestitus* revealed that existing populations are fragmented and primarily restricted to ecotonal zones adjacent to built-up areas and disturbed landscapes. This pattern highlights the species' vulnerability to edge effects and habitat fragmentation, raising concerns about long-term population stability in peri-urban environments.

Additionally, through spatial analysis tools available in ArcGIS Pro, researchers can identify any clustering or dispersion patterns among *Dipterocarpus Semivestitus*. This analysis helps in understanding how *Dipterocarpus Semivestitus* is spatially distributed across the landscape, which could be indicative of ecological processes or environmental factors influencing their distribution. For instance, areas where *Dipterocarpus Semivestitus* are highly clustered identified using Average Nearest Neighbor and Kernel Density tools in ArcGIS Pro, may indicate suitable microhabitats or undisturbed forest patches. In contrast, dispersed or fragmented patterns, particularly near developed or cleared land, may reflect environmental stressors such as logging activity, land conversion, or edge effects. By analysing these spatial patterns quantitatively, the

study reveals potential landscape-level threats and habitat dynamics. This spatial insight is critical for informing targeted conservation and management strategies to preserve *Dipterocarpus Semivestitus* populations.

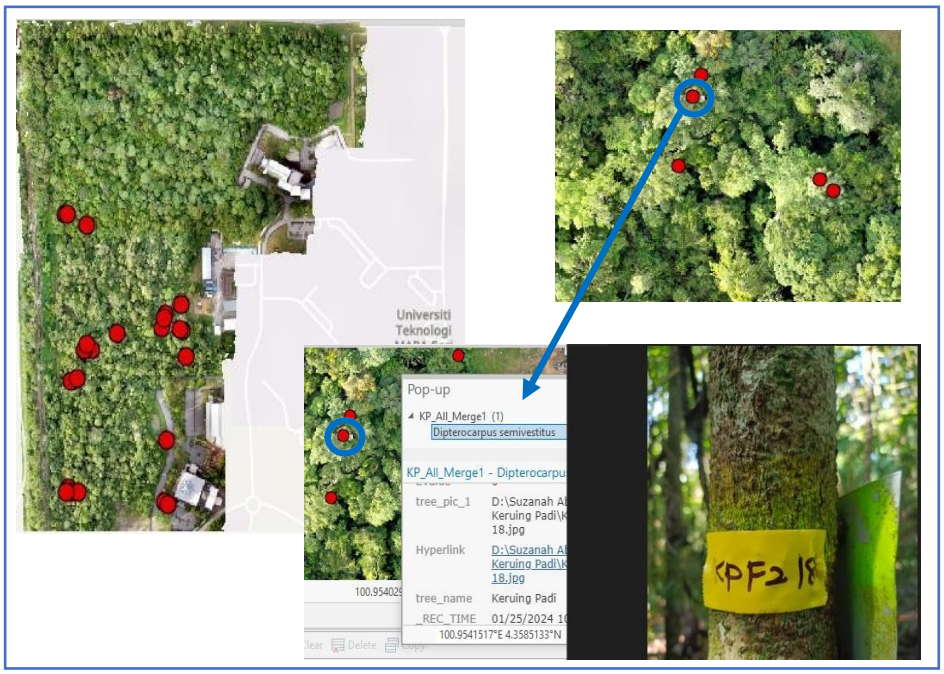


Figure 7: Mapping the Dipterocarpus Semivestitus Locations and Analysing Their Spatial Patterns using ArcGIS Pro

Figure 7 presents the spatial distribution and observed patterns of *Dipterocarpus Semivestitus*, offering a better understanding of its ecology and contributing to local conservation planning. *Dipterocarpus Semivestitus* distribution patterns can be detected and visualised using spatial analysis in ArcGIS Pro. In this study, the spatial distribution of *Dipterocarpus Semivestitus* revealed notable clusters of occurrences, particularly in areas with specific environmental conditions such as moderate elevation ranges and proximity to undisturbed land cover. By analyzing spatial patterns in relation to environmental variables like land cover type, elevation, and soil characteristics, the study identified potential habitat preferences and areas of ecological importance. These relationships help explain the species' current distribution and inform targeted conservation strategies. By analyzing the spatial distribution and clustering of *Dipterocarpus Semivestitus*, researchers can gain insights into the species' habitat preferences, potential seed dispersal mechanisms, and ecological interactions with surrounding landscape features such as forest edges, disturbed zones, and

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vegetation types. This data is valuable for conservation planning as it not only identifies areas with high species concentration or ecologically significant zones but also includes key attribute information such as the number of individual trees, their size, health status, and age class. These attributes are essential for assessing forest structure, monitoring tree conditions, and implementing targeted protection or restoration strategies. Relying solely on spatial location would limit management effectiveness, whereas integrating both spatial and attribute data provides a more comprehensive foundation for informed decision-making.

CONCLUSION

The application of UAV-GIS technology in this study has proven to be a highly effective and scalable method for conserving *Dipterocarpus Semivestitus*, an endangered tropical species, within the peri-urban landscape of UiTM Perak Branch (Seri Iskandar). Through high-resolution spatial mapping, the study revealed that existing populations are fragmented and primarily restricted to ecotonal zones adjacent to developed or disturbed areas. Habitat condition analysis indicated signs of edge degradation, while spatial overlays demonstrated the species' increasing proximity to urban expansion underscoring the urgency for targeted conservation measures.

By enabling precise, non-invasive habitat assessments, UAV-GIS integration offers a robust alternative to conventional field surveys, which are often time-consuming, labor-intensive, and potentially disruptive to fragile ecosystems. This technology allows for rapid data collection across extensive areas while minimizing ecological disturbance, making it particularly suited for conservation planning in sensitive environments.

The insights gained from this research are critical for guiding biodiversity-sensitive land use and green infrastructure planning, particularly in rapidly transforming peri-urban academic settings like UiTM. Moreover, the study supports broader sustainability objectives by aligning with key Sustainable Development Goals (SDGs), including SDG 15 (Life on Land), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action). Overall, this work reinforces the role of spatial planning and geospatial technology in preserving vulnerable ecosystems amid ongoing landscape change.

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SELECTION CRITERIA WHICH INFLUENCE RESIDENTS' PREFERENCES FOR HYGIENIC INTERIOR FLOOR FINISHES

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Abstract

This study investigates how Malaysian residents select hygienic interior floor finishes to support sustainable living environments. Recognizing flooring's impact on health, comfort, and safety particularly in tropical climates prone to moisture and allergens. This research addresses a critical gap in existing literature by examining hygienic material selection in Malaysian residential interiors. Using a Kruskal–Wallis test on data from 314 respondents across 11 residential areas in the Kinta District, the study reveals that residents prioritize durability, ease of maintenance, and hygiene. Materials such as tiles, timber, marble, carpet, mosaic, and vinyl are selected based on performance in specific spaces. Bacteria-resistant marble and dust-free timber are preferred in living areas, while fire-resistant mosaic and vinyl enhance safety. The findings highlight the influence of emotional and functional factors on flooring preferences. This research contributes to sustainable design practices, aligning with Malaysia's GBI and QLASSIC systems, and adds insights to post-pandemic health-oriented material selection in tropical environments.

Keywords: Selection Criteria, Preferences, Interior Floor Finishes

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INTRODUCTION

A sustainable living environment enhances well-being by promoting comfort, safety, and a connection to nature while ensuring long-term usability (Abu Bakar et al., 2017). The researcher also stated that interior spaces play a key role in achieving this through effective spatial layouts, functional design, and appropriate material selections. Among these, flooring is particularly significant due to its direct and constant contact with users, demanding properties such as durability, comfort, and hygiene (Ching et al., 2005).

In Malaysian residential interiors, the most commonly used floor finishes are tiles, timber, marble, carpet, mosaic, and vinyl (Blakey & Rohde, 2002; Harris & Fitzgerald, 2015; Ulrich et al., 2008; Tuladhar et al., 2015). These materials fall into three categories which are hard, resilient, and soft flooring which each suited for specific spatial and functional needs (Bower, 2006; Moussatche & Languell, 2001;). Selection is typically based on four key criteria: beauty, hygiene, durability, and comfort (Callery, 2007; Binggeli, 2014; Brownell, 2008; Chavhan et al., 2014). Despite this, residents often lack clear guidelines and rely on professionals like interior designers or suppliers to make informed choices. Preferences, as defined by Coolen and Hoekstra (2001) and Mahmud Jusan (2010), are dynamic and emotionally driven, influenced by daily interaction with the built environment (Zinas, 2013).

Understanding these preferences allows construction professionals to offer tailored design solutions, reducing renovation frequency and resource wastage. This research provides guidance to both practitioners and government agencies, as well as enhancing sustainable rating systems such as GBI and QLASSIC (Lent et al., 2010; CIDB Malaysia), thus supporting a healthier, more efficient residential environment.

RESEARCH BACKGROUND

In Malaysia, although various studies have investigated pro-environmental behaviours, limited attention has been given to the relationship between individuals and their immediate interior environments, particularly how interior finishes and ambience influence sustainable practices and health perceptions (Abu Bakar et al., 2017; Ibrahim et al., 2024). One critical yet underexplored component within this context is interior floor finishes, which significantly influence hygiene, indoor air quality, and overall well-being in residential spaces.

Hygiene is a cornerstone of public health, particularly in humid tropical climates where flooring is often exposed to moisture, dust, and mould. Inappropriate floor finish selections may lead to the accumulation of allergens, emission of volatile organic compounds (VOCs), and microbial proliferation, which are linked to respiratory disorders, asthma, and skin-related illnesses (Azizul Azli, 2015; Bluyssen, 2013). This risk is exacerbated in tropical

residential settings, where high humidity and fluctuating temperatures further compromise material hygiene and durability. A healthy interior environment must not only be devoid of harmful substances but also support psychological well-being, social interactions, and physical safety (Halliday, 2008; Ibrahim et al., 2024). While Halliday's framework remains influential, current challenges such as environmental toxins and heightened hygiene awareness in post-pandemic life necessitate updated interpretations. Previous models by Heerwagen and Zagreus (2005) and Hassanain and Mudhei (2006) have drawn links between building design and occupant health, but these are seldom adapted to flooring-specific concerns within tropical, domestic settings.

In healthcare design, hygienic flooring has long been acknowledged for its role in infection prevention, yet comparable attention in residential design, especially in Malaysia, remains insufficient. Therefore, this study aims to fill this gap by exploring the selection criteria influencing residents' preferences for hygienic interior floor finishes focusing on balancing functional performance with health-conscious design in the Malaysian home context.

RESEARCH METHODOLOGY

This research employed a comprehensive methodology beginning with an in-depth literature review, drawing on reputable sources such as academic journals, scholarly books, design periodicals, and other relevant publications. Data analysis was conducted using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) Version 24. The Kruskal-Wallis test was selected as the primary statistical tool after a careful evaluation of available analytical methods. This nonparametric test was deemed most suitable due to the study's relatively small sample size, high variability among groups, and non-normal data distribution.

Nonparametric methods were preferred because they are more flexible and do not rely on strict assumptions about population parameters. Specifically, the Kruskal-Wallis test is useful for detecting statistically significant differences in a variable across multiple independent groups. Unlike parametric tests, it does not assume normality or homogeneity of variance, making it appropriate for real-world, human-related research contexts. In order to obtain a compliance statement which is administered in accordance with the ethical research practices, hence the researcher has claimed all the information obtained shall be used solely for the purpose of this research only and the confidentiality of the response is assured. It is stated on the front page of the questionnaire's surveys.

The next procedure is that the closed-ended questionnaires have been distributed to 314 respondents. This number of respondents is calculated carefully by using the stratified random sampling technique by using the formula and significance level which is prescribed in the social sciences field to determine the number of respondents. These respondents resided in these 11 housing areas in

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Kinta District in Ipoh, Perak. All of these residential areas have then been divided into four geographical divisions, namely north, south, east, and west, by using the sample size calculation formula. The total number of respondents represents all of these housing areas to avoid bias.

Reliability Statistics

Based on Table 1, it presents the results of internal consistency reliability assessed using Cronbach's Alpha, a standard method for evaluating how well items within a scale measure a single construct (Peter & Paul, 1979; Siti Norlizaiha 2005; N.R. Muhamad Ariff, 2009). A Cronbach's Alpha value nearing 1.0 indicates a high level of internal consistency, while values below 0.6 are generally considered poor. According to Uma Sekaran (2000), a value of 0.7 or above is typically regarded as acceptable, and the alpha value of 0.9 obtained in this study confirms the reliability and consistency of the research instrument used.

Table 1: Reliability Statistics

	Reliability Statistics	
Cronbach's Alpha Size 10pt	Cronbach's Alpha Based on Standardized Items	N of Items
.900	.932	31

Source: Abdul Halim, N., et al., (2021)

Analysis Findings

The Kruskal-Wallis nonparametric test was selected after the researcher conducted several preliminary statistical analyses. This decision was influenced by the characteristics of the dataset, which included small sample sizes, high within-group variance, and normal distributions. Nonparametric tests, such as the Kruskal-Wallis test, are particularly suited for such data conditions due to their simplicity and flexibility. Most importantly, this test is effective for determining whether the values of a particular variable differ significantly across two or more independent groups (Laerd Statistics, 2015). Nonparametric methods are termed "nonparametric" because they do not rely on assumptions about population parameters such as the mean or variance, nor do they require the data to follow a specific distribution (Siegel & Castellan, 1988). The Analysis of Interior Floor Finishes with the Interior Spaces by Selection Criteria of Hygiene is as follows:

Tiles

The Kruskal-Wallis test results (please refer to Table 2) indicate that in living areas, dust-free tiles received the highest mean rank (75.72, N = 29), followed by moisture resistance, slip resistance, and other protective attributes. These findings suggest that flooring in living spaces is prioritized for its ease of cleaning and ability to support frequent maintenance activities, which is essential for ensuring

indoor hygiene in high-traffic, multifunctional environments (Hassanain, 2008; Zhang et al., 2021).

The living room, being a central area used for various activities. The surface finishes should be quickly cleaned using basic tools such as a broom or damp cloth. In dining areas, moisture-resistant tiles were ranked highest (25.88, N = 8), which highlighted the need to address frequent food and liquid spills.

Therefore, dense, hard, and non-porous tiles are preferred in this zone. It is owing to the reasons to minimize water retention and facilitate cleanliness (Aman et al., 2019; Barbosa et al., 2020).

Table 2: The Correlation between Interior Floor Finishes (Tiles) with Interior Spaces Used and Selection Criteria of Hygienic

Interior Floor Finishes :	**Tiles**								
Selection Criteria :	**Hygiene**								
Interior Spaces	**Stain Resistant**	**Slip Resistant**	**Moisture Resistant**	**Dust-Free**	**Bacteria Resistant**	**Fire-Resistant**	**Gas Chemical**	**Selected Criteria**	**Average**
	Mean Rank								
Living Area	72.07	73.29	74.69	75.72	72.76	72.76	73.03	**Dust-Free**	73.47
Dining Area	22.88	22.75	25.88	23.00	21.63	18.50	19.94	**Moisture Resistant**	22.08
Kitchen Area	27.78	30.76	29.14	30.44	32.02	28.5	32.08	**Gas Chemical**	30.10
Bedroom	15.25	9.50	9.50	8.25	16.25	8.00	9.50	**Bacteria Resistant**	10.89
Restroom	9.00	8.19	6.13	8.25	9.50	11.63	12.75	**Gas Chemical**	9.35

Source: Abdul Halim, N., et al., (2021)

Timber Floorboard

The Kruskal-Wallis test in Table 3 indicates that dust-free timber floorboards were most preferred in living areas due to their ease of maintenance (mean rank = 90.52, N = 45). Living rooms, being multifunctional and high-traffic, benefit from hygienic and easy-to-clean surfaces.

In dining areas, slip-resistant timber ranked highest (22.00, N = 8), likely because of its dense, non-porous nature that prevents spills from causing slips (Aman et al., 2019; Barbosa et al., 2020). For kitchens and bedrooms, bacteria resistance (48.50, N = 1) and moisture resistance (21.63, N = 8) were

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prioritized, respectively, highlighting timber's health and comfort benefits. It was posited by Zhang et al., (2021) and Matan & Matan, (2007). However, concerns remain about timber's performance in wet environments like restrooms, where it is prone to warping and splitting due to humidity and heat (Ching et al., 2005; Brownell, 2008).

In Malaysian kitchens, the use of oil and water also shortens timber's lifespan, making it an unsuitable flooring choice. Though easy to clean, timber requires consistent maintenance to avoid damage from dust, sand, or spills. Surfaces need to be polished every few years and cleaned immediately after contact with liquids as posited by Lim et al., (2020). The installation of timber floors requires professional skills, and untreated timber is vulnerable to termite attacks (Matan & Matan, 2007). Additionally, timber can be slippery when wet, posing safety hazards especially for children and the elderly (Zhang et al., 2021).

Table 3: The Correlation between Interior Floor Finishes (Timber Floor Board) with Interior Spaces Used and Selection Criteria of Hygienic

INTERIOR FLOOR FINISHES:	TIMBER FLOOR BOARD							SELECTED CRITERIA	AVERAGE
SELECTION CRITERIA:	HYGIENE								
INTERIOR SPACES	STAIN RESISTANT	SLIP RESISTANT	MOISTURE RESISTANT	DUST-FREE	BACTERIA RESISTANT	FIRE-RESISTANT	GAS CHEMICAL		
	MEAN RANK								
LIVING AREA	83.89	80.48	85.89	90.52	83.13	77.84	78.77	DUST-FREE	82.93
DINING AREA	21.19	22.00	19.00	14.44	20.31	18.50	21.00	SLIP RESISTANT	19.49
KITCHEN AREA	42.50	24.50	47.00	47.00	48.50	46.00	46.00	BACTERIA RESISTANT	43.07
BEDROOM	13.19	18.38	21.63	20.25	20.50	17.75	17.75	MOISTURE RESISTANT	18.49
RESTROOM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NIL	0.00

Source: Abdul Halim, N., et al., (2021)

Carpet

By referring to Table 4, it shows that fire-resistant carpets ranked highest in living areas (85.44, N = 18). It is due to their heat resistance and durability, especially when made from polyamide fibres (Kang & Lee, 2013). In dining areas, gas and chemical resistance were prioritized (40.50, N = 2), as carpets can absorb volatile organic compounds (VOCs). It is due to some users to select natural, low-emission alternatives like jute or sea grass to reduce indoor air pollutants (Salthammer et al., 2010). For bedrooms, stain resistance was the top criterion (17.60, N = 10). The wool carpets were preferred for their dense fibre structure, durability, and hypoallergenic properties (Chen et al., 2012). However,

respondents generally avoid using carpets in kitchens and restrooms due to the high moisture exposure in these spaces. It promotes microbial growth and material deterioration (Nicolai et al., 2006).

In colder climates, such as in western countries, carpets are widely used because of their slip resistance and thermal insulation. It is also preferred for the reasons of sound absorption, providing comfort and warmth underfoot, especially in barefoot households (Fujita & Kimura, 2012). To reduce the risk of slipping caused by water, rubber padding is sometimes installed beneath carpets to improve grip and positional stability (Klenz Larsen et al., 2010). Despite these benefits, carpets are often perceived as unhygienic due to their tendency to trap dust, bacteria, and allergens. These that can lead to respiratory issues as posited by Mendell et al., (2005). Moisture retention and food spills can also lead to foul odours, especially when they are not promptly cleaned. Thus, contributing to discomfort in enclosed spaces (Levin & Hodgson, 2002).

These hygiene concerns explain why carpets are rarely chosen for wet zones, despite their comfort and aesthetic value in dry indoor environments. Overall, material selection reflects a balance between comfort, indoor air quality, and maintenance effort depending on the function of each interior space.

Table 4: The Correlation between Interior Floor Finishes (Carpet) with Interior Spaces Used and Selection Criteria of Hygienic

INTERIOR FLOOR FINISHES:	CARPET							SELECTED CRITERIA	AVERAGE
SELECTION CRITERIA:	HYGIENE								
INTERIOR SPACES	STAIN RESISTANT	SLIP RESISTANT	MOISTURE RESISTANT	DUST-FREE	BACTERIA RESISTANT	FIRE-RESISTANT	GAS CHEMICAL		
	MEAN RANK								
LIVING AREA	69.94	69.36	64.53	60.58	62.00	85.44	80.50	FIRE-RESISTANT	70.34
DINING AREA	24.25	19.00	16.50	16.50	26.25	29.00	40.50	GAS CHEMICAL	24.57
KITCHEN AREA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NIL	0.00
BEDROOM	17.60	12.85	8.95	12.65	10.45	15.15	13.60	STAIN RESISTANT	13.04
RESTROOM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NIL	0.00

Source: Abdul Halim, N., et al., (2021)

Mosaic

The Kruskal-Wallis test (Table 4) shows that mosaic flooring is highly preferred in living areas, with fire resistance ranking highest (73.25, N = 8). It is for the reason of its ability to act as passive fire protection in central communal spaces (Aman et al., 2019). In kitchens and dining areas, fire resistance (28.80, N = 15)

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and slip resistance (31.00, N = 4) are prioritized. It is as a result of the small tile format and grout lines help reduce slipperiness, especially in spill-prone environments (Ghazali et al., 2015).

For bedrooms and restrooms, moisture resistance is the leading criterion (23.90, N = 5; 11.29, N = 7). It is for the reasons of reflecting mosaic's effectiveness in controlling humidity and preventing mould and mildew growth (Zhang et al., 2021). The non-porous and water-resistant surface of ceramic or porcelain mosaic tiles inhibits fungal development. It happens owing to limiting moisture penetration which the primary trigger for microbial growth (Mendell et al., 2005). When grout lines are properly sealed, tile flooring becomes easier to clean and maintain. They reduce the presence of damp microenvironments that can affect indoor air quality (Salthammer et al., 2010).

The use of mosaic tiles in restrooms is also functional, as grout channels assist in directing water efficiently toward drains. Subsequently, enhancing safety and hygiene (Barbosa et al., 2020). Moreover, mosaic tiles contribute to environmental sustainability and do not encourage mould formation when properly maintained (Lim et al., 2020). Cleaning is straightforward, requiring only a soft towel and mild detergent to remove stains or grease from the surface. However, the smooth surface of the tiles can become slippery when wet, increasing the risk of home injuries. This issue can be mitigated by applying a non-slip sealer. It can improve traction without compromising the aesthetic quality of the tile (Klenz Larsen et al., 2010).

Table 5: The Correlation between Interior Floor Finishes (Mosaic) with Interior Spaces Used and Selection Criteria of Hygienic

INTERIOR FLOOR FINISHES:	MOSAIC							SELECTED CRITERIA	AVERAGE
SELECTION CRITERIA:	HYGIENE								
INTERIOR SPACES	STAIN RESISTANT	SLIP RESISTANT	MOISTURE RESISTANT	DUST-FREE	BACTERIA RESISTANT	FIRE-RESISTANT	GAS CHEMICAL		
	MEAN RANK								
LIVING AREA	45.13	55.50	70.25	49.94	56.94	73.25	69.88	FIRE-RESISTANT	60.13
DINING AREA	18.13	31.00	18.38	22.13	14.50	19.50	25.00	SLIP RESISTANT	21.23
KITCHEN AREA	22.27	24.50	19.10	19.13	22.17	28.80	20.57	FIRE-RESISTANT	22.36
BEDROOM	13.60	18.70	23.90	18.80	19.20	19.10	17.40	MOISTURE RESISTANT	18.67
RESTROOM	8.71	9.43	11.29	8.86	7.43	6.86	5.14	MOISTURE RESISTANT	8.25

Source: Abdul Halim, N., et al., (2021)

Marble

The Kruskal-Wallis test (Table 6) shows that in living areas, bacteria-resistant marble was most preferred (mean rank = 88.44, N = 52). It is by reason of its smooth, glossy surface that it supports hygiene and ease of disinfection (Zhang, Ma, & Ji, 2021). In dining and kitchen spaces, users favoured dust-free (30.19, N = 27) and moisture-resistant (36.94, N = 16) finishes. It is due to their surfaces prone to effect by spills. Therefore, textured marble helps to prevent slips (Aman, Ahmad, & Ariffin, 2019).

The residents preferred marble flooring for their bedrooms and restrooms, which has stain resistance (22.14, N = 7) and moisture resistance (12.50, N = 2) as top priorities. It is attributable to the reasons of marble's surface inhibits bacterial and fungal growth (Mendell et al., 2005). Its glossy finish also enhances aesthetics by creating the illusion of a consistently clean space (Ching, Jarzombek, & Prakash, 2005).

Marble requires minimal cleaning tools, making it a hygienic choice for regular upkeep (Brownell, 2008). However, marble's high porosity makes it prone to staining from coloured liquids, and it cannot withstand acidic cleaners without surface damage (Plunkett, 2010). The installation is complex and demands skilled workmanship to prevent cracks or uneven finishes (Ching et al., 2005). A major drawback is its slipperiness when wet or greasy, increasing the risk of accidents in wet areas (Barbosa, Pinheiro, & Noriega, 2020). This safety issue can be mitigated by opting for textured marble, which provides better grip while preserving its elegant look (Aman et al., 2019). Overall, marble is valued for its hygiene and visual appeal, but practical limitations must be managed for safe and lasting use in interior spaces.

Table 6: The Correlation between Interior Floor Finishes (Marble) with Interior Spaces Used and Selection Criteria of Hygienic

INTERIOR FLOOR FINISHES:	MARBLE							SELECTED CRITERIA	AVERAGE
SELECTION CRITERIA:	HYGIENE								
INTERIOR SPACES	STAIN RESISTANT	SLIP RESISTANT	MOISTURE RESISTANT	DUST-FREE	BACTERIA RESISTANT	FIRE-RESISTANT	GAS CHEMICAL		
	MEAN RANK								
LIVING AREA	85.94	86.96	82.45	78.62	88.44	79.04	83.12	BACTERIA RESISTANT	83.51
DINING AREA	28.33	26.37	28.54	30.19	29.3	29.72	26.89	DUST-FREE	28.48
KITCHEN AREA	36.38	30.75	36.94	34.88	29.47	28.91	31.03	MOISTURE RESISTANT	32.62
BEDROOM	22.14	20.93	20.93	21.29	21.43	18.5	21.43	STAIN RESISTANT	20.95
RESTROOM	10.00	10.75	12.50	12.50	12.50	6.00	7.50	MOISTURE RESISTANT / DUST-FREE / BACTERIA RESISTANT	10.25

Source: Abdul Halim, N., et al., (2021)

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Vinyl

The Kruskal-Wallis test (Table 7) indicates that in living areas, fire-resistant vinyl achieved the highest mean rank (111.20, $N = 5$), likely due to its inherent chlorine content that provides some level of flame resistance (Shen et al., 2013). However, the flexible nature of vinyl reduces its fire-retardant capability, necessitating the use of enhanced flame-retardant formulations for improved safety. In dining areas, slip resistance was the most valued feature (43.00, $N = 1$), as matte-finished vinyl surfaces are designed to reduce slipping incidents, especially in spaces with frequent spills (Aman et al., 2019).

For bedrooms, gas and chemical resistance ranked highest (27.00, $N = 1$), where respondents favoured low-VOC vinyl options such as tile vinyl to support healthier indoor air environments (Zhang et al., 2021). Despite these advantages, vinyl is not recommended for kitchens and restrooms because it becomes slippery when wet, increasing the risk of accidents. Vinyl flooring is highly durable and resistant to acids, alkalis, solvents, water, and dirt, making it suitable for high-traffic areas (Patnaik, 2002). It also provides resistance to harmful gases and microbial growth, which contributes to its growing use in healthcare and residential spaces (Matan & Matan, 2007). Nevertheless, one major drawback is its chemical composition, which can negatively affect indoor hygiene unless certified non-toxic or low-emission vinyl brands are selected (Yoon et al., 2011). Sheet vinyl with seams or joints is particularly problematic, as dirt can accumulate beneath the wax layer, fostering an unhygienic environment (Brownell, 2008).

To ensure safety and health, interior designers and architects should recommend environmentally friendly vinyl options that emit minimal volatile organic compounds (VOCs) and meet green building standards (Zhang et al., 2021).

Table 7: The Correlation between Interior Floor Finishes (Vinyl) with Interior Spaces Used and Selection Criteria of Hygienic

INTERIOR FLOOR FINISHES:	VINYL							SELECTED CRITERIA	AVERAGE
SELECTION CRITERIA:	HYGIENE								
INTERIOR SPACES	STAIN RESISTANT	SLIP RESISTANT	MOISTURE RESISTANT	DUST-FREE	BACTERIA RESISTANT	FIRE-RESISTANT	GAS CHEMICAL		
	MEAN RANK								
LIVING AREA	89.80	88.30	72.20	111.10	76.30	111.20	82.10	FIRE-RESISTANT	90.14
DINING AREA	36.50	43.00	39.00	39.00	38.00	40.50	40.50	SLIP RESISTANT	39.50
KITCHEN AREA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NIL	0.00
BEDROOM	26.00	26.50	13.50	13.00	14.00	26.50	27.00	GAS CHEMICAL	20.93
RESTROOM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NIL	0.00

Source: Abdul Halim, N., et al., (2021)

CONCLUSION

The Kruskal-Wallis test analysis reveals that residents select interior floor finishes based on how well they suit the functional needs of each space. In living areas, tiles are preferred for their ease of cleaning and suitability for regular maintenance, which is essential in high-traffic, multifunctional zones. Dust-free timber floorboards are also favoured due to their low-maintenance qualities, while fire-resistant carpets made from polyamide fibres are selected for their heat resistance and durability. Mosaic flooring is appreciated for its fire-resistant properties and its function as passive fire protection in communal areas. Bacteria-resistant marble is chosen for its smooth, glossy surface that supports hygiene and ease of disinfection. Vinyl flooring is also considered, likely due to its inherent chlorine content that offers a degree of flame resistance.

These selections demonstrate a strong resident focus on cleanliness, safety, and practicality in flooring choices. Overall, the findings highlight that users prioritize materials that enhance hygiene, reduce maintenance, and contribute to safer living environments as summarized in Table 8.

Table 8: Comparison of Interior Floor Finishes Based on Functional and Hygienic Performance

Flooring Material	Key Functional Attributes	Hygienic Features	Preferred Interior Spaces	User Priorities Supported
Tiles	Easy to clean, durable, suitable for regular maintenance	Smooth surface minimizes dust and allergen accumulation	Living areas, multifunctional zones	Cleanliness, maintenance efficiency
Timber	Low maintenance, aesthetically warm	Dust-free surface improves indoor air quality	Living and family areas	Hygiene, comfort, reduced allergens
Carpet	Fire-resistant, durable, provides comfort underfoot	Resistant to heat and minimizes risk of fire spread	Bedrooms, lounges	Safety, comfort
Mosaic	Fire resistance as passive fire protection	Smooth, non-porous surface resists bacteria	Community and transition areas	Safety, hygiene
Marble	Durable, glossy finish, visually elegant	Bacteria-resistant, easy to disinfect	Living, dining, and high-contact areas	Hygiene, cleanliness, aesthetics
Vinyl	Flexible, easy installation, cost-effective	Contains chlorine content that enhances flame resistance	Kitchens, service areas	Safety, practicality, low maintenance

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Residents in Malaysian tropical homes emphasize flooring materials that balance hygiene, durability, and safety. Preferences reflect awareness of health-oriented design, with surfaces chosen for their ease of cleaning, allergen control, and fire resistance. The data reinforces that functional suitability and hygiene drive flooring selection across interior spaces.

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RE-INTERPRETING TRADITION: INTEGRATING INTERIOR SPATIAL PLANNING PRINCIPLES OF TRADITIONAL MALAY HOUSE AS VERTICAL MODERN DWELLING DESIGN STRATEGY

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Abstract

This study investigates the application of TMH's interior space planning principles into contemporary housing design to produce culturally attuned, climate responsive and spatially adaptable housing strategies for the 21st century Malaysian environment. The research is motivated by the extended gap of contemporary house types to socio-cultural, environmental and spatial value that rooted in local heritage of Malay Vernacular architecture. Through a qualitative case study approach, the research investigates spatial configuration, zoning patterns, environmental attributes and socio-cultural relationships in identified TMH instances within Peninsular Malaysia. These understandings are subsequently compared against contemporary urban housing units namely PR1MA Apartments in Ipoh, Perak, to determine spatial disconnection and or synergies. Based on architectural drawings, field survey and interviews to architects and residents the research outlines adaptive design methods. The main findings that emerged about the principles of TMH planning, such as hierarchical spatial sequence, multifunctional open spaces, passive ventilation strategies and community-orientated layout become valid concepts for versatile thermal comfort, social interaction and flexibility in the morphology of urban dwelling. A design suggestion to incorporate TMH principles in today's interior layouts without interfering with building codes or visual aesthetics is suggested at the end of the study. This work adds to the discourse on culturally grounded sustainable design, emphasizing the need for tradition based spatial wisdom being revived as an approach towards a more liveable and contextually aware housing typology in Malaysia.

Keywords: Traditional Malay House, Spatial Planning, Green Design, Principles, Wellbeing

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INTRODUCTION

Malaysia s residential architecture has evolved dramatically in the past few decades, from traditional vernacular models to current housing standards. This shift-driven largely by urbanization, globalisation, and increasing housing demand-has seen housing such as mass-produced high-rise apartments and terrace houses proliferate architecture. The result is that far too many developments not only ignore cultural identity but also flexibility of space and environmental responsiveness. By comparison, the Traditional Malay House is a beacon of Malaysia's architectural heritage. It embodies generations worth of architectural wisdom, a convergence of humanity with space and nature under diverse social, cultural and climatic conditions.

The TMH goes far beyond a mere shelter. It represents the spatial embodiment of Malay societal values, way of life, and environmental thinking. Its interior spatial layout features raised flooring, a layered spatial hierarchy, multi-functional rooms, passive ventilation and open verandas. All these elements foster community, modulate privacy, let in the right amount of light, reflect Islamic design and have their roots in *adat* (customary law). In today's urban housing projects, however, these values are often ignored for a house that is both efficient and uniform in design; market demand constraints lead people to put up with what's not really suited to their needs. As a result, modern housing often fails locally speaking to satisfy social, cultural demands. Consequently, living environments are culturally remote and fuel inefficient.

Problem Statement

Current design approaches tend to rely heavily on international standards and Western planning paradigms, with little attention paid to traditional design intelligence. This has led to a pressing concern: how can the spatial principles of the TMH-rooted in heritage yet inherently functional be reinterpreted and applied meaningfully in modern dwelling contexts, especially within the spatial constraints of urban living. The lack of study on the integration of TMH interior planning into modern housing contributes to this gap. While some research highlights the environmental performance of traditional houses, there is limited focus on how these spatial arrangements can be transformed and adapted as viable design strategies in present-day interior and architecture.

Research Objectives

The objective of this research is to fill this gap by studying modern urban housing design from the viewpoint of traditional Malay house architecture. The study is undertaken in the belief that traditional architectural models can provide beneficial perspectives for sustainable living that does not negate its environment,

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that is sensitive to different cultures and flexible on a spatial level. In many ways, the issues raised are linked to current urban problems.
Through this research, I hope to:

i. Analyse the interior spatial planning of the Traditional Malay House, specifically looking at spatial hierarchical order, functional zoning, environmental adaptability, and socio-cultural usage.
ii. Assess modern urban housing types such as PR1MA apartments for their spatial dimensionality in terms of flexibility that is user friendly and provides comfort in varying climatic conditions.
iii. Offer a design guide or series of strategies for making traditional Malay House-derived interior spatial principles assimilation into modern housing design a reality– while drawing attention to current architectural regulations, material systems, and lifestyles that are evolving.

By tying history to present practice, this study intends to provide a culturally embedded and environmentally adaptable way of housing design. Ultimately, it sees a future where Malaysian homes are revived by drawing on tradition's authentic essence rather than obliteration within the modern world. This effort contributes to a broader conversation within architectural circles on how to bring vernacular architecture back from the brink of extinction, design that is sustainable, and cultural continuity within built environments.

LITERATURE REVIEW

A residential home serves as a sanctuary from peril, inclement weather, and environmental factors (Talib, 2010). Homeownership is the aspiration of every individual. The home serves not only as a refuge but also as the cornerstone of both structure and life development. The quality of a home's interior space significantly impacts the success of an individual's life. This attribute pertains to the interaction of architecture, interior space, and the environment. Residential spaces should be created to harmonize physical, human, and environmental elements to promote the well-being of inhabitants in accordance with the rhythms of daily life, (Hossein, 2018). The internal physical characteristics of the houses should be in line with the basic needs of the users, (Pauzi et al., 2022).

Traditional Malay House (TMH)

TMH are characterized by their distinctive architectural style, rooted in centuries-old cultural and environmental influences. These iconic dwellings reflect the harmonious integration of function, aesthetics, and the natural landscape (Hossein, 2018). Featuring intricately carved wooden structures, elevated platforms, and sweeping, tiered roofs (Choo et al, 2024), Malay houses embody

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a rich heritage that has inspired contemporary interpretations in modern living spaces. The traditional Malay house is an architectural marvel, featuring a distinct design that reflects the cultural heritage and environmental adaptations of the region. As urban populations grow, the need for efficient and sustainable vertical dwelling solutions has become increasingly important. This paper will explore how the principles of traditional Malay house spatial planning can be adapted and reinterpreted for modern vertical living designs. According to Shamsudin (2016), Malay communities are rich with their customs, culture and values guided by the Islamic principle. He suggested that to promote an ideal living environment for the Malay-Muslim community, lessons can be learned from the traditional settlements such as the Malay kampong house.

Spatial Planning Quality

Malay house design follows several rules. Traditional Malay dwellings need climatic and environmental design to generate a suitable climate. Traditional Malay houses are passive and energy-efficient due to site and construction orientation relative to dawn (Hanafi, 2014). Traditional Malay houses feature modular construction with a unique joint method for adding and removing modules (Surat, 2015). Post-and-lintel structure with prefabricated system. Building a stilt-supported timber house for storm and flood protection (Gibbs, 1987). Less building effect than modern approaches. Wide roof eaves and low walls control direct solar radiation and rain in TMH architecture. High roofs with big windows and ventilated walls circulate air for cooling (Lim, 1987). Traditional Malay homes are tailored to local needs. Traditional Malay dwellings are fractured and open plan, allowing wind and natural air to cool them. Multifunctional spaces like *anjung, serambi, rumah ibu*, and *dapur* are socially defined, comfortable, and reduce central home heat gain and energy usage. Building lumber quality depends on homeowners' reputation (Hanafi, 2012). Sustainability requirements, including carbon reduction, have been applied and documented (Kassim, et al., 2017). Artistic expressions in design, culture, and architecture that apply sustainable design principles to conserve electricity and money. Figure 1 illustrates TMH hose form and space planning concerns.

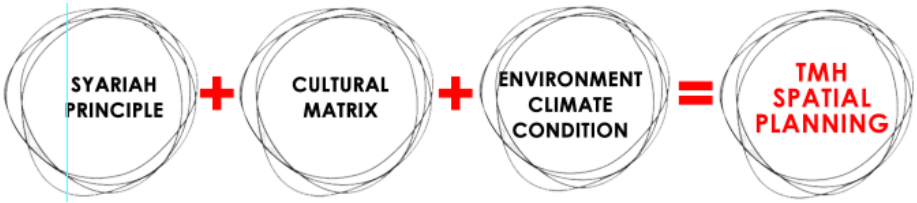


Figure 1: Factors Influencing House Form and space planning of TMH
Source: Authors infographics

Space Classification

The set space and form in the Malay architecture is developed on utalirian principle. Spaces were usually public, private and semi-public. Family privacy was reflected in its layout. The earlier writer on traditional Malay houses had noted that space was identified by its qualities. Abdullah (1981) suggests that traditional Malay homes contain three categories of space: cooking area *(Dapur),* veranda *(Anjung)* and formal chambers for guests or administrative use. Secondly, there's a functional space for family day chores like cooking and washing or *pelantar.* Third place is passive space, it means the core house *(rumah ibu)* and bedroom for family members main activities. Lim (1987) explains that the traditional Malay house is divided into two parts, namely, the front and back section based on the core house *(rumah ibu)* and kitchen. In the Malay house, compartments are organised by function and adjacency. This house consists of three areas: Verandah *(Serambi)*, Main House *(Rumah Ibu)* and also Kitchen. Ibrahim (2020) also discovered that complex is preferred by Malays for feasts. Socio-cultural values must be taken into consideration while designing Malay traditional house grounds. So too should the design of urban housing. Private yard and landscaping planning must be included in plans. And that, the shape and form of the house depend on the family requirements and surrounding, culture, religion. This study enables the new generation to appreciate precious Malay culture. Therefore, this paper is to analyse the spatial organization design and architecture of the functional diversity of a TMH and explore how space influences traffic ability. In this way, space will be utilized most effectively for the intended function. In the traditional Malay house literature various writers have classified space as tabulated in Table 1.

Table 1: Space Classification by previous researchers of Traditional Malay House

Space Classification	Spatial Organization	Space Classification by	Character/Key Principles
Gender Types	Male Areas; Female Areas; Common Areas	Phillip Gibbs	Open Plan, Linear Plan, Multifunction Space, Flexible, Clear Hierarchy, Minimalist Plan, environmentally friendly
Genders Type and position of space	Male areas (in front of the house); Female areas (Main House/centre of house); Space for common areas	Abdul Halim Nasir	
Genders type and privacy space	Dual compartmentalization concept; Front Area Zone; Back area zone; Central Zone; Public-private Zone	Mokhtar Haji Ismail	
Construction technique	Standard/ basic areas; added space	Abdul Rahim Abdullah	
Frame/structure	Main structure; Secondary structure	Phillips Gibbs	

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Space Classification	Spatial Organization	Space Classification by	Character/Key Principles
Functions	Public areas; Special area	Zulkifli Hanafi	
Religion; social-culture; custom	Ruang Serambi/veranda & Kitchen areas; centre areas-main house/ room	Mokhtar Haji Ismail	

Source: Tahir (2016), Hossein (2018)

Spatial Organization

The traditional Malay house has an *Anjung* (porch space), Veranda *(Serambi),* Core House *(rumah ibu)*, Bedroom, Loft *(loteng),* Kitchen, and Platform *(Pelantar).* Nasir (1994) claims that the Malay traditional house's layout depends on its residents' needs and habits. According to Hanafi (2012), a successful life begins at home, and the traditional Malay house meets several needs, including functionality, comfort, safety, and spiritual ambitions. The Malay community's architecture must meet Islamic socio-cultural standards. Arbi (1997) claims that building or habitation depicts civilization because it includes spirituality, physiology, emotion, gastronomy, philosophy, and religion. Malay architecture seamlessly blends people, nature, and spirituality. Table 2 below shows a traditional Malay home's layout.

PR1MA Apartment Housing in Malaysia

In 2011, the Perumahan Rakyat 1Malaysia (PR1MA) program was launched under the PR1MA Act (Act 739) to solve home affordability issues for Malaysia's M40 demographic. The program has built medium-to-high-rise apartment units in important growth areas nationwide to provide quality, affordable urban housing. Despite its policy importance, the PR1MA housing typology-particularly vertical apartments-has been criticized in scholarly debate for spatial quality, user pleasure, and cultural adaptability.

Mohamed and Baqutayan (2014) found that PR1MA flats are affordable but often neglect spatial planning and socio-cultural needs, mismatching policy goal and lived experience. Standard modular designs maximize unit amount per block, limiting ventilation, natural lighting, spatial seclusion, and functional adaptability. Vertical housing complicates socio-behavioural issues in densely populated urban regions (Salleh & Yusuf, 2006).

Samsudin and Idid (2016) found that PR1MA layouts rarely include Malay cultural standards including public-private separation, multi-generational interaction spaces, and gender-sensitive zones. In traditional Malay homes, these omissions can damage family intimacy and cultural practise. The absence of semi-outdoor spaces like verandas or transitional thresholds reduces social

involvement and passive environmental regulation in traditional Malay design (Kamal et al., 2004).

Environmental and climatic responsiveness is another issue. Traditional Malay houses use passive cooling and site-responsive layouts, but PR1MA designs generally ignore these. Using generic, imported models increases mechanical system use and reduces thermal comfort, creating unsustainable living conditions, according to Hanafi (2012).

Raja Ariffin et al. (2010) argue that design innovation can improve policy. They advise employing vernacular spatial techniques to improve livability, identity, and sustainability in future PR1MA housing. Traditional Malay dwelling forms are modular and expandable, yet many PR1MA units have fixed interior designs that hinder household evolution (Utaberta, et al., 2009).

The research on PR1MA residences in Malaysia shows a large gap between functional delivery and cultural or spatial resonance. Although the program meets quantitative housing targets, it sometimes sacrifices user experience. Design study that reassesses PR1MA's spatial framework for cultural relevance, environmental responsiveness, and adaptive use is needed, especially for vertical urban life.

METHODOLOGY

This was a qualitative type of study using spatial analysis to investigate Traditional Malay House typologies and the PR1MA apartment unit in Ipoh. The focus was to study the design concept in TMH regarding spatial planning with emphasis on space utilisation and recommend principles of it as a guideline for designing vertical living environment such as PR1MA Apartments. We measured the likely incorporation by considering parameters such as spatial variability species rank and environmental satisfaction.

The study analysed the design of TMH in terms of its ideals and aspirations through plans that were obtained from drawing storage department in Pusat Penyelidikan Kajian Alam Melayu University Technology, Malaysia, and Centre for Knowledge Understanding of Interior Architecture. Four TMHs were purposively selected from the major zones (North, South, East Coast and West/Central) of Peninsular Malaysia. Data were collected through a combination of site observation, literature review and drawing analysis with an emphasis on a 750 sqft mobile vertical modern PR1MA apartment using architectural drawings from the Majlis Bandaraya Ipoh Office.

Ethical Issues- The study was conducted on the analysis of architectural design (plans), drawing and review of literature, without direct human participation. As such, formal ethical approval was not necessary, and all sources were publicly accessible or institutionally provided.

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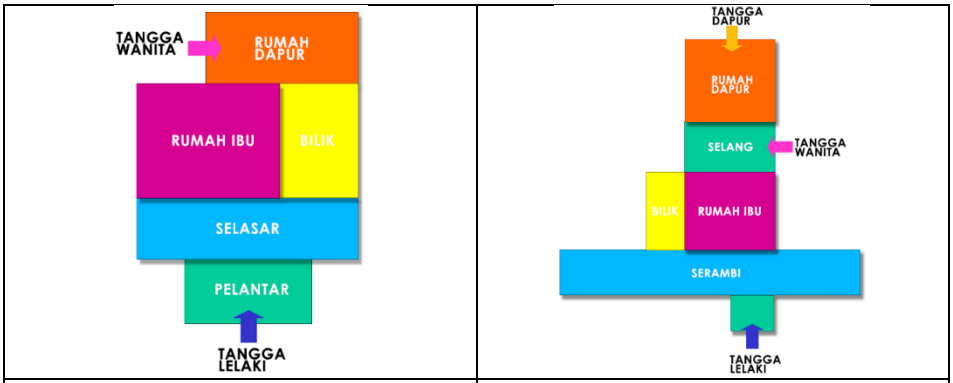
Conclusion-A major methodological constraint was the limited scope of case studies used, restricted to specific PR1MA housing units that limit the applicability of findings. Also, the non-interviewed occupants did not provide information on resident satisfaction and perceptions. Subsequent work would benefit from a more diverse array of cases and some user interviews grounded in people's actual lived experience and preferences.

FINDING AND DISCUSSION

From the observation of spatial analysis on TMH typology, it is evident that the separation of space based-on characteristic requirement culture and Islamic residential for privacy have been achieved. The finding showed that the layout plan of TMH is well meet segregation male and female, segregation public and private space, public, semi-public and private provides specific room for bathing house orientation, moderation in expenses and cleanliness need.

Figure 2: Typical of TMH space planning according to traditional house types in Peninsular Malaysia

	
Typical Spatial Planning of Limas House -TABAK (LTH)	Typical Spatial Planning of Kutai House (KPH)



Typical Spatial Planning of Rumah Bujang Terengganu House (RBH) | Typical Spatial Planning of Negeri Sembilan House (NSH)

Source: Authors drawing (2025)

Figure 2 above illustrates typical TMH spatial organization categorized by zones, including Rumah Limas - TABAK (LTH), Rumah Kutai Perak (KPH), Rumah Bujang Terengganu (RBH), and Rumah Negeri Sembilan (NSH). Colour coding is employed to examine the similarities and distinctions among various housing styles. Initial findings indicate that the characteristics and components of TMH space planning are aligned with past research. However, discrepancies may arise from specific causes. Table 2 below presents a summary of the conducted space planning study:

Table 2: Summary of the Spatial Planning Analysis of Traditional Malay Houses (TMH). *Note: The symbol ✓ indicates "Complete", while @ indicates "Partly".*

Space	Space Classification	LTH	KPH	RBH	NSH	Analysis
Anjung/Porch	Public Space	✓	@	✓	✓	Only the RBH house has a small porch to cover the main entrance stairs due to environmental and wartime pressure factors
Serambi	Semi Public	✓	@	✓	✓	The RBH and NSH houses have a long *Serambi* room, lower space and adjacent to the main room/ mother's house for welcoming and entertaining guests, children's sleep areas as well as guests and recite al-Quran. The KPH house has a porch internally house due to the constraints and pressure of the surrounding atmosphere

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Space	Space Classification	LTH	KPH	RBH	NSH	Analysis
Rumah Ibu/Core Area	Private	✓	✓	✓	✓	Almost all categories have this space with minimal furniture use, partitions and interior walls are good to allow proper ventilation and natural lighting into space. Make it a flexible and open space to carry out activities.
Bilik tidur/bedroom	Private	✓	✓	✓	✓	All house types have a room for parents' use as well as a dressing room for young women for privacy. There is also a loft space for some Malay houses that serve as space for young women and store items.
Selang/	Public	✓	@	@	✓	Space is used for welcoming, chatting and entertaining activities for women. Apart from that, it is also used as a place to weave mats, sewing, for generate economic.
Dapur/Kitchen	Semi Public	✓	✓	✓	✓	All house types have *rumah dapur* that are used for food preparation, cooking and family meal processing.
Pelantar	Public	✓	✓	@	@	Not all types of the house have this space that is adjacent to the kitchen to wash groceries and equipment in the process of food preparation. Under certain circumstances, it is also used to bathe the infants and mothers who are in abstinence.

Source: Authors (2025)

The analysis of Traditional Malay House (TMH) typologies-specifically Limas House (LTH), Rumah Bujang Terengganu House (RBH), Kutai Perak House (KPH), Rumah Bumbung Panjang (RBH), and Negeri Sembilan House (NSH)-reveals distinct spatial compositions and classifications that emphasize cultural, environmental, and functional considerations. These spatial characteristics offer valuable insights for reinterpreting traditional planning principles in modern vertical housing design.

Space Classification and Functional Hierarchy - Spaces in TMHs are classified into three main categories: public, semi-public, and private. This hierarchical zoning is consistently observed across all house types and plays a critical role in managing social interactions and privacy levels.

- Public spaces like *anjung, selang,* and *pelantar* function as transitional or community areas. The anjung is usually a reception area, but wartime or environmental limits may reduce it, as in the RBH. The selang and pelantar are flexible social and utilitarian areas.
- Semi-public spaces include *serambi* and *dapur.* These regions balance domestic and social life. *Serambi* accommodates guest receptions, Quranic recitations, and children's sleep spaces, demonstrating its versatility. Besides food production, the *dapur* (kitchen) enables communal meal sharing and nurturing.
- Private spaces like *rumah ibu* and *bilik tidur* use little partitioning, cross-ventilation, and flexible layouts. The central room of a household, the *rumah ibu,* offers flexible usage and unimpeded ventilation, making it appropriate for modern compact apartments.

Spatial Adaptability and Cultural Integration - The analysis reveals that spatial flexibility, natural ventilation, and cultural appropriateness are consistent traits across TMH types. For instance, the absence of fixed walls in *rumah ibu* allows spaces to be repurposed easily. Bedrooms (*bilik tidur*) are modest yet strategically placed to ensure privacy, often featuring lofts for additional storage or privacy for unmarried daughters.

Moreover, the presence of multi-use zones like the *serambi* and *selang* underlines the significance of adaptive reuse of space based on time, activity, and user demographics-a concept especially relevant in the context of small urban dwellings.

Design Implication for PR1MA Apartments **-** The study suggests that these spatial attributes can be translated into PR1MA apartments by introducing flexible partitioning, reconfigurable core spaces, and tiered zoning that respects cultural norms. The incorporation of transitional semi-outdoor areas or multi-use corridors, akin to the *serambi* or *selang*, can enhance social interaction, comfort, and privacy within compact vertical layouts.

In conclusion, the findings support the hypothesis that integrating traditional Malay spatial principles into modern vertical housing can significantly improve spatial quality, cultural identity, and environmental responsiveness in PR1MA apartments and similar public housing projects in Malaysia.

Finding from the spatial planning of the Falim PR1MA Apartment in Ipoh, Perak, reflects a typical vertical housing typology developed to accommodate Malaysia's middle-income group within limited urban land areas. Designed for efficiency and affordability, the layout presents a compact, modular organization of space within a constrained floorplate of approximately 785 square feet. Despite achieving density targets, the spatial composition reveals several

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limitations when evaluated through the lens of traditional Malay spatial planning principles.

Zoning and Spatial Hierarchy - The internal configuration of the Falim PR1MA unit adopts a linear and compartmentalized layout, divided into fixed zones: living area, dining space, kitchen, bedrooms, and bathrooms. This model emphasizes privacy through enclosed rooms but lacks the nuanced gradation of public, semi-public, and private spaces. The entrance typically opens directly into the living area, merging visitor and family spaces without transitional buffers such as *anjung* (porch) or *serambi* (veranda), which in TMH architecture mediate between public and private spaces.

Limited Flexibility and Adaptability – the spatial planning is rigid, with minimal opportunity for reconfiguration or adaptive use. The use of permanent walls to demarcate bedrooms and living areas restricts spatial flexibility. This contrasts with the TMH, where spatial fluidity enables rooms to transform for sleeping, hosting, or family rituals based on time and need.

Environmental and Climatic Response - Ventilation and daylighting in the PR1MA unit are achieved primarily through standard window placements in bedrooms and living areas. However, the absence of cross-ventilation strategies, overhangs, or shaded verandas-hallmarks of the TMH environmental response-results in increased reliance on mechanical cooling. Moreover, the kitchen is often enclosed and located at the rear, separating it from any external semi-outdoor working space such as the traditional *pelantar* used for washing or post-cooking tasks.

Privacy and Social Interaction - While the unit provides three bedrooms and two bathrooms, the overall layout does not accommodate multi-generational living or gender-sensitive zoning effectively, both of which are critical in traditional Malay households. The compact nature of the unit forces overlapping between private and communal functions, often leading to compromises in personal privacy and domestic rituals.

RECOMMENDATION

It is proposed for industry players, particularly in design and planning of vertical housing such as upcoming PR1MA Apartment projects to consider infusing culturally responsive spatial concepts that harmonize the environment in their product. In this context, the results could be used in guiding the design and planning issues, where spatial interventions are expected to improve user experience and use considerably as Table 3 (as follows):

Table 3: Recommendation for future design and planning of vertical dwelling apartment

Recommendations	TMH	Modern House
Reinterpretation of *Kolong* and Outside Compound	The *kolong* (under-house space) and outside compound, traditionally crucial for daily activities, storage, social gatherings, and festive celebrations.	Adapting and should be re-envisioned for modern vertical dwellings. These concepts can provide valuable multi-functional areas.
***Serambi* Integration**	The *serambi*, which historically served as a semi-public transitional space for welcoming guests while preserving privacy between genders, warrants reinterpretation in contemporary layouts.	Modern homes have often replaced the *serambi* with direct entry into living rooms, which can compromise privacy for both guests and the host family.
Rethinking Linear Planning Layouts:	Specifically, welcoming areas that promote privacy, where kitchens are typically located at the rear, can lead to discomfort during guest interactions.	The layout of the reception area that places less emphasis on privacy, with the kitchen positioned at the front, can cause discomfort during interactions with guests.
Incorporation of *Selang* Functionality	The *selang as* transitional space that connects the core house to the kitchen and often functions as a secondary entrance and a designated area for women activities.	Reintroducing its functional and social roles could cater to daily life practices and enhance spatial flow.
Embracing Open-Plan and Minimalist Design	The design principles of the Traditional Malay House (TMH), with an open-plan and minimalist approach characterized by simple geometry, straightforward layouts, unobtrusive detailing, and honesty in material usage, can facilitate spatial flexibility and adaptability, in line with the multifunctional nature of the spaces.	Adopting principles of open-plan and minimalist design, characterized by uncomplicated geometry, simple layouts, inconspicuous detailing, and honesty of materials, can facilitate spatial flexibility and adaptability.
Utilizing Flexible Furniture	The use of minimal furniture that suits daily activities is a concept inherent in the	The integration of flexible furniture for supporting open-plan spatial organization,

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Recommendations	TMH	Modern House
	adaptable nature of Traditional Malay House (TMH) spaces.	enabling dynamic adaptation to diverse activities and occupant needs

Source: Authors (2025)

CONCLUSION

This study examined the application of TMH interior spatial organization principles in modern vertical house design to tackle Malaysian high-rise housing issues. The theory of vernacular architecture, space syntax and cultural sustainability were employed to analyse features as practicable principles for adaptation TMH spaces alongside open-plan flexibility, zonation hierarchy, climate responsive design and levels of communal connectivity. The research results reveal that the spatial logic can resolve contemporary apartment privacy, environmental comfort, social interaction and cultural identity problems. We can only attract our clients in PR1MA projects to have a sense of ownership while staying true to such inspiration which has been proven transformative over the years, unnecessarily at a cost, by adopting and applying this concept for more human friendly, liveable and culture enriched designed vertical houses. It is a proof of the fact that tradition and innovation can go hand in hand when well interpreted matching heritage with urban requirements. By linking historical spatial understanding with present design limitations, the research contributes to sustainable and culturally (Islamic) compatible housing. It raises the importance of local cultural stories for spatial identity and condemns homogenizing models of high-rise living independent of social and environmental milieu. To propose a culture inspired urban housing project, this research resets vertical housing in the tradition. It recommends to the designers, urban planners and housing authorities that vernacular spatial intelligence should be considered as an innovative design approach for addressing Malaysia housing provision as well as preserving its architecture heritage.

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FROM TRADITION TO TRANSITION: ADDRESSING THE MALAY LANDSCAPE DEFICIT IN PERAK TENGAH

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Abstract

This study addresses the growing issue of cultural and spatial disparities in traditional Malay settlements, focusing on Perak Tengah. The key issue investigated is the Malay landscape deficit; the measurable decline of culturally embedded spatial patterns, vernacular architecture, land use traditions, and communal values, driven by rapid urbanisation and modern planning practices. The research aims to conceptualise and examine this deficit by identifying key indicators of landscape and cultural transformations in rural Malay contexts. Specifically, the objectives are to trace physical changes, evaluate the condition of traditional houses, and assess socio-cultural implications over time. Using a qualitative case study method combining document analysis, field observation, and GIS mapping (1990–2020), the study focuses on villages such as Kampong Ekor Bota, Kampong Bota Kiri, and Kampong Padang Tenggala. The limitations are subjected to accessible data gained through GIS and fieldwork. Findings highlight four authenticity deficit indicators and the erosion of traditional landscapes. The study contributes to culturally sensitive planning by offering recommendations aligned with the future demands for inclusive, heritage-resilient development in Malaysia.

Keywords: Malay Landscape, deficit, authenticity, kampong, Perak Tengah

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INTRODUCTION

The traditional Malay cultural landscape, once richly embedded in Malaysia's physical and social fabric, faces a growing threat of erasure. Rapid urbanisation, changing lifestyles, and prioritising economic development have led to the neglect and marginalisation of indigenous spatial traditions, architectural heritage, and community values. As a result, many Malaysian towns and rural areas reflect globalised urban forms rather than the nuanced, place-based identities rooted in the nation's cultural history (Yusof et al., 2022).

In the Malay worldview, the landscape is not merely a physical setting but an embodiment of *adat* (customs), belief systems, and social structures. The traditional kampung, with its organic layout, timber houses on stilts, shaded communal spaces, and intimate relationship with nature, represents more than architecture; it symbolises a way of life (King, 2008; Gullick, 1987). Yet, these elements are often absent in contemporary planning practices, giving rise to what this paper terms a "Malay landscape deficit".

This deficit refers to the tangible, measurable erosion of the traditional Malay cultural landscape. It includes the loss of traditional spatial arrangements, vernacular architectural typologies, agricultural land use, and spaces of communal interaction. As settlements modernise, organic kampung layouts are replaced with grid systems; timber stilt houses give way to concrete structures; and rice fields or orchards are converted into residential or industrial zones.

Closely linked but conceptually distinct is the idea of an "authenticity deficit", a deeper, qualitative disconnection between modern developments and the genuine cultural expressions they attempt to represent. This occurs when so-called Malay identity is evoked only at the surface level through motifs, signage, or symbolic references without preserving the embedded spatial logic, environmental responsiveness, or social coherence of traditional Malay settlements (Ismail, 2018).

As Malaysia looks toward more inclusive and sustainable development, there is a critical need to interrogate the extent of these deficits and their implications. This paper raises concerns on: Is the Malay landscape facing a deficit in Perak Tengah? What are the spatial, architectural, and social changes in kampung life? And how can planning considerations better accommodate cultural continuity amid inevitable change? By critically assessing the interface between tradition and modernity, and between physical form and lived experience, this study uniquely contributes to the discourse on culturally sensitive planning by contextualizing the concept of 'authenticity deficit' within the Malay rural landscape, framing it as both a planning and cultural sustainability issue.

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LITERATURE REVIEW

(i) The Malay Cultural Landscape Tradition

The Malay cultural landscape is rooted in a holistic worldview that integrates physical, social, and spiritual dimensions. Traditional kampung settings reflect adat (customs), Islamic values, and environmental responsiveness. Scholars such as Gullick (1987), King (2008), and Wan Hashim (1994) describe how kampung spatial arrangements featuring timber houses on stilts, open verandahs (*anjung*), and modular layouts (*rumah ibu, rumah dapur*) are designed to accommodate communal living, environmental adaptation, and spiritual orientation.

These built forms are intimately tied to the landscape: houses face rivers or roads, compounds are shaded with local trees, and agricultural land surrounds the residential core. The kampung functions as both a settlement and a living system of knowledge, with values of *gotong-royong* (mutual help) and familial continuity shaping everyday life.

(ii) Cultural Landscape Transition

Over recent decades, Malaysia's rural and peri-urban regions have undergone substantial transformation due to development pressures, changing lifestyles, and planning paradigms prioritising modernisation. Scholars like Hussein (2008) and Said & Shamsuddin (2015) document the steady erosion of kampung spatial identity, replaced by gridded housing layouts and infrastructure-driven development. This transition often disrupts traditional land-use patterns, replacing agriculture with institutional or residential zoning (Nordin et al., 2019; Rashid & Othman, 2021).

Planning mechanisms, though technically robust, are often culturally blind. Ahmad et al. (2020) and Kamarudin et al. (2022) critique current spatial planning for sidelining heritage preservation in favour of efficiency and uniformity. Attempts to "preserve" Malay identity frequently result in superficial representations using decorative motifs or symbolic facades without maintaining spatial logic, environmental adaptation, or social function (Farid et al., 2023; Ismail, 2018).

This transition phase reflects a complex interplay between policy, land speculation, youth migration, and lifestyle shifts. In regions like Perak Tengah, where *kampung* morphology once defined the rural landscape, these pressures lead to a fragmentation of cultural continuity.

(iii) Emerging Evidences of The Malay Landscape Deficit

The term Malay landscape deficit captures the cumulative loss of traditional Malay spatial identity, cultural function, and environmental integration. It is both a physical and symbolic erosion of the *kampung* landscape visible in the disappearance of timber houses, fenced compounds, and the decline of communal spaces like *balai raya* or *suraus.* Zainol et al. (2022) and Mazlan et al. (2022)

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highlight landscape changes in Perak Tengah where agricultural areas are fragmented, traditional houses deteriorate, and social spaces are underused or repurposed.

Closely related is the concept of authenticity deficit (Ismail, 2018), which describes how modern developments may mimic visual elements of Malay architecture without retaining their embedded cultural logic. The loss of features such as the *rumah panggung*, passive cooling systems, or house orientation to Qibla signifies a disconnect between form and meaning. This deficit is further exacerbated by planning approaches that neglect cultural indicators. As planning documents and local development plans prioritise growth targets and infrastructure delivery, *kampung* settlements become increasingly excluded from the vision of sustainable development (Kamarudin et al., 2022).

This study positions the Malay landscape deficit as a critical planning challenge, particularly in areas like Perak Tengah where traditional and transitional elements collide.

METHODOLOGY

This research adopts a qualitative case study methodology to examine the Malay landscape deficit in Perak Tengah, Perak, a district known for its concentration of traditional kampung settlements and ongoing peri-urban transformation. Perak Tengah was selected as the study area because it represents one of the few remaining regions in Peninsular Malaysia where traditional Malay *kampung* settlements still exist alongside rapidly growing urban development. GIS analysis from 1990 to 2020 shows a 37% increase in built-up areas, mainly replacing paddy fields and timber-based housing compounds. As many kampungs in Perak Tengah still retain vernacular architectural features, spatial layouts, and social practices, this pursuits the suitable location for studying the transition from tradition to modernity in the Malay landscape.

Further to the investigations, five (5) villages were selected for detailed study namely Kampung Ekor Bota, Kampung Bota Kiri, Kampung Padang Tenggala, Kampung Baru Bota, and Kampung Pulau Pisang. The selected reasons are based on (i)Traditional Features Still Present (ii) Visible Transformation (iii) Good Access and Data Availability. These sites provide the right conditions to study how traditional Malay landscapes are being lost or changed over time, and how planning can better protect them. Furthermore, the selection of these five villages was guided by their representativeness of traditional features, observable transitions, and accessibility for fieldwork. However, limitations include the modest sample size, dependence on accessible GIS datasets, and the limited transferability of results beyond Perak Tengah's specific socio-cultural context.

The methodology integrates several data collection and analysis strategies:

i. **Field Observation:** On-site visits to selected kampung locations in Perak Tengah were conducted to observe changes in building typologies, spatial arrangements, land use, and human activity patterns.
ii. **Document Analysis:** Review of planning documents, policy guidelines (such as the National Physical Plan and local development plans), and archival records of kampung development.
iii. **GIS-based Land Use Mapping**: Satellite imagery and land use data from 1990, 2000, 2010, and 2020 were analysed to visualise spatial transformations, identify encroachment patterns, and quantify the loss of cultural and agricultural landscapes.

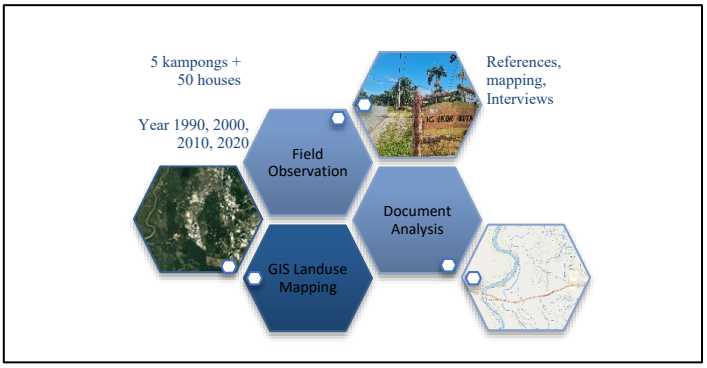


Figure 1: Mixed qualitative approach with triangulation method
Source: Author

This mixed qualitative approach allows for a triangulation of data sources to capture both the visible and intangible dimensions of the Malay landscape deficit. It also facilitates the identification of key indicators, such as spatial pattern disruption, architectural homogenisation, land use conversion, and decline in communal spaces, which form the basis of the analysis and recommendations. Ethics Statement: The field observations conducted in this study complied with institutional ethical standards. No human subjects were directly interviewed; however, permissions for site visits were obtained from local community representatives and the university's research committee.

FINDINGS AND DISCUSSIONS

The study identified four interrelated indicators that characterised the Malay landscape deficit in Perak Tengah. Each reflects a material and symbolic transformation of the traditional kampung landscape, further complicated by top-down planning paradigms and shifting socio-economic conditions. The indicators are: (i) Loss of Tangible Landscape and Traditional Spatial Patterns, (ii)

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Architectural Homogenisation, (iii) Land Use Changes and Agricultural Decline, and (iv) Decline of Communal Functions and Social Spaces. Together, these indicators reflect how modern planning, institutional priorities, and socio-economic shifts have fundamentally restructured the once-cohesive Malay rural landscape.

i. Spatial Patterns Disruption

The transformation from organically evolved kampung layouts to formal grid-based subdivisions signifies a significant rupture in spatial culture. Traditionally, Malay settlements were orientated toward natural features rivers, communal spaces, and agricultural fields anchored by social logic and *adat*. However, spatial analysis of Perak Tengah indicates a standardised street grids and cul-de-sacs imposed by state housing schemes and private developers.

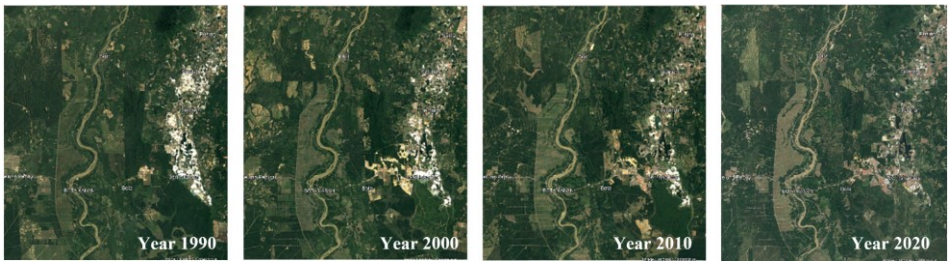


Table 1: Comparative Analysis of Malay Landscape Changes in Perak Tengah (1990-2020)

Year	1990	2000	2010	2020
Built-up Area	Sparse development (10%), primarily traditional Malay kampung settlements.	Moderate increase (30%) in development, especially around Seri Iskandar.	Rapid expansion (60%) of urban and institutional zones.	Significant urban sprawl (80%), large portions converted to housing and industry.
Traditional Kampung Houses	Majority (90%) intact, scattered across rural settings.	Beginning signs (70%) of renovation using concrete materials.	More kampung houses (40%) were replaced or extended with modern materials.	Only 20% remain liveable in original form; many abandoned or deteriorated.
Agricultural Land	Extensive paddy fields and mixed rural agriculture.	Still dominant, but beginning to reduce around new developments.	Rapid conversion to mixed-use land.	Highly fragmented; some replaced by urban and commercial use.
Natural Landscape & Forests	Forested regions and river systems largely undisturbed.	Some deforestation around Seri Iskandar and Tronoh.	Noticeable fragmentation and degradation of green belts.	Significant loss due to mining, urbanisation, and infrastructure projects.
Infrastructure Development	Minimal roads and connectivity.	Major roads expanding toward Seri Iskandar and educational institutions.	Road networks densified, connecting towns and satellite settlements.	Full road networks, commercial areas, and residential grids established.
Cultural Landscape Integrity	High integrity of spatial, social, and	Gradual decline due to structural and	Fragmentation increases;	Severe deficit in authenticity and

Year	1990	2000	2010	2020
	architectural traditions.	social modernisation.	authenticity begins to diminish.	continuity of Malay cultural landscape.

Source: Author

This shift undermines the relational nature of kampung design by disrupting environmental responsiveness, privacy gradients, and communal proximity (Ahmad et al., 2020). The National Rural Physical Planning Policy has inadvertently privileged uniformity over local adaptation, thereby marginalising kampung planning principles (Kamarudin et al., 2022).

An analysis of GIS and field observation data revealed a significant transformation of the physical landscape across the five kampongs; between 1990 and 2020, built-up areas increased by an average of 37%, often at the expense of agricultural and green spaces. In Kampung Baru Bota, several traditional timber houses were either replaced or modified with concrete structures lacking climatic responsiveness and symbolic detailing. Compound boundaries once defined by vegetation and social function have become fenced and isolated (Ibrahim et al., 2013).

Moreover, Figure 3 also shows the remaining traditional Malay house, though it physically remains, it is no longer liveable, showing signs of neglect and abandonment. The house retains its cultural form but has lost its function, highlighting a shift from lived tradition to static heritage.



Figure 3: The Remaining Original Malay Traditional House in Perak Tengah
Source: Author

ii. Architectural Homogenisation

There is a marked disappearance of traditional architectural forms, such as the *rumah Melayu* with elevated floors, ventilation-focused design, and symbolic carvings. These have been replaced by generic terrace and single-storey dwellings, often devoid of vernacular cues. While some developments attempt to simulate 'Malay identity' through superficial motifs (e.g.wood carvings panels), the loss of symbolic authenticity and ecological design principles remains evident.

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This form of architectural erasure aligns with what Ismail (2018) terms the authenticity deficit; a gap between visual representation and lived cultural meaning. Contemporary houses do not respond to climatic or social needs, resulting in a loss of identity and performance.



Figure 4: Photo evidence juxtaposes timber heritage homes in Perak Tengah kampongs with adjacent concrete resettlement units built post-2000, illustrating stylistic and functional discontinuity *Source: Author*



Figure 5: Remaining Authentic feature in Malay Traditional Houses in Perak Tengah *Source: Author*

The erosion of traditional Malay house features in contemporary development reflects a deeper authenticity deficit that goes beyond physical changes; it signals a disconnection from the cultural, spiritual, and environmental logic that once defined Malay domestic architecture. Traditional elements such as *tiang seri* (central pillars), elevated timber floors, and modular layouts were not merely aesthetic choices but expressions of values rooted in spiritual beliefs,

family structure, and climatic responsiveness (Wan Hashim, 1994; Lim, 1987). The loss of features like the *anjung* (verandah), *rumah ibu - rumah dapur* modularity, and ornate wood carvings represents a rupture in the intangible cultural knowledge passed down through generations (Tajuddin, 2006). Details of these authenticity deficits as labelled in Figure 5 are explained in Table 2.

Table 2: Analysis of Authenticity deficit in Traditional Malay House in Perak Tengah

Authentic Feature	Modern/Altered condition	Nature of Deficit
Rumah Tiang 12 / Tiang Seri (central pillars)	Replaced by reinforced concrete frames	Loss of sacred spatial anchor; structural symbolism removed
Timber Construction (chengal, meranti, etc.)	Substituted with cement, bricks, or steel	Loss of local material knowledge and climate-responsive design
Bumbung Perabung Lima (five-ridge roof)	Changed to flat/slab or generic pitched roofs	Disconnection from cultural roof geometry and spiritual orientation
Tangga Batu / Tangga Kayu (front stairs)	Removed or replaced by generic tiled steps	Loss of transitional space that signals respect and welcome
Ukiran Kayu (intricate wooden carvings)	Omitted entirely or mass-produced alternatives used	Loss of craftsmanship, identity and storytelling motifs
Open Verandah / Anjung	Enclosed or removed for space or air-conditioning	Loss of communal interaction space and natural ventilation
Elevated Floor (Rumah Panggung)	Ground-level construction due to concrete base	Loss of flood resilience and airflow underneath the house
Modular Expansion (Rumah Ibu, Rumah Dapur)	Static floor plan from commercial developer housing	Loss of adaptability and familial growth embedded in house desgn
Orientation to Qibla / Landscape	Ignored or inconsistent in newer housing designs	Loss of spiritual and environmental alignment

Source: Author

Simultaneously, when contemporary traditional house renovation was replaced with mass-produced, concrete-based forms lacking symbolic orientation or environmental adaptation, the Malay house loses its identity as a living cultural artefact. This transformation diminishes not only the architectural heritage but also the embedded social norms, rituals, and communal ways of life traditionally anchored in the home (Hussein, 2008; Said & Shamsuddin, 2015). As such, the authenticity deficit in house features becomes a key indicator of the broader Malay landscape deficit, a visible manifestation of how planning and development have failed to uphold cultural continuity in the built environment.

iii. Land Use Changes and Agricultural Decline

Kampung settlements in Perak Tengah historically relied on agrarian land use, including paddy cultivation, rubber tapping, and small - scale orchards. GIS land use data shows that from 1990 to 2020, approximately 37.5% of paddy and orchard lands in selected subdistricts were converted into housing or light industrial zones. This shift correlates with rising land speculation, housing schemes under Rancangan Malaysia, and youth migration away from agriculture (Rashid & Othman, 2021).

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The conversion disrupts not only livelihoods but also embedded knowledge systems tied to seasonal rhythms and intergenerational stewardship. Additionally, this contributes to broader issues of food security and ecological imbalance in rural Malaysia (Shafie et al., 2019).

The elaboration in Figure 1 showed distribution and classification data revealed substantial land cover changes around kampong in Bota and mukim Layang-layang in Perak Tengah, which was once dense with agricultural land and activities was now subsequently developed.

iv. Social Cohesion Decline

Communal life, once a defining feature of kampung society, is diminishing under the pressure of individualised lifestyles and the disappearance of shared spaces. Observations highlighted the closure or underuse of *balai raya*, open prayer grounds, and weekly markets. With fewer youths remaining in villages, older residents report social fragmentation and reduced intergenerational transmission of customs.

Planners often neglect these intangible cultural functions, focusing instead on infrastructure delivery. However, the social vibrancy of kampung life stems from spatial encounters and ritual events that necessitate physical venues (Abd Wahab & Ahmad, 2022).



Figure 6: The repurposing of communal lots including mosque, schools, community hub
Source: Author

Table 3: Summary of The Malay Landscape deficit in Perak Tengah

Indicator	Symptom	Underlying Issues	Impact on Malay Landscape	Malay Landscape deficit
Spatial Pattern Disruption	Gridded layouts replace organic.	Top down planning, lack of participatory design	Fragmentation of organic settlement layout. Disconnection from river-oriented development logic	Loss of spatial identity
Architectural Homogenisation	Vernacular lots to modern form	Symbolic vs Genuine Identity	Loss of timber-based architecture and traditional passive cooling techniques	Loss of architectural authenticity
Landuse changes & Agricultural Decline	Rise of residential / Industrial	Market-driven land reform, Youth migration	Loss of self-sustaining village economy and relationship with land	Loss of cultural ecology
Social Cohesion Decline	Disuse of Communal facilities	Neglect of Social Infrastructure in Planning	Decline in intergenerational living, weakening of *gotong-royong* and *adat*	Loss of socio-cultural coherence

Source: Author

This refined analysis aligns with field data and positions the Malay landscape deficit within global concerns about heritage loss, rural depopulation, and culturally blind urbanism (UNESCO, 2020). It also underscores the limitations of current planning instruments in sustaining culturally rooted landscapes in transitional regions like Perak Tengah.

CONCLUSION

This study emphasises the critical need to reassess planning strategies in light of the lived cultural realities of Malay settlements. Through grounded, place-based analysis in Perak Tengah, the research has achieved its aim of identifying the drivers and manifestations of the Malay landscape deficit. The analysis of physical transformations in Perak Tengah from 1990 to 2020 reveals a clear pattern of cultural and spatial erosion within traditional Malay kampung settlements. The shift from organic, low-density layouts to rigid, modern housing schemes has disrupted the spatial identity rooted in Malay customs and environmental adaptation. A significant decline in traditional architecture, agricultural land use, and communal functions further illustrates the depth of the Malay landscape deficit.

Addressing these deficits calls for a reintegration of traditional knowledge in planning policy, a revaluation of cultural spaces, and active community participation. If unaddressed, the authenticity deficit will continue to widen, resulting in *kampung* environments that retain symbolic facades but lose

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their soul. Future planning must therefore look beyond infrastructure to encompass meaning, memory, and identity in spatial development.

The practical recommendations offered, such as incorporating cultural indicators into spatial planning instruments, promoting community-based stewardship of heritage landscapes, and enabling adaptive reuse of traditional homes, seek to reconcile tradition with transformation. These strategies are relevant to Malaysian planners, particularly in addressing the objectives outlined in national frameworks such as the National Physical Plan (NPP), National Urbanisation Policy (NUP), and Shared Prosperity Vision 2030, all of which stress the importance of inclusivity, sustainability, and cultural resilience.

Ultimately, this research contributes to a more culturally sensitive planning paradigm that aligns with the mission of Plan Malaysia: to support evidence-based policies that honour local identity, promote spatial equity, and empower communities to shape their own futures. Preserving the Malay rural landscape is not about resisting change but about ensuring that it is rooted in a sense of place, memory, and cultural resilience. Future research could expand the concept of 'Malay landscape deficit' to comparable Southeast Asian contexts such as Indonesia, Thailand, or Brunei, where rural cultural landscapes face similar pressures of modernisation and authenticity erosion

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PUBLIC ART AS A CATALYST FOR CULTURAL REVITALIZATION AND TOURISM IN SMALL TOWNS: A CASE STUDY OF PEKAN PARIT, PERAK

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Abstract

This study investigates the transformative role of public art in promoting tourism and fostering community engagement in Pekan Parit, Perak. Adopting a mixed-methods approach combining surveys and site observations, the research reveals that 88.3% of residents perceive murals, sculptures, and installations as valuable in preserving cultural identity and attracting visitors. However, challenges such as inadequate maintenance and a lack of thematic alignment with local heritage remain significant. Beyond aesthetic value, public art emerges as a conduit for expressing collective memory, identity, and cultural narratives embedded in everyday life. The findings highlight the importance of cultural relevance and active community participation in the artistic process. To support sustainable implementation, the study proposes an integrated framework encompassing community co-creation, systematic maintenance strategies, and curated tourism initiatives. These insights contribute to broader discourses on creative place making and sustainable cultural tourism, offering practical implications for policymakers and urban planners engaged in small-town revitalization.

Keywords: Public Art, Cultural Tourism, Community Engagement

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INTRODUCTION

Public art encompasses a wide range of artistic expressions in public spaces, including murals, sculptures, installations, and monuments. Beyond aesthetics, it serves as a medium for cultural reflection, social commentary, and community storytelling, embedding creativity into everyday life (Hunting, 2005; Zakariya & Azhari, 2017). As towns and cities modernize, public art increasingly functions as a placemaking tool that reinforces local identity, civic pride, and cultural continuity. This is particularly relevant in heritage-rich regions such as Perak, Malaysia, where modernization must align with cultural preservation.

From an anthropological perspective, heritage is a socially constructed and dynamic process rather than a fixed legacy (Smith, 2006). Public art thus becomes a contested arena where narratives of identity and history are negotiated and reinterpreted. In Pekan Parit, a small but historically significant town in Perak, public art has emerged as both a creative intervention and a reflection of local tensions between modernization and heritage authenticity. While some initiatives have successfully enhanced the town's visual appeal, others risk detachment from local culture and community values (Jasmi & Mohamad, 2016). In Malaysia's small towns, where economic stagnation and limited tourism programming persist, public art offers a strategic avenue for revitalization. It can transform neglected spaces into cultural landmarks, promote walkability, and strengthen community identity through shared narratives. However, challenges such as inadequate maintenance, superficial participation, and lack of institutional support hinder its long-term impact.

This study examines the role of public art in promoting tourism and community engagement in Pekan Parit, Perak. Using a mixed-methods approach involving surveys and field observations, it explores public awareness, emotional engagement, and perceptions of cultural and economic value. By focusing on a small-town Malaysian context, the study contributes to the broader understanding of how public art can serve as a sustainable and inclusive tool for cultural revitalization and tourism development in heritage settings undergoing socio-economic transition. While previous research has examined public art in metropolitan settings, this study uniquely situates the discourse within a small-town Malaysian context, contributing to the understanding of how public art facilitates cultural revitalization and tourism in heritage towns undergoing socio-economic transition.

LITERATURE REVIEW

Public art has increasingly been recognized worldwide as a strategic component of urban development and cultural regeneration. Once viewed primarily as decorative or commemorative installations in public spaces, it is now understood through a more expansive lens that highlights its capacity to shape place identity,

foster civic dialogue, and drive socioeconomic development (Miles, 1997; Cartiere & Willis, 2008). In rapidly transforming urban environments, public art functions not only as a visual landmark but also as a participatory and symbolic practice that embodies community values and shared narratives. This broader perspective reconceptualizes the notion of place, not as fixed or singular, but as continuously shaped through dialogue, negotiation, and the selective construction of collective memory.

Public Art and Place Identity

Public art plays a vital role in expressing and reinforcing place identity. By visually narrating local histories, cultural values, and community stories, it contributes to a distinctive sense of place that differentiates one locality from another (McCarthy, 2006). This function is especially pertinent in smaller towns, where the preservation of local heritage is often threatened by modernization and urban homogenization. When public art reflects local traditions and aspirations, it can act as a form of cultural resistance embedding identity within the physical landscape and countering the forces of erasure. Miles (1997) highlights that public art participates in the "cultural production of space," transforming ordinary public areas into sites imbued with memory, meaning, and symbolic resonance. In doing so, public art fosters emotional attachment to place, reinforcing a sense of collective belonging and continuity amidst social or spatial change.

This role is particularly significant in historically rich towns like Pekan Parit, where local identity is deeply intertwined with the built environment and cultural legacy. However, it is crucial to acknowledge that identity and memory are not monolithic. Artistic interventions may privilege certain narratives while marginalizing others, depending on who participates in the decision-making process and whose voices are amplified. As such, public art becomes part of a continuous cultural negotiation unfolding not only in the physical environment but also through the everyday experiences and interactions of the community (Hall, 1990).

Public Art and Community Engagement

The success of public art initiatives often hinges on the degree to which communities are meaningfully involved in their planning, design, and interpretation. Community participation not only empowers local residents but also enhances the perceived legitimacy, relevance, and long-term value of the artwork (Cartiere & Willis, 2008). Rooted in social practice theory, this approach emphasizes that the creative process is as important as the final product, particularly when artists collaborate with communities to co-create site-responsive and culturally resonant works. In multicultural and pluralistic societies like Malaysia, inclusive public art practices can function as platforms for dialogue

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across ethnic, cultural, and generational divides, fostering civic engagement and strengthening social cohesion.

McCarthy (2006) found that public art projects grounded in local participation were more likely to be embraced and sustained over time, as communities identified with them as reflections of their collective identity and shared values. However, participatory processes are often more complex than they appear. Communities are not homogeneous, and divergent perspectives on heritage, aesthetics, or representation may emerge. Furthermore, participation is not always equitable or empowering; local dynamics such as informal leadership structures, generational hierarchies, and cultural norms can influence whose voices are heard and how public art is interpreted and maintained (Cornwall, 2008).

Public Art in Tourism Development

From a tourism perspective, public art enhances the appeal of destinations by improving the aesthetic and experiential quality of public spaces. In an increasingly competitive tourism landscape, towns must distinguish themselves through unique and authentic cultural offerings. When strategically integrated into tourism planning, public art can serve as a catalyst for cultural tourism, attracting visitors who seek place-specific and immersive experiences (Richards, 2018). Mathews (2014) contends that public art can revitalize economically declining areas by drawing tourists, stimulating local businesses, and generating media attention.

This aligns with the principles of the Experience Economy Theory, which suggests that contemporary tourists prioritize emotionally engaging and memorable encounters. Art installations that reflect local culture, heritage, or contemporary social themes not only enrich the visitor experience but also provide visually compelling, photogenic sites that are frequently shared on social media amplifying a town's visibility and appeal. In small towns like Pekan Parit, public art can complement heritage tourism by creating visual anchors that guide visitor movement, link disparate heritage sites, and enrich the town's interpretive landscape.

However, integrating cultural narratives into tourism strategies requires thoughtful consideration. Over-curated or overly sanitized representations may simplify complex local histories, favoring themes that cater to tourist expectations while marginalizing everyday lived realities. Balancing local authenticity with tourist engagement is key. When done sensitively, public art can support more inclusive, meaningful storytelling that resonates with both residents and visitors, strengthening cultural identity while contributing to sustainable tourism development.

Challenges of Integration and Sustainability

Despite its many benefits, the integration of public art into small-town environments presents several challenges. A primary concern is the authenticity of the installations, particularly when artworks are perceived as externally imposed or disconnected from local cultural contexts (Evans, 2005). Such interventions risk being viewed as symbolic intrusions rather than genuine expressions of community identity, resulting in limited public ownership, weak engagement, and eventual neglect. This challenge is further intensified when public art appears to cater more to external audiences such as tourists or funding bodies than to local residents, raising important questions about whose narratives are represented and whose are marginalized.

Another critical issue is the long-term sustainability of public artworks. Zebracki (2012) emphasizes that ongoing maintenance and stewardship are essential to preserving the aesthetic, cultural, and symbolic value of public art. Yet, many small towns lack structured funding mechanisms, institutional support, or dedicated policies for upkeep, often leading to physical deterioration and diminished public interest. Beyond maintenance, sustainable public art initiatives also require sustained collaboration among municipal authorities, artists, and community groups to ensure that artworks continue to fulfill their intended social and cultural roles over time.

Furthermore, the absence of clear policy frameworks or integrated master plans for public art often results in fragmented, ad hoc efforts with minimal coordination among stakeholders. This disconnect weakens the overall coherence and long-term impact of public art as a tool for community revitalization and cultural continuity.

STUDY AREA

Pekan Parit is a small heritage town located in the Perak Tengah district of Perak, Malaysia (see Figure 1). Strategically positioned between Ipoh and Lumut, it once served as an administrative and commercial hub during the colonial era. The town retains distinctive British-era architecture, traditional shophouses, and civic buildings that form a unique cultural identity—an ideal setting for public art interventions that enhance heritage preservation and tourism appeal. In recent decades, Pekan Parit has faced economic decline due to regional development shifts and urban migration, leading to reduced commercial activity and underutilized heritage assets. Yet, this condition also presents opportunities for revitalization through creative urban strategies, particularly public art that reconnects the community with its cultural roots. The town's compact, walkable layout and closely knit community provide a strong foundation for participatory public art planning. Notable examples, such as the murals along Memory Lane and installations near the riverfront, have already revitalized public spaces and

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drawn growing tourist interest. These initiatives visually narrate the town's history and local trades, transforming everyday settings into cultural landmarks.Pekan Parit was selected as a case study because it represents many Malaysian small towns rich in heritage yet underrepresented in national tourism planning. Its early adoption of public art demonstrates both the promise and challenges of cultural revitalization at a local scale. This study explores how public art can strengthen community pride, stimulate economic renewal, and offer practical insights for integrating creative placemaking in small-town revitalization across Malaysia.

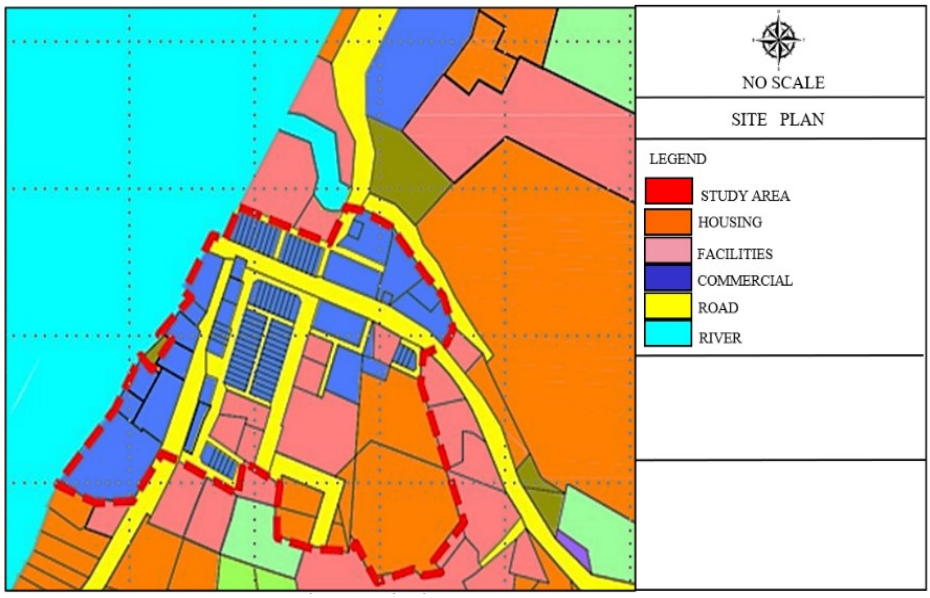


Figure 1: Site Plan

METHODOLOGY

This study employs a mixed-methods approach to examine the impact of public art on tourism development and community engagement in Pekan Parit, Perak. The integration of both quantitative and qualitative methods allows for a more nuanced and holistic understanding of how public art is perceived and experienced within a small-town context. This approach aligns with Creswell and Plano Clark's (2011) recommendation that mixed methods are particularly well-suited for investigating complex social phenomena.

Quantitative data were collected through a structured questionnaire designed to measure community awareness, perceptions, and the perceived influence of public art on cultural identity and tourism appeal. The questionnaire utilized a five-point Likert scale and was administered to 103 respondents using

convenience sampling during site visits to key public art locations, such as Memory Lane and the town square. While non-probability sampling limits generalizability, it is widely accepted in exploratory research targeting geographically bounded populations (Etikan, Musa, & Alkassim, 2016). Survey items were adapted from validated instruments in prior studies on public art and urban identity (McCarthy, 2006; Zebracki, 2012), and a pilot test was conducted to ensure clarity and relevance. Reliability testing using Cronbach's alpha yielded values above 0.70, indicating strong internal consistency (George & Mallery, 2016).

Concurrently, qualitative data were gathered through non-participant observations over a two-week period at prominent public art sites in Pekan Parit. Observations focused on the physical condition of artworks, spatial integration within the urban landscape, and patterns of community interaction, guided by principles of urban ethnography (Whyte, 1980; Creswell, 2014). Field notes and photographic documentation were systematically recorded to support subsequent interpretive analysis. An interpretive lens was applied to examine symbolic meaning, identity narratives, and cultural values embedded in the artworks and their spatial contexts.

The data from both strands were analysed independently. Quantitative data were subjected to descriptive statistical analysis and cross-tabulations, while qualitative data were analysed thematically to identify emergent patterns related to symbolic value, community engagement, and tourism potential. The findings were then triangulated to enhance the validity and credibility of the results by corroborating evidence across multiple data sources (Denzin, 1978).

The use of convenience sampling, while suitable for exploratory research, limits the generalizability of findings to the broader population. To mitigate this limitation, the study triangulated quantitative data with qualitative field observations, enhancing the robustness and contextual validity of the results. Ethical approval for the study was obtained from the university's research ethics committee. Informed consent was secured from all participants, and ethical protocols concerning anonymity and confidentiality were strictly observed in accordance with established standards for research involving human subjects (Bryman, 2012).

This study was conducted in accordance with the ethical standards of Universiti Teknologi MARA's Research Ethics Committee. Participation was voluntary, informed consent was obtained from all respondents, and data confidentiality was strictly maintained.

FINDINGS AND ANALYSIS

This section presents the empirical findings derived from the quantitative survey and qualitative field observations conducted in Pekan Parit, Perak. The analysis

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is organized thematically around three core dimensions: (1) community awareness and perceptions of public art, (2) the perceived contribution of public art to tourism development and local identity, and (3) practical concerns related to maintenance, cultural relevance, and spatial integration. These thematic categories provide a structured lens through which to interpret the data and assess the multifaceted role of public art in a small-town context.

1. Community Awareness and Perception of Public Art

The data indicates that a substantial majority of respondents are aware of public art in Pekan Parit. Of the 103 participants surveyed, 88.3% (n = 91) reported having encountered public art installations in the town, reflecting a relatively high degree of spatial visibility and public exposure. In contrast, only 11.7% (n = 12) had not observed any such installations, highlighting potential areas for improving accessibility or enhancing community outreach and awareness initiatives. Overall, respondents expressed strong appreciation for the aesthetic and cultural value of public art. As presented in Table 1, the highest mean score (M = 4.13) was associated with the belief that public art raises awareness about the sustainability of local culture and heritage. This was closely followed by perceptions of its contribution to the town's aesthetic appeal (M = 4.12) and its enhancement of cultural ambiance (M = 4.12). In contrast, statements reflecting concerns about the cultural relevance of certain artworks (M = 2.50) and the unsuitability of their placement (M = 2.64) received the lowest mean scores. These findings suggest that while public art is generally well-received, respondents prefer installations that are contextually grounded and culturally aligned with the local heritage. These results affirm that public art is widely perceived as both culturally enriching and aesthetically meaningful, aligning with the findings of McCarthy (2006) and Cartiere and Willis (2008), who emphasize the symbolic significance and placemaking potential of community-responsive art installations.

Table 1: Community Awareness and Perceptions of Public Art

Statement	Mean (M)	Std. Dev.	Interpretation
Public art raises awareness of local culture and heritage	4.13	0.67	Very High Agreement
Public art enhances the cultural ambiance of Pekan Parit	4.12	0.68	Very High Agreement
Public art adds aesthetic value to the town	4.12	0.69	Very High Agreement
I am aware of the concept of public art	3.84	0.72	High Agreement
Public art is poorly maintained in Pekan Parit	3.68	0.85	Moderate Agreement

Statement	Mean (M)	Std. Dev.	Interpretation
Public art in the town is not suitably placed	2.64	0.90	Low Agreement
Public art does not reflect the history or culture of the town	2.50	0.88	Low Agreement

Source: Field Study (2024)

2. Perceived Impact on Tourism and Local Economy

Respondents also acknowledged the economic and tourism-related potential of public art in Pekan Parit. As shown in Table 2, the highest-rated statement (M = 4.34) reflected strong agreement that public art can attract tourists and visitors to the town. This was followed by similarly high ratings for public art's perceived role in contributing to economic growth (M = 4.32) and revitalizing the town's image (M = 4.26). These findings align with perspectives in cultural tourism literature, which suggest that art-based placemaking can enhance destination appeal and stimulate local economic activity (Richards, 2018; Mathews, 2014).

Interestingly, typical concerns associated with increased tourism—such as overcrowding, discomfort, or safety risks were not widely shared among respondents. The lowest-rated statement, "The arrival of more tourists will cause discomfort if public art increases," received a mean score of just 2.33. This suggests that residents perceive minimal disruption from tourism growth and, overall, support public art as a vehicle for tourism-driven revitalization. These findings reflect strong community support for the continued integration of public art as a catalyst for tourism and local development. They further suggest that public art enhances the visitor experience without negatively impacting the town's functionality or livability, which is an important consideration in the context of sustainable cultural tourism planning (Zebracki, 2012).

Table 2: Perceived Impact of Public Art on Tourism and Economy

Statement	Mean (M)	Std. Dev.	Interpretation
Public art can attract tourists and visitors to Pekan Parit	4.34	0.60	Very High Agreement
Public art can positively contribute to local economic growth	4.32	0.61	Very High Agreement
Public art can help to revitalize Pekan Parit	4.26	0.65	Very High Agreement
The town has seen more visitors due to existing public art	3.31	0.78	Moderate Agreement
Existing public art installations are unattractive	3.11	0.85	Neutral

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Statement	Mean (M)	Std. Dev.	Interpretation
Public art causes traffic congestion and delays	2.45	0.89	Low Agreement
Public art has contributed to safety hazards for drivers or pedestrians	2.46	0.90	Low Agreement
The arrival of more tourists will make residents uncomfortable	2.33	0.92	Low Agreement

Source: Field Study (2024)

3. Observational Insights: Maintenance and Spatial Integration

Qualitative observations supported the quantitative findings, particularly regarding concerns related to maintenance and community engagement. Many of the artworks, especially murals near Memory Lane were visually striking and frequently photographed by both locals and tourists, indicating their appeal and informal promotional value. As shown in Figure 2, the murals along Memory Lane illustrate several installations exhibited signs of physical neglect, such as fading paint, cracked surfaces, and insufficient signage These issues reflect challenges identified by Evans (2005), who argues that inadequate maintenance can diminish the cultural value of public art and erode community pride. In addition, the spatial positioning of certain artworks appeared misaligned with historical pathways or pedestrian traffic, thereby limiting their visibility and interpretive impact. In contrast, installations placed along primary walkways or integrated with heritage buildings attracted greater public attention and interaction. These findings underscore the importance of contextual sensitivity and urban legibility in the planning and placement of public art, as emphasized by Miles (1997) and Whyte (1980).



Figure 2: Public Art & Mural at Memory Lane in Pekan Parit
Source: Study Field (2024)

Overall, the study reveals a broadly positive and supportive community attitude toward public art in Pekan Parit, particularly in relation to its role in cultural preservation, aesthetic enhancement, and tourism promotion. However, the findings also highlight critical areas for improvement, including the need for sustained maintenance efforts and stronger alignment between public art content, community values, and spatial context. These insights reinforce the view that successful public art interventions must be both locally grounded and strategically managed to ensure their long-term sustainability, cultural relevance, and effectiveness as tools for small-town revitalization.

DISCUSSION

The findings of this study underscore the multifaceted role of public art in shaping cultural identity, fostering community engagement, and enhancing the tourism potential of small towns such as Pekan Parit. The high level of community awareness and appreciation suggests that public art is not merely a passive aesthetic feature but is actively regarded as a meaningful vehicle for cultural expression and civic pride. These insights are consistent with prior scholarship emphasizing the symbolic and functional role of public art in reinforcing place identity and fostering a sense of belonging (Miles, 1997; McCarthy, 2006).

Positive community sentiment regarding the aesthetic and cultural contributions of public art aligns with the concept of placemaking, in which creative interventions reframe spatial narratives and elevate the experiential quality of public spaces (Cartiere & Willis, 2008). In this study, respondents valued public art not only for its visual appeal but also for its contribution to cultural sustainability, particularly through artworks that reflect the town's heritage and historical identity. This highlights the importance of content authenticity, a recurring theme in cultural tourism literature and the Experience Economy Theory, which posit that emotionally resonant and symbolically authentic experiences are central to visitor satisfaction (Richards, 2018).

Notably, respondents expressed minimal concern regarding common externalities associated with increased tourism, such as congestion, discomfort, or safety risks. This suggests that in smaller towns with lower population density and slower development pressure, cultural strategies such as public art may offer a socially acceptable and environmentally sustainable path to tourism development. These findings lend empirical support to the notion that public art can serve as a low-impact, high-reward strategy for revitalizing rural and semi-urban economies (Mathews, 2014; Zebracki, 2012).

However, qualitative field observations provided a more nuanced perspective, particularly concerning issues of maintenance and spatial integration. Several artworks were found to be deteriorating, with signs of neglect such as faded paint, cracked surfaces, and inadequate signage. In addition, some

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installations were poorly positioned and spatially disconnected from high-traffic pedestrian areas or heritage landmarks, thereby limiting their visibility and interpretive value. These challenges echo concerns raised by Evans (2005) and Whyte (1980), who argue that without institutional support and formal maintenance frameworks, the long-term sustainability of public art is jeopardized. The gap between public appreciation and physical upkeep highlights the urgent need for municipalities to develop comprehensive public art policies that address not only commissioning but also long-term stewardship and care.

The findings also emphasize the critical role of community participation not merely as consumers of public art but as active contributors to its conception and design. Artworks that reflect local stories, cultural values, and collective memory received stronger support, while those perceived as generic or culturally disconnected generated limited engagement. This aligns with the views of Cartiere and Willis (2008), who argue that co-created, community-driven artworks are more likely to resonate with residents and endure over time. As such, public art initiatives should move beyond top-down commissioning models and embrace participatory approaches where local voices shape the artistic vision from the outset.

Nevertheless, participatory approaches are not without limitations. Public art in small towns like Pekan Parit often operates within larger strategic agendas such as tourism development and place-branding that influence decisions about representation and visibility. As Sharp et al. (2005) caution, these initiatives can risk privileging institutional or commercial narratives at the expense of grassroots, community-defined perspectives. This tension calls for critical reflection on how public art negotiates symbolic representation while meeting the expectations of funders, planners, and audiences.

Moreover, the participatory imperative is inherently spatial. Public art is not experienced in isolation but within lived environments shaped by movement, memory, and social interaction. Drawing on Lefebvre's (1991) theory of socially produced space, the meaning of public art emerges through everyday encounters and spatial routines. Artworks strategically located along pedestrian pathways, near heritage landmarks, or in informal gathering spaces are more likely to be perceived as relevant, accessible, and memorable. Conversely, those lacking contextual or spatial resonance risk becoming overlooked or culturally inert.

In the context of Pekan Parit, the findings offer a compelling argument that heritage-rich small towns can leverage public art as a strategic instrument for cultural and economic revitalization provided that interventions are contextually grounded, meaningfully participatory, and supported by robust policy infrastructure. These insights hold practical implications for local authorities, cultural institutions, and urban planners seeking to harness public art as a tool for sustainable tourism, placemaking, and the reinforcement of civic identity.

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Comparatively, similar public art initiatives in Southeast Asia, such as those in Yogyakarta (Indonesia) and Georgetown (Malaysia), reveal parallel challenges in balancing tourism development with heritage authenticity. These comparative insights underscore that, like Pekan Parit, many small towns in the Global South are navigating tensions between creative expression and cultural preservation.

CONCLUSION

This study has demonstrated the vital and multidimensional role of public art in the revitalization of small towns, particularly in contexts like Pekan Parit, where cultural heritage and community identity remain underutilized yet potent assets. Employing a mixed-methods approach, the research revealed a high level of public awareness and favourable perceptions regarding the aesthetic, cultural, and economic value of public art. These installations are not merely decorative enhancements, but they are seen as vehicles for cultural storytelling, place branding, and expressions of collective pride. Significantly, public art was widely perceived as a catalyst for tourism development, with residents reporting minimal concerns about potential disruptions. This suggests that when thoughtfully implemented, culturally grounded public art can attract visitors and stimulate local economies without compromising the social or spatial integrity of small-town life.

Nonetheless, the study also identified key challenges that could hinder the long-term success of public art initiatives. Observational findings pointed to issues such as inadequate maintenance, poor site integration, and limited community participation, which are factors that may risk diminishing the intended cultural and social impact over time. For public art to realize its full potential, it must move beyond surface-level beautification and be firmly rooted in the lived experiences, values, and aspirations of the community it serves. Inclusive authorship, spatial relevance, and long-term stewardship are essential to ensuring that public artworks retain meaning and resonance over time.

Ultimately, for public art to fulfil its transformative potential, it must be treated as a strategic component of broader cultural planning, one that requires thoughtful curation, multi-stakeholder collaboration, and strong policy support. Local authorities and cultural practitioners must work together to develop comprehensive public art masterplans that embed artworks within larger frameworks of heritage preservation, urban aesthetics, and community empowerment. As Ibrahim et al. (2023) argue, the implementation of such strategies must be studied carefully to ensure that the outcomes benefit all stakeholders, including government agencies tasked with cultural development.

In the case of Pekan Parit, a structured and participatory approach to public art could pave the way for a culturally vibrant, visually compelling, and

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economically resilient future. The insights from this study may serve as a useful model for other heritage towns in Malaysia and across the Global South seeking to balance the pressures of modernization with the preservation of cultural identity through the transformative power of public art. The study's contribution lies in extending the discourse on public art beyond major cities to small-town Malaysia, demonstrating how contextually grounded artistic interventions can serve as catalysts for heritage preservation and community-led revitalization

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CHALLENGES IN IMPLEMENTING ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) PRINCIPLES IN FACILITIES MANAGEMENT AND MAINTENANCE: A PRELIMINARY SURVEY

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Abstract

Facilities Management and Maintenance (FMM) play a crucial role in ensuring the efficient operation and sustainability of buildings. The integration of Environmental, Social, and Governance (ESG) principles into FMM is increasingly important to promote ethical governance, social responsibility, and environmental stewardship within Malaysia's built environment. However, the key industry players continue to face multiple constrains that hinder effective ESG implementation (i.e., inadequate technical expertise and inconsistent policy enforcement). Therefore, this study aims to identify the key challenges that hinder the implementation of ESG principles in FMM practices. Semi-structured interviews were conducted with seven key players in FMM practices using purposive sampling, and the data were analysed thematically. The findings reveal four major challenges, which include contract complexity, financial constraints, limited data sharing, and knowledge gaps. These challenges weaken transparency, financial planning, and professional competency, which are essential for sustainable facility management. Although the small sample size limits the generalisation of the findings, the study provides valuable insights for policymakers and practitioners. It highlights the need for standardised contract frameworks, transparent data systems, and capacity building efforts to strengthen Malaysia's i-ESG Framework and support national sustainability goals.

Keywords: Facilities Management and Maintenance, Environmental, Social, Governance, Challenges

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INTRODUCTION

Facilities Management and Maintenance (FMM) serve as a cornerstone in the development and administration of government infrastructure and other sectors including commercial, educational, healthcare and industrial facilities, ensuring operational efficiency and asset longevity (Hoxha et al., 2022). Globally, FMM has grown into a multi-disciplinary field that integrates various services such as financial management, operational management and others to optimize facility operations (Wiggins, 2021). Over time, FMM has evolved from a simple workspace organization into a comprehensive discipline that encompasses not only the efficient use of space but also the well-being and productivity of the occupants (Wiggins, 2021). This is supported by the definition of Facilities Management by International Facilities Management Association (IFMA, 2024), where FM integrates people, place and process to ensure the functionality, comfort and safety of the occupants in the building. In Malaysia, the development of FMM has slowly mirrored global trends, with significant advancements over the past few years. This progress is further reinforced by the introduction of Sustainable Development Goals (SDGs), particularly SDGs 11: 'Sustainable cities and communities', which emphasizes the optimization of building operations and resource utilization (Lok et al., 2021). Initially, FMM practices in Malaysia were primarily reactive, focusing on repairs and ad hoc maintenance without comprehensive strategic. However, as Malaysia's economy and infrastructure expanded, coupled with the government's initiative, Malaysia's maintenance service has shift from reactive maintenance towards preventive maintenance (Hauashdh et al., 2022). This shift aimed to reduce the frequency of breakdowns and extend the lifespan of facilities through regular inspection (Dzulkifli et al., 2021). As FMM practices continue to evolve, their implementation plays a pivotal role in managing the nation's infrastructure. However, despite its critical function, FMM faces numerous challenges that impede its effectiveness. These challenges range from budgetary constraints to knowledge limitations, making it difficult for the government to maintain infrastructure assets optimally (Ochieng & Ominde, 2020).

In recent years the adoption of Environmental, Social and Governance (ESG) principles has gained prominence as a means of enhancing the sustainability and accountability of FMM practices (IFMA,2024). ESG serves as a strategic framework that encourages organizations to integrate responsible environmental management, ethical labour practices and transparent governance into their operations, aligning FMM with broader sustainability goals (Delova-Jolevska et al., 2024; MITI, 2024). Among principles of ESG are environmental (natural resource use, carbon emissions, energy efficiency), social (workforce, diversity, supply chain) and governance (board independence, diversity, shareholder rights, corporate ethics). The adoption of ESG principles is closely

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aligned with broader national initiatives such as Malaysia's 'Ekonomi Madani' policy, that highlights sustainable development as a key component in the structural reforms of Malaysia's economy (Krishnan, 2023). The Malaysian government through Ministry of Investment, Trade and Industry (MITI) had launch i-ESG Framework in the third quarter of 2023 to promote the ESG principles within various sectors including FMM (MITI, 2024). The i-ESG framework aims to enhance ESG practices in Malaysia by assessing its readiness and providing support for its implementation. It focuses on four pillars which are standards, capacity building, financing and market mechanisms, to guide the companies in evaluating their ESG compliances and continuously monitor their progress. By the end of 2026, the framework intends to enhance awareness, conduct training, and provide financial support to assist the industrial sector in embarking on their ESG journey (MITI, 2024). By integrating ESG into FMM, it does not only support the operational and business objectives of an organization, but also mitigates adverse effects on the environment, society and governance (IFMA, 2024). Although ESG is important in FMM, Gray (2024) stated that by putting these principles into practice comes with its own challenges. FMM key players often struggles to balance the operational demands with long-term sustainability goals, especially when these principles are not fully incorporated early in the planning stages of FMM operations (Hamid et al., 2021). Thus, the objective of this research is to identify the challenges faced by the FMM key players in implementing FMM practices for office building, particularly in relation to the integration of ESG principles.

LITERATURE REVIEW

FMM in Malaysia and its Challenges

FMM in Malaysia has become increasingly essential as the nation continues to develop its infrastructure. Recognizing the importance of effective FMM, the Malaysian government has implemented several initiatives to enhance the sector through various policies and initiatives and the additional budget allocated for FMM through Malaysia's Plan and Malaysia's budget (MOF, 2023). The establishment of regulatory frameworks and guidelines aims to promote best practices in FMM, fostering an environment that prioritizes safety, efficiency and sustainability (Hauashdh et al., 2022).

In recent years, Malaysia's FMM focus has shifted toward integrating technology in FMM practices. The adoption of smart building solutions and data analysis has allowed facility managers to optimize operations and improve decision making processes (Olimat et al., 2023). This technological advancement helps in addressing some of the persistent challenges within the sector, such as resource management and operational efficiency (Hauashdh et al., 2024). As Malaysia aspires to align with international standards, there is an increasing

emphasis on training and developing the skills of professionals in the field (MITI, 2024). This continuous professional development is crucial to provide facility managers with the latest knowledge and tools that are necessary to navigate the complexities of modern FMM (Ishak et al., 2023). Effective FMM practices are crucial for ensuring the longevity and optimal functioning of facilities, yet several significant challenges hinder their successful implementation (Ensafi & Thabet, 2021).

Firstly, knowledge gaps present significant challenges in FMM practices. Azzran Sh Said and Hayani (2025) mentioned that the occupant's lack of understanding in FMM practices has significantly influences building maintenance works. Adding to this, Moayedi et al., (2023) stated that to provide an effective FMM strategies, the occupants must possess a comprehensive knowledge in various aspects such as resource consumption, maintenance reporting and compliance with safety protocols. Yang and Bayapu (2020) stated that facility managers can be overwhelmed by the wide range of data sources, such as sensor data and maintenance records. There is a need for robust data management solutions to be developed. Moayedi et al. (2023) and Razali et al. (2021) added that a well-structured data storehouse that is consistently updates can improve the overall efficiency of FMM. Thirdly, challenges related to contract issue. One of the primary concerns in the FMM is, it is often characterized by inaccuracies in information exchanged between service providers and clients (Asare et al., 2021; Zou et al., 2019). These inaccuracies can lead to misunderstanding and affect the performance and quality of the service delivery (Abdul-Malak & Ezzeddine, 2023). Lastly, financial challenges. Inadequate financial resources and a limited understanding of the precise allocation requirements can lead to delays in maintenance, which in turn heightens the likelihood of facility malfunctions (Mewomo et al., 2022).

ESG in Malaysia and its Challenges

Environmental, Social and Governance (ESG) principles in Malaysia have emerged as one of the critical factors in the management of facilities, influencing the operational practices and strategic decision-making across various sectors (Wan Mohammad & Wasiuzzaman, 2021). In Malaysia, the integration of ESG into FMM practices reflects a growing recognition of the need for sustainable development a corporate responsibility (Lok et al., 2021). ESG is a framework that evaluates a company's commitment to sustainable practices to ensure the companies operate sustainably while considering their environmental impact, social equity and governance integrity (Huang, 2024).

The environmental aspect emphasizes in reducing the ecological footprint of the facilities through energy-efficient operations, the social aspect focuses on enhancing the occupant well-being and ensuring safety within the

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building, while for governance aspect, it involves establishing a clear policies and frameworks to ensure transparency and ethical conduct in an organization (Delova-Jolevska et al., 2024). The implementation of ESG in Malaysia is still in the transition phase (MITI, 2024). In line with ESG, the Malaysian government had introduced various policies and frameworks to encourage their adoption. However, the full implementation of these ideas within the industry are still not yet being achieved (Tang & Teoh, 2023).

The implementation of ESG principles in Malaysia faces several challenges namely difficulty in understanding and quantifying ESG risks, training costs associated with adopting new technologies, the presence of multiple standards and framework that create confusion and rapid evolution of international standards to be adhere to (MITI, 2024). These challenges have created barriers for organization, particularly for small and medium enterprise, where the additional costs related to the training, technology adoption and digital platforms can be particularly burdensome, as they often lack resources to keep up with the revolving ESG principles (Bakri et al., 2021).

Additionally, the low awareness of ESG principles among Malaysians has also limited its incorporation into daily life (Tang & Teoh, 2023). Many individuals and business are still unfamiliar with how ESG can be practically applied to enhance sustainability, reduce environmental impact and foster better governance in everyday practices. Salin et al. (2023) points out that the ESG principle is driven for a longer-term impact where it aims to reduce the usage of fossil fuels-based and carbon intensive energy towards a cleaner energy source from the solar, wind and hydro by 2030. These become a challenge when business organisations are more interested in making the best return for the company and they do not aware of the concept and benefits of ESG practices that can contribute to their business's long-term growth. Moreover, Moayedi et al. (2023) pointed out that the insufficient efforts in promoting ESG and lack of training developed by the government also contributes to the lack of ESG implementation in Malaysia. This is also supported by Shapsugova (2023) stating that lack of standardize framework for ESG poses a significant challenge towards business as it results into different interpretation among the stakeholders on the extent and nature of ESG.

Challenges of FMM in implementing ESG in Malaysia

Environmental Challenges in FMM

Hauashdh et al. (2024) and Feng et al. (2020) both recognise the construction sector to be one of the major drivers of energy consumption, highlighting its critical impact on environmental sustainability. This is further emphasized by Zhao et al. (2022), who note that the operation and maintenance (O&M) phase contributes 75% to 80% of the total lifecycle costs of a building. these findings

shows that the financial expenditure and environmental harm associated with ingoing building management costs. Hauashdh et al. (2024) claim that building expenditure typically increases when the maintenance is inadequately performed or it is being neglected entirely, especially if the building is intended to endure for 50 years or longer. This increases not just impacting the finances, but it also contributes to the environmental issues including the higher carbon emissions as per discussed by Feng et al. (2020). FMM practices that fail to prioritize the reduction of carbon footprints, particularly through inefficient heating, ventilation, and air conditioning systems, often result in higher greenhouse gas emissions. This is supported by Alghanmi et al. (2022) where having an early detection and timely diagnosis of system faults, it can reduce the energy waste, from 25%- 50% to less than 15%.

Social Challenges in FMM

Social principle in ESG relates to the issues on social responsibility such as human rights, employee well-being and others and they directly impact the workforce dynamics (Martiny et al., 2024). One of the reported social issues happening is ensuring fair labour practice, safe working conditions and ethical supplier management (Alghababsheh & Gallear, 2022). Concerns regarding fair labour practices encompass human rights violations, including insufficient wages, excessive working hours, and unsafe working environments. These issues are particularly prevalent in industries where low-skilled labour is predominant, making workers more vulnerable to exploitation (Boufkhed et al., 2022). In FMM, the modern slavery can happen both directly and indirectly (Obeirne, 2023). This may happen through their operations, partnerships with businesses or through their supply chains, particularly when employing temporary workers through third party agencies or outsources. This could lead to a decline in the quality of work as employees become disengaged and demotivated due to unfair compensation. As a result, companies may face reputational damage and other businesses may become reluctant to collaborate, fearing a negative impact on their own standards and operations (Heil, 2018) Other than that, Wadock and Graves (1997) as cited by (Mohd Radzi et al., 2023) mentioned that organizations that are sensitive towards social issues often have better financial results, and this is correlated with efficient business management.

Human rights, employee well-being and social responsibility are all part of the social principles of ESG, which has big effect on how people work together (Martiny et al., 2024). Studies shows that fair labour practices, safe working conditions and ethical supplier management are important part of the social issue where concerns arise regarding the human rights violations during working such as low wages, low working-hours and unsafe environments (Alghababsheh & Gallear, 2022; Boufkhed et al., 2022). Within FMM, modern slavery among the

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workers can happen both directly and indirectly through its operations and partnerships, especially when it involves temporary workers that are hired from third-part agencies (Obeirne, 2023). This kind of exploitation could lower the quality of works by making the employees less interested and motivated due to the unfair payment. As a result, companies may suffer reputational harm and face challenges in terms of making partnership, as other businesses tend to avoid from relationship that might negatively impact their own standards (Heil, 2018). Wadock and Graves (1997), cited by Mohd Radzi et al. (2023) further reinforce the importance oof social responsibility by linking sensitivity to social issues with better financial performance and efficient business management. These results show that taking social aspect in ESG is not only a moral imperative but also strategically beneficial for organizational success.

Governance Challenges in FMM

According to Zahari et al. (2024), governance in the context of ESG is closely tied to issues such as bribery and corruption within an organization. Jin and Kim (2022) further highlight that governance practices significantly influence corporate performance, emphasizing that strong governance frameworks can mitigate unethical behaviour while enhancing overall business outcomes. In FMM, the lack of transparent decision-making process and insufficient regulatory compliance can lead to unethical practices such as mismanagement of contracts, fraud and favouritism in procurement (Ali et al., 2016). Another issue is the lack of proper monitoring and reporting structures. Without clear guidelines on how ESG performance is tracked and disclosed, organizations may fail to demonstrate their commitment to governance transparency (Shapsugova, 2023). The implications of weak governance practices in FMM not only leads to financial losses but also affect the quality of services provided (Kshaf et al., 2022). Additionally, this governance issues also affect the procurement process where favouritism in procurement can distort competitive bidding process, leading to suboptimal selections of service providers (Wang, 2020). Such practices can erode trust among stakeholders and damage the reputation of organizations involved.

In FMM, governance is very important in making sure that the services are ethical and transparent. According to Zahari et al. (2024), weak governance system often causes problems within the organization, such as corruption where it can damage the integrity of the organization. This is supported by Jin and Kim (2022) where a strong governance procedure not only mitigate unethical behaviour but also enhance overall business performance. When it comes to FMM, poor governance can be seen from the lack of openness when making the decisions and inadequate regulatory compliance. These shortcomings open the door to practices such as contract mismanagement, procurement fraud and

favouritism (Ali et al., 2016). The lack of strong monitoring and reporting systems makes the situation worse due to it hinder organizations from demonstrating their commitment to governance transparency (Shapsugova, 2023). These not only results in financial inefficiencies, but it also degrades the quality of FMM services (Kshaf et al., 2022). Another view from Wang (2020) support this statement where, when biased choices are made during the procurement process, the credibility of competitive bidding is compromised, leading to poor service delivery and loss of trust from stakeholders. Such practices can erode trust among stakeholders and damage the reputation of organizations involved.

RESEARCH METHODOLOGY

This research presents the findings of the preliminary survey, which adopted the qualitative approach through a semi-structured interview. Before semi-structured interview is conducted, ethical approval for this research has been obtained from the Universiti Teknologi MARA Research Ethics Committee (Approval No.: REC/01/2024 (PG/MR/36)). All participants were informed about the objectives and procedures of the study, and written informed consent was obtained prior to participation. The conducted semi-structured interview consists of several questions aimed to explores the key challenges in implementing ESG principles within FMM practices in Malaysia. Purposive sampling was adopted, with potential participants shortlisted based on pre-determined criteria specifically participants directly involved in FMM projects with a minimum of 5 years working experience. A total of 7 key players in FMM practices agreed to participated. These includes five facility managers and two academicians. While purposive sampling allowed the selection of information-rich participants, the small sample size (n=7) limits the generalizability of the findings to the broader FMM industry. Although the number of participants is small, the data analysis achieved data saturation when no new codes or themes emerged from subsequent interviews, indicating adequate coverage of perspectives relevant to the research objective. This aligns with Guest et al. (2020), who found that saturation in qualitative studies can often be reached with as few as six to twelve interviews, provided the participants are homogenous and well-informed about the topic. The interview questions were divided into two sections: Section A captured the demographic information and Section B that comprised open-ended questions aimed at discovering the challenges regarding the implementation of ESG principles within FMM practices. The interview process was conducted over the course of one month. The interview data were analysed using thematic analysis via ATLAS.ti@24 and reported using tabulation format.

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FINDINGS

Demographic Background

The demographic data gathered from the Section A were compiled from the participants which consists of their represented organisations, working experience and positions in the organisations. Table 1 presents the summary of the participant's demographic profile.

Table 1: Demographic profile (n=7)

Items	Sub-Items	Frequency (n)	Percentage (%)
Organisations	Facility Managers	5	71.4
	Academician	2	28.6
Years of Experience	10-20 years	3	42.9
	20-30 years	4	57.1

Table 1 presents the demographic background of the participants involved in the paper. The majority were facility managers (71.4%), while only two were academicians (28.6%). Four participants had between 20 to 30 years of experience (57.1%) with the remaining three having 10 to 20 years of experience (42.9%).

Challenges of ESG principles within FMM practices

Table 2 below gathered the findings from the interview that revealed the challenges that are faced by the participants. With the aid of thematic analysis, the research identified four major themes affecting the implementation of the FMM interrelated with the ESG which are contract complexity, financial constraints, limited data sharing and lack of knowledge.

Table 2: Results of the interviews

Themes	Challenges	Pillar	Participants
Limited Data sharing	Data sharing issues	Environmental	R1, R2
	Reliance on outdated historical data		R4, R3, R6
Financial Constraints	Absence of budgetary allocations	Environmental	R3, R4, R7
	Challenges with using obsolete materials		R2, R7
	Cost escalation without corresponding increases in contract value	Social	R3
	Clients' lack of understanding in pricing works		R4
	Budgetary constraints	Governance	R3, R4, R7
Contract complexity	Lack of specific contracts for individual buildings	Social	R1, R4, R5, R6
	Lack of clarity in defining scope of work		R5
	Misleading sources of complaints leading to clean performance records		R3, R6
	Failure to meet contractual obligations		R5, R3

Themes	Challenges	Pillar	Participants
	Government's reluctance to utilize private sector contracts	Governance	R7
	Involvement of multiple contracts		R1
	Failure of reference to FMM2016 standards		R2, R3
	Lack of standardized tender evaluation procedures		R3, R6
	Absence of standard contracts for private sector		R5
	Lack of clear methods for evaluating performance		R7, R5
Lack of knowledge	Concerns regarding the competency of facility managers	Social	R2, R4, R6
	Lack of standardized definitions for FMM		R6, R7

Themes 1: Contract Complexity

The most prominent challenge identified by participants relates to contract complexity, which encompasses the social and governance pillars of ESG. Several respondents (R1, R4, R5, R6) highlighted the absence of specific contracts for individual buildings and the lack of clarity in defining the scope of work. When the responsibilities of service providers are not clearly outlined, it creates confusion among facility managers, contractors, and general workers. This uncertainty often leads to unmet contractual obligations (R3, R5) and, in some cases, workers being required to perform tasks beyond their agreed duties without fair compensation, raising concerns over ethical and fair labour practices (Haron et al., 2020).

Respondents (R3, R6) also pointed out that communication gaps further complicate FMM operations. Misleading complaint channels and the absence of standardized reporting procedures frequently result in unresolved technical issues, leading to discomfort among occupants and reduced operational efficiency (Hauashdh et al., 2022b). From a governance perspective, the involvement of multiple contracts (R1), lack of standardized tender evaluation procedures (R3, R6), and non-standardized contract documentation (R5) were identified as major contributors to role ambiguity and mismanagement (Ali et al., 2016). These inconsistencies weaken transparency and accountability, contradicting ESG's governance principle of ethical and responsible management.

Additionally, respondents (R5, R7) highlighted the lack of clear methods for performance evaluation, while others (R2, R3) mentioned that inconsistent reference to the FMM2016 standards has resulted in fragmented practices and contract misinterpretations. Respondent R7 also emphasized the government's reluctance to utilize private-sector contracts, which limits flexibility and prevents the adoption of more dynamic, ESG-responsive models. Such issues reveal systemic governance gaps and a misalignment between

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national sustainability goals and actual implementation practices (Noor et al., 2021). These shows that contract complexity in Malaysia's FMM sector extends beyond administrative inefficiencies, it reflects deeper governance and social shortcomings that hinder ethical labour management, transparency, and accountability. This challenge underscores the need for a standardized contracts and consistent regulatory oversight, aligning with the i-ESG Framework, CITP, and National Construction Policy (NCP 2030) to strengthen sustainable governance in facility management.

Themes 2: Financial Constraint

The second most highlighted themes are the financial constraint. Challenges such as cost escalation without corresponding increase in contract value (R3) pose a major threat to service continuity. As noted by Zainal (personal communication, 2023), increase material cost or unforeseen repair works often lead to budget overruns, without contractual provision for financial revisions, service providers may compromise service quality to stay within budget and results to placing undue pressure on workers (Gajjar et al., 2018). This financial pressure is compounded by the client's limited understanding when pricing the works (R4). When client underestimate the cost of services or fail to appreciate the value of lifecycle costing, it leads to underfunded projects. This lack of financial literacy hinders fair decision-making and create disputes over cost justifications (Ismail et al., 2020; Salleh et al., 2020).

Moreover, budgetary constraints (R3, R4, R7) fall under the governance pillars in this theme. These constraints typically reflect poor financial planning and inconsistent fund allocation (Noor et al., 2021). Without proper funding, critical initiatives like carbon reduction, indoor air quality improvements and asset preservation are jeopardized. Another challenge is the lack of budgetary allocation (R3, R4, R7). for adopting necessary technologies to support environmental sustainability initiatives. Ekins and Zenghelis (2021) highlight that without adequate financial resources, organizations may struggle to implement innovative technologies and practices that can enhance their environmental performance. The absence of budgetary allocations for data cost investment in adopting technologies also hinder the promotion of environmental sustainability in FMM (Hamid, personal communication, 2023). Insufficient planning, limited awareness of sustainable costing and weak policy practice linkages hinder organizations from realizing the importance of ESG goals. Strengthening the financial governance and introducing ESG-aligned funding mechanisms such as green procurement incentives or sustainability-linked budgeting under the ESG framework are important to achieve long-term operational and environmental resilience.

Themes 3: Limited Data Sharing

Limited data sharing among stakeholders disrupts coordination, making it difficult to monitor energy use and resource consumption effectively (Zainal, personal communication, 2023; Alghanmi et al., 2022). At the same time, this issues also contributes to the tender pricing issues where the absence of up-to-date and transparent data makes it hard for service providers to accurately estimate costs. In addition, organizations often rely on outdated data (R4, R3, R6), which skews decision-making and results in the use of obsolete materials (R2, R7). This not only affects environmental performance but also creates financial strain when switching to newer and compliant materials (Majid, personal communication, 2023). The cascading effect of these environmental decisions further impacts contract budgets. Rather than viewing this data gaps as a purely technical concern, these finding shows these as a strategic governance gap that undermine the environmental goals of ESG implementation. Without a centralized data management and digital integration, Malaysia's FMM sector will have a risk in treating sustainability reporting as a formality rather than a performance tool.

Themes 4: Lack of Knowledge

Finally, knowledge limitations, especially regarding the competency of facility managers (R3, R4, R6) and the lack of a standardized definition of FMM (R4, R7). As highlighted by Au-Yong et al. (2023), competent personnel are essential to executing efficient and sustainable maintenance practices. Without a clear understanding of what FMM entails, it becomes difficult to measure performance, define roles or maintain service quality and it reflect the social concerns of the ESG. To bridge this gap, it requires a stronger educational response. Integrating ESG-oriented modules into professional certification programmes and promoting continuous professional development would enhance the technical capacity.

CONCLUSIONS

The increasing implementation of ESG principles within the FMM sector in Malaysia presents both significant opportunities and challenges. This research contributes uniquely to the FMM literature by exploring the integration of ESG principles into Malaysia's FMM practices, an underexplored area. It identifies key areas of concern, particularly within the ESG framework, such as contractual complexities, financial constraints, data sharing issues, and knowledge gaps across the three ESG pillars. The research highlights the importance of collaboration between the public and private sectors to address these challenges, especially in standardizing contracts, improving data sharing, and fostering professional growth within the FMM field. While Malaysia is still transitioning toward fully adopting ESG principles, the growing focus on sustainability and

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corporate responsibility, exemplified by initiatives like i-ESG, provides a path forward. A standardized FMM contract document, as recommended in this research, can serve as a critical tool to address recurring challenges. It would not only clarify roles, streamline service expectations, and enhance ESG compliance but also support Malaysia's broader sustainability goals. This research offers a significant contribution to the FMM literature in Malaysia by addressing the gaps in ESG integration, paving the way for more efficient, transparent and responsible facilities management aligned with global sustainability targets and national policy initiatives.

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SUSTAINING THE PAST FOR THE FUTURE: ADAPTATION OF *ISTANA LAMA SERI MENANTI* NEGERI SEMBILAN TRADITIONAL ARCHITECTURE IN SEREMBAN DISTRICT OFFICE

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Abstract

Every region in the world has distinctive architecture that serves as an iconic representation of its architectural identity. In Malaysia. Negeri Sembilan is renowned for the identity of Bumbung Panjang with the modest curve of the roof ridge. This identity is found in most of the Negeri Sembilan traditional houses and old palace designs. To sustain this traditional architectural uniqueness, there is a dire need to investigate how this design can be adapted into modern buildings. This research aims to investigate how the Negeri Sembilan traditional architectural elements are being adapted into modern buildings, referring to its two iconic buildings, namely Istana Lama Seri Menanti and Seremban District Office. The research methodology includes archival analysis of ILMS and SDO drawings and field observations. This research demonstrates that traditional architecture can be adapted into modern buildings by integrating seven key traditional architectural elements, which are site plan typologies, layout plan, space function, façade design, roof shape, interior design, and material/technology used. It also provides practical guidelines for the architect and local authority in sustaining the past for future design.

Keywords: Negeri Sembilan, Adaptation, Traditional Architecture, Modern Design, Sustainability

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INTRODUCTION

The adaptation of modern and traditional architectural elements had long been considered by many scholars (Zhang, 2024; Xeumei & Manteghi, 2024; Othman, 2018; Nurdiyana et al., 2017; Mamun & Dilshad, 2015; Sabrizaa, 2015; Canizaro, 2007; Othman, 2004). They are believed to be historically relevant combinations, preserving cultural identities in the face of global urbanization and uniformity towards a more sustainable design. Although there is a transition towards modern architecture after the industrialization era (Gurupiah, 2008, and Raizman, 2003), traditional architecture is still being inspired by most of the modernist architects (Hasnizam, 2022; Salwana et al, 2020; Zhang, 2024). This is in line with Abel (1996), emphasizing the need to return to our local heritage. Thus, the clashes of these two architectural concepts create gaps in understanding architectural identity.

This research aims to investigate how the Negeri Sembilan traditional architectural elements were adapted into modern buildings by referring to its two iconic buildings, i.e, Istana Lama Seri Menanti (ILSM) and Seremban District Office (SDO). Two research objectives had been developed: (i) to identify key traditional architectural elements to be adapted in modern buildings and (ii) to examine the adaptation of key traditional architectural elements in modern buildings. The outcome of this paper will provide practical guidelines for the architect and local authority in sustaining the past for future design. The uniqueness of this study lies in its focused comparison between a royal heritage building and a contemporary administrative structure, offering new insights into how regional identity can be sustained through architectural adaptation in Malaysian public design.

LITERATURE REVIEW

The present study employed a **qualitative research approach** through **archival analysis** and **on-site observation** of the *Istana Lama Seri Menanti* (ILSM) and *Seremban District Office* (SDO). These two buildings were purposefully selected as they represent **iconic architectural landmarks and administrative symbols** of Negeri Sembilan. The ILSM serves as a historically significant **wooden heritage structure** and a **tourist landmark** that embodies traditional Minangkabau and Negeri Sembilan architectural values. Meanwhile, the SDO reflects a **modern interpretation** of these traditional elements within a contemporary government building.

Due to the **limited availability of original ILSM architectural drawings**, the study referred to **measured drawings** produced by *Pusat Penyelidikan Kajian Alam Melayu (KALAM)*, *Universiti Teknologi Malaysia (UTM)*. For the SDO, architectural drawings were obtained from *Nazri Architect*, appointed by the

Seremban Public Works Department. These materials were analysed to examine the **floor plans, elevations, and sectional compositions** of both buildings.

In addition to archival analysis, **on-site observations** were conducted at both case study locations to investigate **the physical adaptation of traditional architectural elements** from ILSM to SDO. This approach allowed the researcher to identify direct correlations between traditional forms and their modern reinterpretations in administrative design. While this **qualitative, archival, and observational approach is valid and contextually appropriate**, the authors acknowledge certain **limitations** in this study. These include **restricted access to original primary drawings** and the **absence of triangulated data sources**, such as **interviews with architects, heritage officers, or local stakeholders**. As a result, the findings are primarily limited to **physical and visual interpretations** rather than insights into **socio-political or institutional motivations** behind the design adaptation. Recognizing these limitations enhances the **transparency and credibility** of the research, while also identifying opportunities for **future studies** to incorporate **multi-source validation approaches** for broader interpretive depth. All archival references and field observations used in this research were conducted in accordance with **institutional and professional ethical guidelines**. No human subjects or personal data were involved, and the authors declare **no conflicts of interest** concerning the data sources, interpretation, or reporting of this study.

Gurupiah (2008) stated that the approach of reviving traditional architecture through replication faced challenges in adapting to modern design due to complete differences in scale, functional frameworks, and materials used. Amongst architectural design adaptations are as follows:

a) The “balloon method” that replicates traditional external facades to acclimate modern building needs was adopted in Bank Bumiputra Podium Hall, the Losong Museum, and the Negeri Sembilan State Assembly Building
b) The “tower and hut method” incorporates traditional forms into simpler parts, such as podiums and verandahs was adopted in Bank Bumiputra Headquarters Complex, Hilton Hotel, and Permodalan Nasional Berhad Building
c) The eclectic method combines architectural images from various ethnic identities in Malaysia. This is adopted in Putra World Trade Centre Complex and Dewan Suarah, Sarawak.

Revivalist architecture in Malaysia often results in superficial imitation, using the traditional elements only decoratively. This shows a limited understanding of regionalism and leads to culturally unsuitable and unorganised designs.

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The Evolution of Negeri Sembilan Architecture

The transition system from the colonial world to the era of independence made various impacts on the evolution of Negeri Sembilan architecture. Since the early pre-colonial period until now, it shows a sudden development in terms of rapid urbanization, economic achievement, and socio-cultural development of local communities (Othman, 2018). Table 1 outlined the evolution of Negeri Sembilan architecture. The evolution of Negeri Sembilan architecture is divided into three eras, namely the traditional era, the colonial era, and the modern era.

Table 1: Era Evolution of Negeri Sembilan Architecture

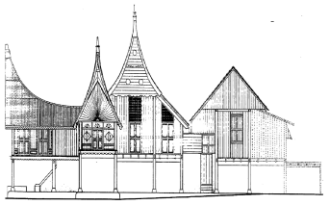
	Traditional Era (1400-1773)	**Colonial Era (1774-1956)**	**Moden Era (1957 onwards)**
Architect/ Contractor	Malay craftman	British architect Chinese contractor	Local architect and foreign-educated
Material	Nature – timber Roof – *rumbia, nipah,* bamboo and zinc	Timber and stone Imported roof tiles, cement	Timber, cement, steel, and glass
Architectural style	Vernacular, traditional	British India, English	Modern, high technology, contemporary

Source: Othman (2018)

During the traditional era, the residential space consisted of vernacular and traditional house designs. The house is built by Malay craftsmen using timber and either bamboo, *rumbia, nipah,* or zinc for the roof. The layout of the house is divided into three main areas, i.e, a formal space (*anjung*), front porch, and back porch, which are usually used for discussion. *Ketua Adat* was an individual elected in the Adat Perpatih system of government. During the traditional Era, the country's administrative system was under monarchical rule, where the Sultan held the highest ruling position in the Malay kingdom (Hazrina, 2012). In this era, there was no office space because all residents' issues were discussed in the house of the *Penghulu* or *Ketua Kampung*.



Istana Lama Ampang Tinggi



Rumah Dato Muda Haji Omar Lajim

Figure 1: Negeri Sembilan Architecture in the Traditional Era – Palace and Office

After the arrival of the colonialists, they introduced a system of government at the district level by centralizing in a building, and they provided furnished office space. The dwellings were designed in a hybrid Anglo Indian style, combining local architectural principles with the influence of European architecture brought in by the British from India. The materials used in this era include imported cement, timber, steel, and glass.



Istana Lama Seri Menanti



Bangunan Persekutuan Seremban

Figure 2: Negeri Sembilan Architecture in the Colonial Era – Palace and Office

Similarly, the house's designs evolved from traditional aspects towards colonial elements. This adaptation may be seen in the roof design, front elevation, and usage of concrete materials. The flat roof design is being blended with hipped roof features, creating apparent modern architectural features. This combination clearly demonstrated that colonists continued to adopt local architectural features. The only difference is the usage of materials such as brick pillars in varying sizes and heights, whereas the original Malay traditional house used timber pillars obtained from the neighbourhood. The traditional use of timber steps was replaced by wider staircase designs, such as a concrete staircase with ceramic finishing. Meanwhile, in the modern era, residential houses in Negeri Sembilan have evolved into distinct shapes and styles, emphasizing style rather than function. Most of the architects are from local and foreign education.

They invented modern and contemporary architectural styles using various technological systems. The buildings used more concrete, timber, steel, and glass. It is recommended that there should be research done in highlighting the postmodern era's strength, with ILSM as a recommended architectural model.

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Istana Negeri Sembilan Bukit Persekutuan



Bangunan Dewan Undangan Seremban

Figure 3: Negeri Sembilan Architecture in Modern Era – Palace and Office

As a historical administrative centre and district icon, ILSM represents local identity and aligns with Public Work Department design guidelines for buildings like the SDO. Thus, the present study will focus on the transition from colonial to modern era, looking into the adaptation of ILSM in SDO.

Background of *Istana Lama Seri Menanti* and Seremban District Office

Istana lama Seri Menanti

ILSM in Kuala Pilah, Negeri Sembilan, is a palace built during the colonial era. It served as the official residence of the Yang di-Pertuan Besar of Negeri Sembilan around the year 1900. ILSM is a unique structure made of timber. It was constructed in 1902 and completed in 1908. His Royal Highness, the Yang di-Pertuan Besar Tuanku Muhammad Ibni Almarhum Yamtuan Antah, resided in this palace until 1931, before moving to a new palace built near the old palace. This palace is a four-storey building. The original plan was designed by two Malay craftsmen, namely Tukang Kahar and Tukang Taib. The palace plan was further detailed and approved in November 1902 by the State Engineer and the British Resident. This palace has 102 pillars, including four main pillars, 67 feet long.



Figure 3: ILSM – Front and Rear View
Source: Syed Iskandar (2014)

The uniqueness of this palace is that it does not use any iron nails; instead, the nails are made of wood. Hard wooden pegs were used to join the boards together. The structure of the palace consists of timber floor beams to roof beams, and the floorboards are fastened with wooden nails. The outer walls can be adjusted to allow light and free airflow. ILSM serves as a residence, and the lounge area functions as a public space for receiving the community and state dignitaries.

Seremban District Office (SDO)

SDO serves as an administrative center and a resource for the community. Originally, it was in the center of Seremban town in an old colonial building before moving to its new building in Seremban Dua.

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Figure 4: SDO – Front View
Source: Syed Iskandar (2014)

The new building was designed to meet the guidelines provided by the Public Works Department. The design was inspired by the Old Seri Menanti Palace. SDO is led by the District Officer, who manages several departments. It also acts as a community service centre for tax payments, local bill inquiries, and administrative services for *Ketua Kampung* (R. Ismail, 2022) and (A. Zainuddin, 2018).

Adaptation of Negeri Sembilan Traditional Architectural Elements to Modern Design

There are five Negeri Sembilan traditional architectures to be adapted in modern design, such as site location, layout plan, space function, façade design – front and side elevations, and roof design (Othman, 2018). This is further illustrated in Table 2. The adaptation of each of these elements will be explained in the findings section.

Table 2: Adaptation Elements of Negeri Sembilan Traditional Architecture to Modern Design

Adaptation Element	Main/Compulsory Sub-Element	Additional Sub-Element
A) Site location	a) Facing/connected to a main road or important route b) Close to the main state/district building, local community centre, and residential area, suitable as a meeting place for residents c) Building design that shows its greatness as a main institution of district administration d) Facing a field or open area e) The location of the building is in the middle of the city and/or is the largest building in the area f) There is a parking area g) There is an area for landscaping h) Building orientation according to the qibla position i) Symmetrical building site position	a) Positioned quite high so that it is more clearly visible b) According to the client's wishes c) Multi-level roof shape
B) Layout plan	a) The main staircase is in the middle of the building that connecting to each floor above b) Safety features of the building and its users, such as facilities for emergency routes (means of escape), emergency doors, and others c) The entrance should face the main staircase and directly lead to the open lobby in the middle of the building d) The void part is in the middle of the building e) The exit is located on the side or back of the building	a) The exit stairs are located on the side of the building lobby b) The floor design extends from the building on the left wing to the right wing c) The entrance is located under the porch d) Low ceiling construction e) There is an arch construction f) There is a glass wall construction to make it look more spacious

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	f) There is a high ceiling in the lobby area g) There is a corridor on each floor h) The position of the floor plan should be symmetrical i) Same size and shape for the upper floors	
C) Space function	a) The ground floor functions as a public space b) The upper floor functions as the main administrative space c) Space hierarchy according to the position and size of the workspace	a) Divided into three main rooms, namely: i. front room - porch and porch. The porch room is the main administrative office/important area. The porch room is the district administration room ii. middle room - 'void' room and 'featured wall' The middle room is the government office room and a place to wait/welcome guests/inquiries iii. back room - office room b) Has a porch that is parallel to the main staircase c) The porch is connected to the back room, which connects to all existing rooms
D) Façade design	a) Multi-storey building b) There is an observation tower with a raised void space in the middle that acts as a focal point c) Repetition of window construction and concrete columns d) Corridors are on each level of the building	a) Square and symmetrical building shape b) Prominent porch shape and a gondola roof c) There is a ventilation space in the building d) The facade of the building is divided into three blocks i. left and right blocks – prominent facade design and the same size
		ii. middle block – prominent facade design and larger in size than the left and right blocks e) Vertical and flat walls without any decorative elements f) The wall surface is white
E) Roof design	a) Symmetrical roof shapes of Malay houses, such as pyramidal roofs, multi-level roofs b) Mixed roofs between flat and hipped roofs, overlapping roofs, spread-out roofs, comb-like bananas, and intersecting skylights at the top of the building c) Roof construction adapted to the equatorial climate	a) The roof is tilted at the entrance porch b) The skylight roof is built for lighting purposes

RESEARCH METHODOLOGY

The present study used a qualitative research technique with archival analysis of ILMS and SDO drawings. These two buildings were selected since they are the iconic administrative buildings/symbols in Negeri Sembilan. In addition, ILSM stands as a landmark and a wooden structure of great historical value and serves as a tourist attraction. Limitation in the availability of ILSM drawings is also another factor to be considered. Therefore, the researcher refers to measured drawings prepared by the *Pusat Penyelidikan Kajian Alam Melayu* (KALAM), Universiti Teknologi Malaysia. Meanwhile, drawings for SDO were obtained from Nazri Architect, who was appointed by the Seremban Public Works Department to design the building. These drawings were used to study the building floor plans, elevations, and sections. Aside from data archiving, site observations of both case studies were conducted to investigate the elements of adoption from ILMS to SDO. The research was also limited by the absence of triangulated data sources, such as interviews and design decision insights. This restriction limits the scope to physical interpretation rather than socio-political or institutional reasons behind the design adoption, as future research may explore through multiple validation approaches.

All archival drawing references and site observations used in this research were obtained and analysed in accordance with institutional and professional research guidelines. No human subjects or personal data were involved, and the researchers declare that there are no conflicts of interest related to the data sources, interpretation, or reporting of this research.

FINDINGS

From the observation, it was found that several elements from the ILMS have been applied in the design of the SDO building. These elements include several aspects as follows:

Site location

The typology of the site plan of ILSM clearly indicates its significance as a royal institution, with its location in an open area making it more visible than the buildings in its surroundings. The main road is the most essential route for transportation. In ancient times, the building location was identified by the current of the river's water both upstream and downstream. If it faces the river, the end of the *porch* should be upstream because the upstream is a sacred place; normally, the end of the *porch* is the place for divinity-related events such as praying, marriage, and funeral prayer.

The residence's main room is positioned at the downstream of the river. The downstream river marks the *edge of the porch* of the palace. It serves as an area for family members to discuss family matters and traditions. This is

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because, according to Negeri Sembilan's family agreement system, *orang pangkal* represents *Orang Adat* or significant decision-making family members. As a result, the ILMS site is likely to orient this concept toward the river. It's merely that its location is close to the river on the craftsmen's side. In ancient times, rivers were an important mode of communication. The characters of the road as an interface to all places. The spacious area in front of the palace also plays an integral part in gathering locals for celebrations and to honor the king.

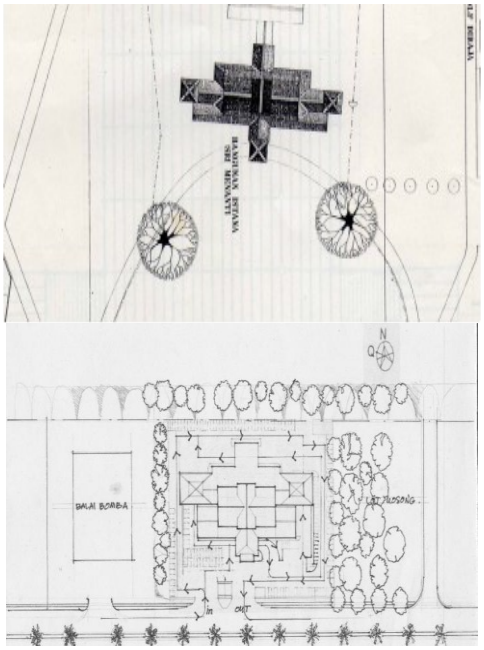


Figure 4: Site plan of ILMS and SDO

Like ILSM, SDO also faces the main road. The site was gazetted for an SDO building in the Urban Planning Plan, not due to the river contour. The current site plan maintains the elements of an administrative centre and stands two stories tall. The design bears resemblance to ILSM, with the open space in front of the building primarily designated for parking. The current location is adjacent to the fire station, courthouse, and police headquarters, while ILSM stands alone, dominant in its role as the heart of the royal governance system. The similarities in form and location highlight the accurate application of these elements in the current site plan. In addition, it is located near other administrative institutions such as the court, fire department headquarters, and police headquarters. The similarities drawn from the site location of ILSM and SDO are:

a) facing the main road, with an open area in front of the building

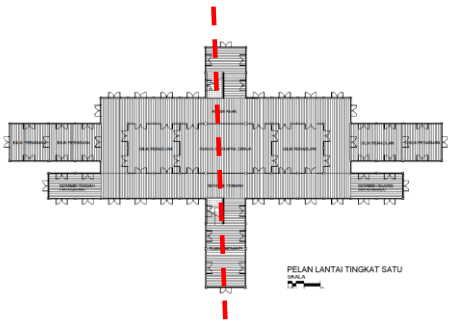
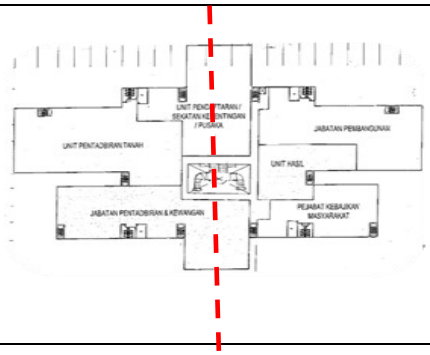
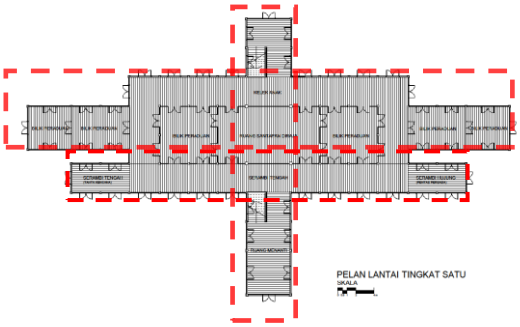
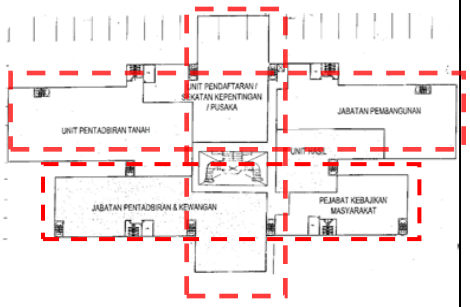
b) being the largest building in the area, acting as an icon of district governance
c) the multi-tiered roof design and symmetrical positioning

Layout plan

a) Symmetry

The proportions of the plan and the position of the floor plan of ILSM are symmetric. The lengthy *anjung* locates the main staircase at the center and the rear staircase. This symmetrical location is in line with the center of the main column, flanked by a *tiang seri* extended to the back through a pathway to *kelek anak* and the kitchen. The proportion of the plan makes it architecturally attractive and suitable for its function as a center for administration and royal palace. Meanwhile, the floor plan of SDO is also symmetrical, like the shape of the ILSM *porch,* except the *porch* of SDO is smaller and wider, as it is only the main office for the district officer and district engineer. The symmetrical arrangement of the foyer is aligned with the main staircase and connects to other administration offices.

Table 3: Adaptation Elements of Symmetric and Floor Design in ILSM and DSO

ILSM	SDO
	
	

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b) Floor Design

ILSM floor design can be divided into three main areas: front, middle, and rear. There are 2 kinds of porches, namely the *anjung* and *serambi* in front of the palace. There are three *porches*: the *serambi pangkal, serambi tengah,* and *serambi hujung*. A central area is in the middle of the palace, while *kelek anak, selang,* and kitchen are at the rear of the palace. The *Anjung* area and *Serambi* are differentiated by the floors with vary in height.

There are no hierarchical floors with varying heights in this building. On the contrary, the hierarchical aspect is translated into the separation of administrative spaces based on positions and employee room sizes. There are also sayap kiri and sayap kanan. In addition, there is a lengthy *anjung* that extends to the back, serving as an intersection between all areas. The SDO building's floor layout is typical for the first and second floors.

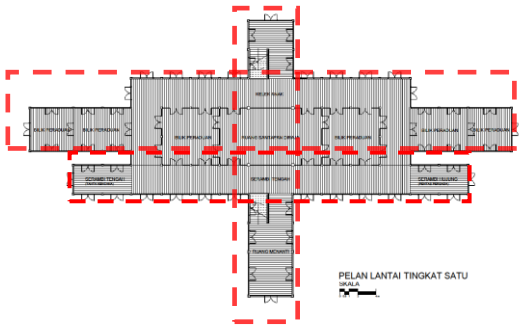
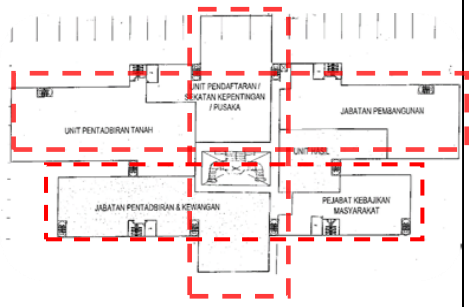
Space function

Each room in ILSM serves a specific purpose. The ground floor has the main stairway leading up to the palace. *Anjung Istana* is on the first floor, serving as a waiting area for royal guests and ordinary citizens to meet the *Yang Di Pertuan*. *Anjung* in front of the palace reflects its function as a semi-public place. After the *anjung*, there is a *pangkal serambi* to meet the *Yang Dipertuan*. The *Serambi hujung* is for the *Raja Muda* to receive his guests and citizens. Besides being a gateway to the center of the palace, *serambi tengah* serves as the royal children's dining area and rooms. The royal visitors' rooms are located on the left and right sides of the royal room. *Kelek anak* and *Selang* connect the palace and the kitchen.

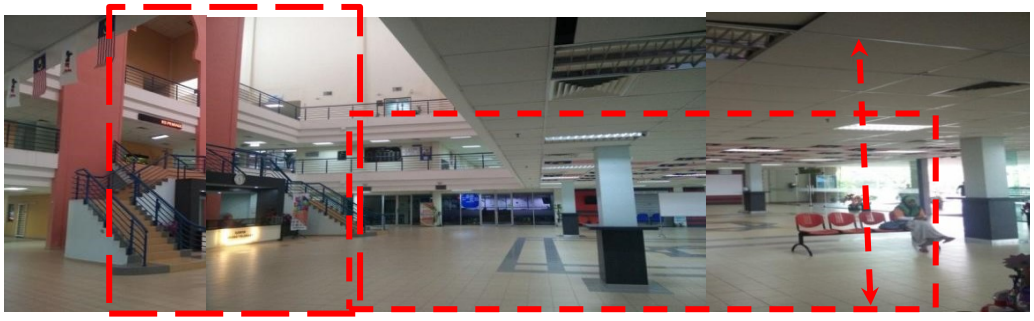


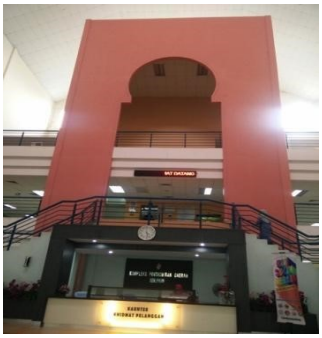
Figure 5: ILSM – *Anjung* and *Pangkal Serambi* area

Table 4: Adaptation Elements of Space Function in ILSM and DSO

ILSM	SDO
	

The SDO space serves the same function as ILSM. The *Anjung* serves as the main administrative area meant for the district officers and the district engineer's office. Meanwhile, the functions of the serambi area are as the district's administrative spaces. Other administration offices are located at the centre and back of SDO.





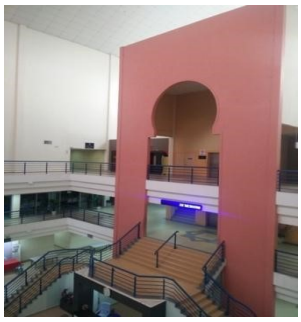


Figure 6: SDO lobby area

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There is a main staircase and an inquiry counter to welcome employees as well as guests. There is a waiting area for the public, similar to ILSM. Overall, the ground floor area operates as a public space. There is also a parking area, canteen, surau, and shops on the ground floor. The first and second floors are mainly for government offices.

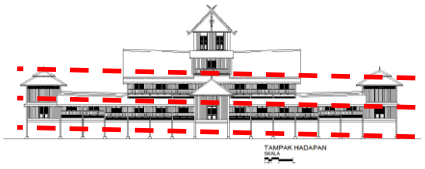
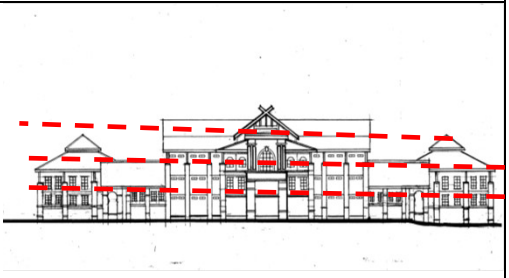
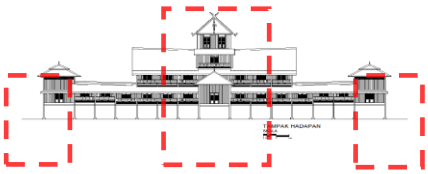
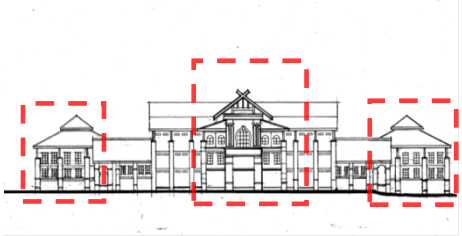
Façade design

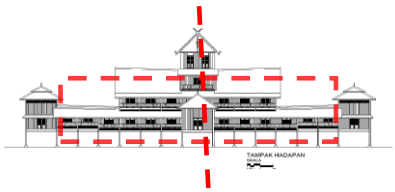
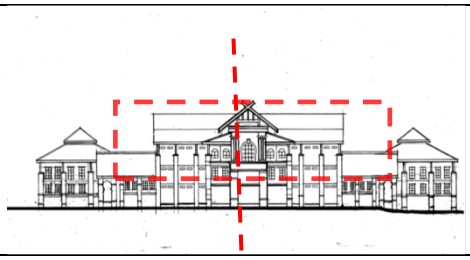
a) Front View and Façade Design

The palace building's horizontal elements are its floor lines. ILSM has four floors. The corridor line is the most apparent element in the front. On the first floor, there is a long corridor; on the second floor, there is a half-sized corridor. On the third and fourth floors, the horizontal corridor lines are thin.

The roof's slope is in the form of a flat roof that runs across the buildings on the first and second floors. The roofs of the palace building's left and right sides overlap. The tower building, as well as the two buildings on the left and right sides of the palace, have the most apparent vertical building block orientations.

Table 5: Adaptation Elements of Front View and Façade Design in ILSM and DSO

ILSM	SDO
	
	

ILSM	SDO
	

Due to their symmetrical character, the carved wooden pillars on the palace's ground level will be repetitive. Other constructions that use repetition are the shape of the palace roof, windows, lintels, and wall panels. The arrangement of the window frames and pillars appears harmonious and balanced. The layout is separated by the wall panels. Repetitions also occurred at the angle of the pyramid roof. This created a cohesive design across the entire roof. Likewise, the palace's windows were also repeated on each floor. The front view of ILSM is symmetrical, dividing the palace into two parts that appear proportioned.

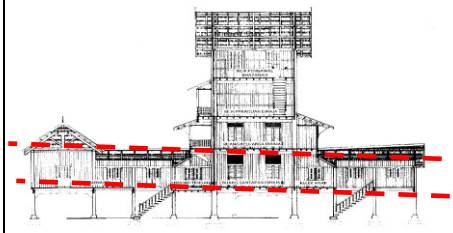
The front view of the SDO is typical of the ILSM, particularly the shape of the facade. The ILSM has a similar image regarding its multi-story building. The facade that stands out in front and behind the building are all the same size. *Anjung* and the tower at the centre of the office are the tallest and most visible front facade.

The front view position of the SDO is also symmetrical, dividing it into three tall building facades. Like the ILSM, the SDO featured a recurring aluminium-framed window system intersected with concrete wall panels. There is also a semi-circular window structure on top of the fixed-frame window.

The SDO building was also designed by elevating its central area, creating a hollow space where the main staircase functions as a meeting point. The high walls with a spread-roof structure and intersecting skylights give the same appearance as the palace concept. The design of the overlapping roof remains intact and proportioned at the left and right of the building, identical to the palace building but larger in size. There is a flat roof on top and *tanda tunjuk langit* at the *anjung*. The front façade of this building uses concrete pillars. The white wall symbolised honesty in leadership. Its façade is divided into three vertical towers, each located on the left, middle and right of the building. These towers are relatively large and apparent. The central position of SDO provides a significant identity of the ILSM front façade.

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Table 6: Adaptation Elements of Side View in ILSM and DSO

ILSM	SDO
	

The DOS building adapted architectural details from the ILSM. The side view of SDO is similarly in style to the standard district office design, particularly the side roof area. The roof is built at different heights, similar to the ILSM roof, which looks like a row of *tebar layar* and an overlapping roof. There is also a repetitive use of aluminum frame windows, concrete columns, and concrete walls on the upper floor of the building.

Roof design

The roof construction at ILSM uses long roofs, hipped roofs, and overlapping roofs. The slope of this type of roof is suitable for the tropical climate, which has high rainfall throughout the year. The roof design of the main building uses *tebar layar* and an overlapped roof at *anjung*.

Table 7: Adaptation Elements of Roof Design in ILSM and DSO

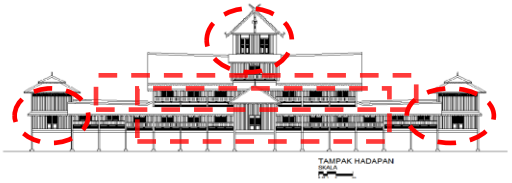
ILSM	SDO
	

Figure 5: ILSM – Roof design.
Source: Sabrizaa (2007)

There are *tunjuk langit* at the roof and overlapping roofs at both the right and left sides of the building. This creates a unique effect with a variation in roof type to provide a pleasant aesthetic impression. The edge on the roof and the long beam projections act as shading devices as well as protecting from rain and sunlight. *Tunjuk langit* can be seen at the apex of the roof at the front of the main building. According to E Kalsum (2024), the presence of ornamental elements on the building facades further reinforces the perception of regional identity in state buildings. The presence of ornamental elements on the building façades further reinforced the perception of regional identity in state buildings. Additionally, cultural symbols, such as totems or cultural elements like cannons present in some state buildings, significantly contribute to the formation of architectural regional identity. These factors have a strong association with the cultural aspects, highlighting their importance in shaping the regional identity.

To strengthen the analytical comparison, this research examines the adaptation findings within the concept of regionalism, where modern administrative design integrates locality and global modernity by selectively adopting vernacular spatial design, symbolic identity indicators, and climatic appropriateness rather than merely replicating forms. The ILSM-SDO comparison reveals a vernacular-modern hybridization pathway whereby historical syntax is functionally re-coded into contemporary governance architecture, culminating as a measurable cultural sustainability construct rather than decorative revivalism.

CONCLUSION

The research highlighted the significance of adapting traditional Negeri Sembilan architectural elements into modern administrative buildings, demonstrating how cultural identity can be operationalised rather than merely symbolised. Beyond improving aesthetic character, the adaptation of vernacular elements such as roof design, spatial layout, and façade design also strengthens environmental responsiveness and functional efficiency. Positioned through the lens of critical regionalism, the ILSM–SDO comparison shows a vernacular modern hybridisation pathway where palace-based cultural is translated into a contemporary administrative building that offers a replicable cultural sustainability model for future government building design. The novelty of this study lies in empirically evidencing how a specific royal palace typology can be systematically adapted into a district administrative office without losing its cultural integrity, contributing a measurable frame for Malaysian regional identity.

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EVALUATION AND OPTIMISATION OF INTEGRATED COMMUNITY BUILDING USING MULTI-SOURCE DATA: A CASE STUDY OF PENGJIAQIAO, NANCHANG

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Abstract

In response to the prevalent issue that most Chinese communities fall short of the Integrated Community standards, this study takes Pengjiaqiao Sub-district in Nanchang as a case study. Based on the conceptual framework and construction criteria of Integrated Communities, an evaluation index system was established. Using spatial analysis methods, including ArcGIS network analysis, kernel density estimation, and inverse distance weighting, the study assesses the community's infrastructure coverage, service accessibility, and functional completeness. Results indicate significant gaps between the current conditions in Pengjiaqiao Sub-district and the required standards. In response to these findings and in consideration of residents' needs, the study proposes targeted optimisation strategies from spatial and resource allocation perspectives, providing an empirical basis for promoting Integrated Community development.

Keywords: Integrated Community, Spatial Network Analysis, Kernel Density Analysis, Inverse Distance Weighting Analysis, POI Data

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INTRODUCTION

The concept of the Integrated Community, first proposed by Academician Wu Liangyong at the 2010 Shanghai World Expo, has become a key guiding framework for urban renewal in China. While policy frameworks and conceptual models have been widely discussed, a notable gap remains in spatially explicit, empirically grounded assessments of Integrated Community performance—particularly at the neighbourhood scale. This study addresses this gap by developing and applying a multi-method GIS approach to evaluate the built environment of Pengjiaqiao Sub-district in Nanchang, a pilot city for urban renewal.

By integrating spatial network analysis, kernel density estimation, and inverse distance weighting, we quantify key aspects of community completeness—including facility distribution, service coverage, and functional configuration—against nationally recognised Integrated Community standards. This methodology not only identifies specific spatial and functional shortcomings in a representative old urban area but also demonstrates how GIS-based techniques can bridge the gap between policy goals and actionable spatial strategies.

This study contributes to the international literature on sustainable community planning by offering a replicable, data-driven evaluation model applicable to cities undergoing similar renewal processes. It advances the discussion on Integrated Communities from conceptual advocacy toward evidence-based spatial planning, with implications for GIS applications in urban regeneration contexts globally.

LITERATURE REVIEW

Integrated Community

The academic community has not yet formed a unified Integrated Community concept. Various construction standards and policy documents have defined and analysed the concept of the Integrated Community, and many scholars have expressed differing views. However, they generally agree that an Integrated community should comprehensively support citizens' living, spiritual, and cultural needs. Charlene Grant (1997) considered an Integrated Community a planning development policy and strategy, essentially a tool for achieving broader social goals rather than a theoretical construct of an ideal community aimed at improving quality of life, characterised by diversity, choice, and compact form. Jennifer Anne Kay (2001) viewed an Integrated Community as a planning approach and urban development model that emerged to address various issues caused by suburban development. This model aims to manage growth while enhancing the quality of life for residents within the community, stipulating

a series of strategies to create communities that balance land use by providing broader employment, shopping, and entertainment opportunities nearby. Jane Koh (2012) believed an Integrated Community should be an excellent place to live, work, shop, and play, meaning there are opportunities locally for food, transportation, housing, entertainment, education, retail, and employment. Hamid Iravani (2020) defined an Integrated Community as an urban planning concept that respects the needs of all residents—regardless of their income, culture, age, or ideology. Marc White (2021) researched Vancouver using data analysis, interviews, and surveys to explore the contribution of housing cooperatives to creating comprehensive, affordable, and complete communities. Wu Liangyong (2010) stated that an Integrated Community has rich connotations and is a true social community, synthesising physical and socio-cultural aspects, including hardware and software elements. It should encompass housing issues, services, security, health, education, internal and external transportation, entertainment, cultural parks, and more.

The Chinese government has issued several policies to guide the construction of Integrated Communities. These policies have significant practical implications for urban planners and policymakers. For instance, the Standards for Integrated Residential Communities (Trial)(Wei Wei,2020) defines an integrated residential community as one with comprehensive essential public services, complete convenience commercial services, adequate municipal infrastructure, ample public activity spaces, full-coverage property services, and sound community management mechanisms within a walkable range for residents, fostering a strong sense of belonging and identity. In the government document "Notice on the Implementation of the Livable Environment Construction Action Plan," Fujian Province proposed community construction reference indicators: Six Essentials, Five Standards, Three Improvements, and One Convention (Liu He, 2017).

RESEARCH SIGNIFICANCE

Provide a practical and feasible plan for the comprehensive development of the community in Nanchang City, Jiangxi Province. Taking Pengjiaqiao Sub-district in Donghu District, Nanchang City, Jiangxi Province as an example, this paper analyses the six indicators of the integrated construction index system standard. It uses GIS to analyse the compliance of different indicators. It clarifies the current hardware deficiencies of the community. It proposes suggestions for optimising the construction of the Pengjiaqiao Sub-district community, providing a path reference for the Integrated Community construction in Nanchang City, Jiangxi Province. The comprehensive development of Pengjiaqiao Sub-district can continuously promote the city's sustainable growth. From the perspective of

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community development, improving the material environment and perfecting facility configuration can constantly enhance the vitality and energy of the community, and promote its secondary development; From the perspective of cultural continuity, the inheritance of traditional culture and the creation of local culture can maintain community cultural capital, reshape community spirit, and avoid cultural discontinuity; From the perspective of residents' daily lives, creating spaces for interactive communication and organizing community activities that align with interests can promote harmonious coexistence among neighbors and enhance a sense of belonging within the community.

Standards and Indicators for Integrated Community Construction

Standards for Integrated Community Construction

The "Standards for Integrated Residential Communities (Trial)" issued in 2020 delineates the construction objectives, tasks, and resource allocation for communities. It establishes the principle of building facilities such as kindergartens and elderly service stations within a 5-10 minute walking distance, which translates to a radius of 300-500 meters. The population size should be controlled at 5,000 to 12,000 people, based on the community life circle defined by the Ministry of Housing and Urban-Rural Development of the People's Republic of China (2018). The "Five-minute Life Circle" is considered the basic unit of an Integrated Community. The Integrated Community categorises community resources into six major categories and 20 subcategories (Table 1), requiring comprehensive essential public services, complete convenience commercial facilities, adequate municipal infrastructure, ample public activity spaces, full-coverage property management, and an active community management mechanism.

Table 3: Integrated Community Supporting Facility Construction Content

Basic Public Service Facilities	Convenient Commercial Facilities	Municipal Infrastructure	Public Spaces	Property Management	Community Management
One Kindergarten	One Comprehensive Supermarket	Water, Electricity, Roads, Gas, Heating, and Communication Facilities	Public Activity Spaces	Property Management	Management Mechanisms

Basic Public Service Facilities	Convenient Commercial Facilities	Municipal Infrastructure	Public Spaces	Property Management	Community Management
One Daycare Centre	Multiple Mail and Parcel Delivery service facilities	Parking and Charging Facilities	Public Green Spaces	Property Management Service Platform	Integrated Management Services
One Senior Service Centre	Other Convenient Commercial Outlets	Slow-traffic System			Community Culture
One Community Comprehensive Service Centre		Barrier-free Facilities			
One Community Health Service Station		Environmental Sanitation Facilities			
One Community Health Service Station		Environmental Sanitation Facilities			

Source: The author has compiled and illustrated based on relevant materials (Weiwei,2020)

Definition of Integrated Community Indicators

The concept of an Integrated Community was first defined by the Fujian Provincial People's Government in the government document "Notice on the Implementation of the Livable Environment Construction Action Plan." The Integrated Community indicator system standard is summarised as Six Essentials, Five Standards, Three Improvements, and One Convention (Table 2).

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Table 2: Standards for the Integrated Community Construction Indicator System

System	Indicator	Remarks
Six Essentials	One Comprehensive Service Centre	It provides essential community services, health services, elderly care services, cultural resources such as books, and a community parcel pickup point.
	One Kindergarten	Considers traffic safety for children, ensuring the entrance is not directly facing high-traffic roads.
	One Bus Stop	Ideally, it is within 500m walking distance from residential areas and has comprehensive public transport facilities.
	One Public Activity Space	Converts street corners and idle land into public activity spaces, with a focus on barrier-free facilities in ageing communities, neighbour-friendly centres, and expanding indoor public spaces in northern communities.
	One Set of Complete Municipal Facilities	Develops sponge cities and green infrastructure, including fire safety facilities, recycling bins, and public toilets. Addresses issues in old neighbourhoods, such as water discharge and electrical leakage. Promotes rainwater and wastewater separation and reuse in rural communities.
	One Convenient Slow-Traffic System	It includes pedestrian and bicycle paths. The slow-traffic system is separated from vehicle traffic, connecting community public nodes and main residential areas.
Five Standards	Appearance Improvement	No non-compliant billboards; building exteriors are clean.
	Park and Green Space Standards	Parks and green spaces are open, offering good rest areas and simple fitness facilities.
	Road Construction Standards	Maintains clear fire lanes, convenient road connections with the outside, and regulated parking
	Municipal Management Standards	Complete drainage and power systems, with rainwater and wastewater separation, centralised sewage collection and treatment, and waste sorting
	Environmental Hygiene Standards	Promotes waste sorting, provides trash bins, specifies requirements for front-door cleaning, and ensures regular cleaning.
Three Improvements	Organizational Team	Integrated Community party organisations, neighbourhood committees, and resident self-governance organisations, with a focus on training specialised and high-quality community workers
	Community Services	Improved public facilities, encouragement of community-specific activities, and fostering a spirit of community co-construction
	Co-Construction Mechanism	Broad resident participation in community management, achieving community co-construction and co-management
One Agreement	Form a Community Resident Agreement	Residents reach a consensus through discussions and formulate agreements on community hygiene, parking management, self-governance, property management, and other areas to ensure resident participation, mutual supervision, and binding regulations.

Source: The author has compiled and illustrated based on relevant materials (Liu He,2017)

"Six Essentials" refers to having one comprehensive service station, one health service station, one kindergarten, one public activity space, one set of complete municipal facilities, and one convenient slow-traffic system.

"Five Standards" means meeting standards for appearance improvement, park green space, road construction, municipal management, and environmental sanitation.

"Three Improvements" entails improving community organisation teams, community services, and co-construction mechanisms.

"One Convention" is a residents' convention, meaning that community residents reach a consensus on community management and construction, participating in and supervising one another.

RESEARCH METHODOLOGY

This study employs both qualitative and quantitative methods, with a focus on the Pengjiaqiao Sub-district. Pengjiaqiao Sub-district is in Donghu District, Nanchang City, Jiangxi Province, China. It is bordered by Qingshan Lake to the east, Beijing West Road to the south, Jingjiu Railway to the west, and Fudayou Embankment to the north. The total area of the jurisdiction is 5.8 square kilometres, comprising 12 communities and one neighbourhood committee.

The data for this study were sourced from the POI (Point of Interest) data of public service facilities in Pengjiaqiao Sub-district, Donghu District, Nanchang City, as of April 2024, which were scraped using Python from Gaode Maps. Each POI data entry includes the corresponding district location and category attributes. The data used in the final analysis was obtained through relevant calculations and processing.

The study area was defined based on the delineated boundaries of Pengjiaqiao Sub-district. According to the Standards for Integrated Residential Communities (Trial) (Wei Wei, 2020), the elements required to construct integrated residential communities were identified, and the POI points for each component were extracted. These elements include comprehensive service stations, kindergartens, bus stops, public activity spaces, municipal facilities, and slow-traffic systems. The residential community boundaries were delineated based on the distribution of each element and the confirmation standards of the POI points. The central location of the integrated residential community was selected as the centre of the five-minute life circle. The compliance rates of various facility elements were determined through facility relevance analysis and the selection of the five-minute life circle.

Referring to the "Notice on the Implementation of the Livable Environment Construction Action Plan," issued by the People's Government of Fujian Province, the data acquisition of the "Six Essentials" indicator is reliable and extensive. The "Six Essentials" indicators can be spatially quantified and

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evaluated in the standards for Integrated Community construction. A comprehensive assessment can be made by combining the spatial distribution of the "Six Essentials" indicators with qualitative research. If the points of supporting facilities for the basic units of the community are fully covered, the community can be defined as an Integrated Community. If the service radii of all indicators fully cover the community, it is defined as a relatively Integrated Community. If the community lacks one or more facilities or has areas where the service range of facilities is inaccessible, it is defined as an incomplete community.

ANALYSIS AND DISCUSSION

Calculation of Service Area Isochrones

An isochrone refers to the area that can be covered within a specific time from a certain point using a particular mode of transportation. Isochrones reflect travel time in geographical space and can be used to analyse urban transportation convenience (Quan Heng,2021). GIS network analysis (based on service area isochrones) utilises the national geographic road network and the base conversion road network. Isochrones can be created by assuming a walking speed of 5 km/h (Figure 1) (Ma Wenjun, 2020).

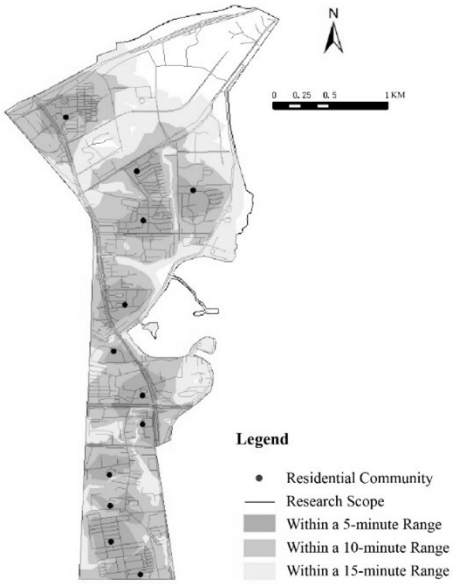


Figure 1: Isochronal Coverage Diagram
Source: illustrated by the author

Total Number of Facilities

In ArcGIS 10.5, the obtained point of interest (POI) data was visualised using the WGS 1984 coordinate system (Roslan, 2025). The coordinate system of the point layer was matched with the vector map coordinates of the Pengjiaqiao Sub-district area, and a corresponding regional POI distribution map was summarised (Liu Dandan, 2021) (Figure 2).

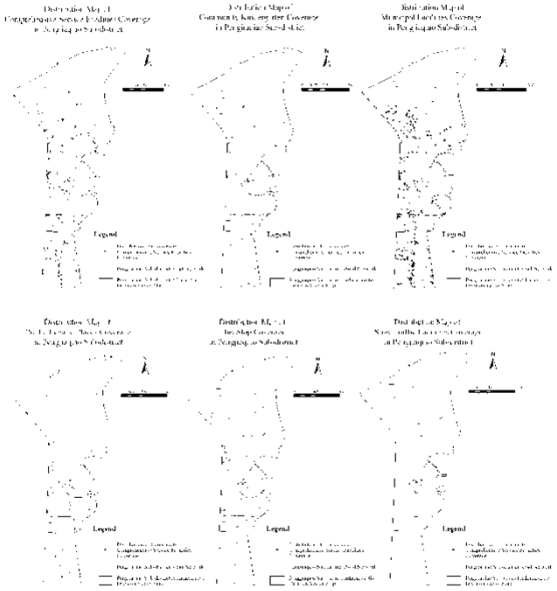


Figure 2: POI Distribution Diagram
Source: illustrated by the author

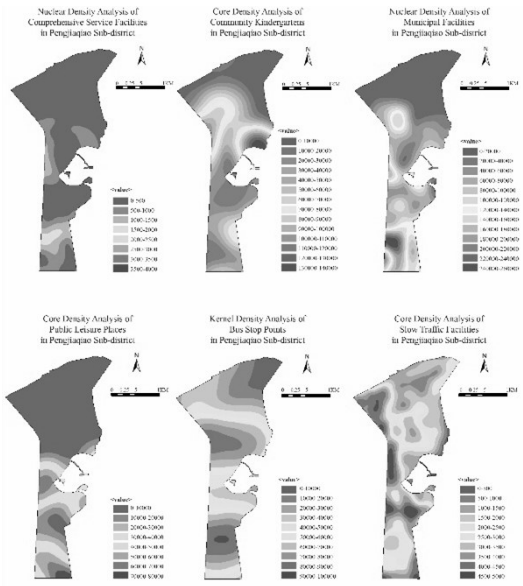


Figure 3: Kernel Density Analysis Diagram
Source: illustrated by the author

Kernel Density Analysis

The density expansion value of facility points in their surrounding neighbourhoods is calculated using kernel density analysis (Yu Wenhao, 2015). The closer the distance between elements, the higher their degree of association. The density expansion value increases as the location approaches the core element. By visualising the spatial form of the point elements, the spatial layout of each facility point within the area can be observed (Figure 3).

Inverse Distance Weighting (IDW) Method

An interpolation method uses the spatial distance between unknown and sample points as weights for weighted averaging (Zeng Jindi, 2019). The closer a sample point is to the unknown point, the higher the weight assigned to it. This paper uses this method to calculate the element coverage of the "Six Essentials"

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indicators, obtain the corresponding indicators, and determine the spatial distribution of elements within the integrated residential community. The total number of facilities evaluation methods is used to assess the coverage of facilities in the central urban area, providing a data basis for subsequent facility location planning (Figure 4).

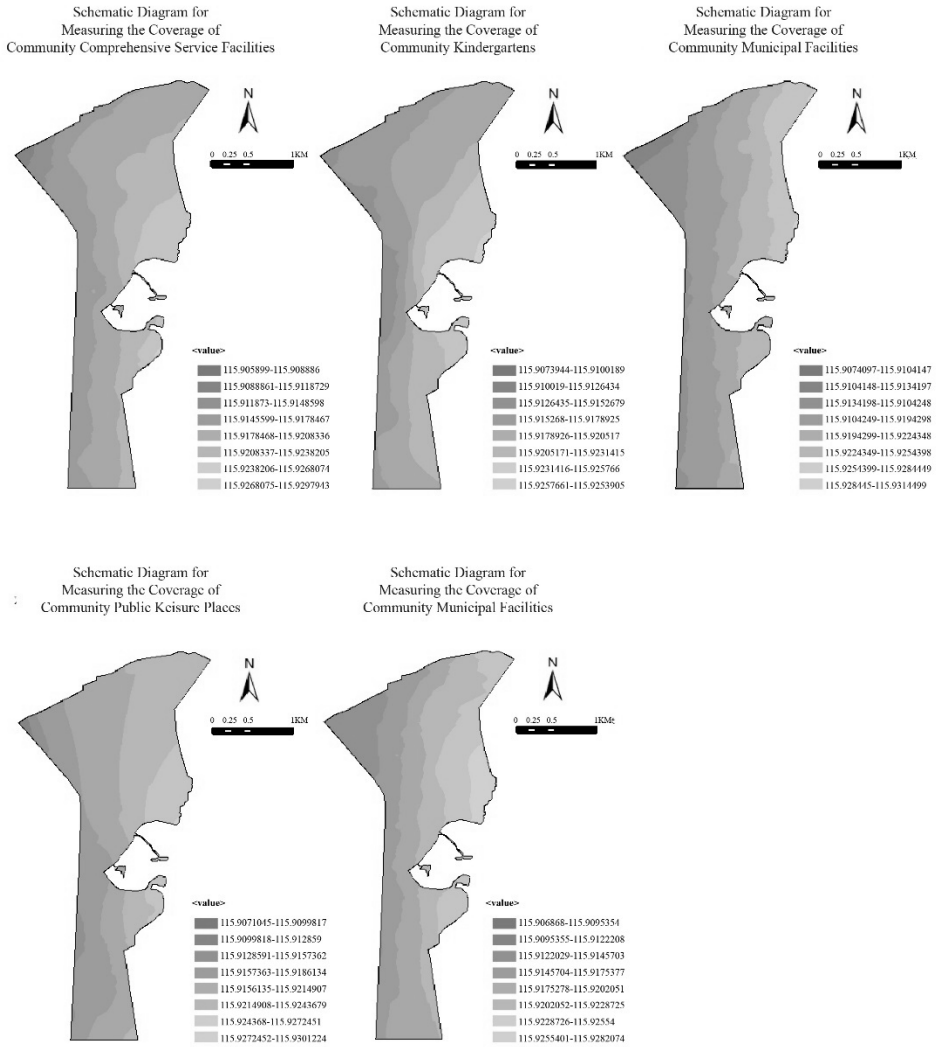


Figure 4: IDW Analysis Diagram
Source: illustrated by the author

Facility Compliance

The spatial coverage and distribution characteristics of the "Six Essentials" indicators for communities in Pengjiaqiao Sub-district are organised into six categories: comprehensive service facilities, kindergartens, municipal facilities, public recreational spaces, bus stops, and slow-traffic systems. A total of 426 points of interest were collected, including 135 comprehensive service facilities, 11 kindergartens, 248 municipal facilities, 9 public recreational spaces, 23 bus stops, and 808 segments of slow-traffic systems (Table 3).

Table 3: Analysis of "Six Essentials " Indicators

Six Essentials	The number within a 5-10 Minute Walking Range	Number of Communities Meeting the Indicator	Community Proportion	Integrated Community Proportion
Comprehensive Service Facilities	110	11	91.6%	0%
Kindergarten	4	4	33.3%	0%
Municipal Facilities	196	12	100%	0%
Public Leisure	7	5	41.6%	0%
Bus Stops	16	10	83.3%	0%
Pedestrian Traffic	2998	12	100%	0%

Source: illustrated by the author

Analysis of the Distribution of "Six Essentials" Facilities

Through a comprehensive evaluation of the “Six Essentials” indicators in the Pengjiaqiao Sub-district community, Nanchang City, it has been found that Integrated Community construction is relatively weak, and no community in Pengjiaqiao Sub-district has yet achieved the “Six Essentials” indicators. Looking at the coverage data of each indicator separately, it is relatively considerable. The configuration of municipal facilities and slow traffic communities meets the indicators, while the configuration of bus stops and comprehensive service facilities is good. However, the configuration of public leisure places and kindergartens is weak; Among them, the coverage of municipal facilities and slow traffic systems within a 5-10 minute walk meets the needs of 12 communities in Pengjiaqiao Sub-district; The distribution of bus stops and comprehensive service facilities is even and reasonable in quantity, but some communities are too large, resulting in some communities having a walking distance of more than 10 minutes from the center to the bus stop. The distribution of public leisure facilities is too concentrated and severely lacking, with a lack of public leisure facilities for residents in the southern and northern parts of the

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region. The existing service radius of public leisure facilities only meets the needs of five communities.

Improvement Strategies

i. Coordinate and Balance, Improve “Hardware” Conditions. Community life circles are the basic units of the entire city, and their everyday operation requires the coordination of community “hardware” and “software” functions. Comprehensive municipal facilities and slow-traffic systems are the main components of the "hardware" in the Pengjiaqiao Sub-district community. In promoting the construction of an Integrated Community in the Pengjiaqiao Sub-district, it is essential to complete municipal infrastructure, coordinate above-ground and underground spaces, supplement parking and charging facilities, and create barrier-free environments (Lim, 2024).
ii. Continuous optimisation of slow-traffic systems is necessary. This includes strengthening the construction of secondary roads and walkways with slow-traffic priority, increasing the density of the slow-traffic road network, and ensuring that the width and spacing of slow-traffic roads meet the needs of pedestrians. Enhancing the accessibility of roads to provide pedestrians with more path choices is also crucial.
iii. Focus on Local Conditions and advocate for Regional Balance. Specific enhancement and renovation strategies should be proposed to address the shortcomings of each community within the Pengjiaqiao Sub-district. The northern area has a basic configuration of bus stops with moderate accessibility. It is necessary to increase the number of bus stops in this area to improve the quality and content of public transportation services. Strengthen comprehensive service facilities, as currently, they are overly concentrated in the southern part, with fewer facilities in the northern communities.
iv. Future community construction should also focus on building mechanisms for residential environmental management and exploring higher-quality residential construction methods. Attention should be given to vulnerable groups to achieve intergenerational coexistence. Based on the actual conditions of different areas, the number of kindergartens and elderly care homes should be increased. Relevant strategies should be proposed to optimise and renovate facilities, activity spaces, and barrier-free facilities, ensuring they meet the full needs of vulnerable groups. Expanding community life circle services should promote resilience by increasing the number, connectivity, and coverage of 5-minute life circles in Integrated Communities.

CONCLUSION

In recent years, Integrated Communities have emerged as a crucial strategy in China's urban renewal efforts. This study examines the characteristics of Integrated Communities and identifies six fundamental elements that comprise them. The GIS-based approach developed for evaluating the Integrated Community represents an established and widely adopted methodology in international urban research. Based on the evaluation index system for Integrated Communities, data analysis was conducted on Pengjiaqiao Sub-district in Nanchang City, Jiangxi Province, and optimisation strategies were proposed:

i. A dual approach to "hardware" and "software" construction. Hardware construction primarily includes the environment, facilities, and municipal infrastructure, while software construction mainly involves urban management, services, and culture.
ii. Identify shortcomings in community construction by comparing ArcGIS software analysis results with Integrated Community construction indicators, effectively pinpointing the deficiencies of the study object.
iii. Provide more comprehensive facilities and services to meet residents' basic needs, focusing on vulnerable groups such as the elderly, children, and the disabled.
iv. With the improvement in living standards, residents have new requirements for the community. Integrated Communities should meet these new demands with facilities and services such as mail and courier services, non-motorised vehicle parking facilities, and electric vehicle charging equipment.
v. Improve community management and safety facilities, establishing a sound community management system.
vi. Establish a GIS-based spatial analysis framework for Integrated Community assessment, providing a replicable, data-driven decision-making model for the international urban planning field and promoting the transition of community renewal from experience-based judgment to evidence-based planning.

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DISCLOSURE STATEMENT

The data for this paper were sourced from Amap POI open data.

ETHICS STATEMENT

This study utilised exclusively publicly available spatial and statistical data, which do not involve personal privacy or ethical risks. All data were processed in accordance with institutional guidelines and the principles of general ethical research.

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REJUVENATING COMMUNITY PARK IN TAMAN LEMBAH BUKIT SUK, SHAH ALAM AND TAMAN PENGKALAN BATU, KLANG

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Abstract

Using a placemaking approach, the paper explores the revitalisation of two (2) Malaysian community parks – Taman Pengkalan Batu (TPBK) in Klang and Taman Lembah Bukit SUK (TLBS) in Shah Alam. Placemaking, a strategy to enhance public spaces, fosters community engagement and collaboration in creating vibrant, functional environments. TPBK suffers from poor maintenance, low community use, and safety issues. The paper aimed to address these by redesigning the park, increasing greenery, and restoring its identity to attract more visitors. Observations and surveys found that the community was dissatisfied with current conditions but supports placemaking improvements. Similarly, TLBS in Shah Alam is well-maintained but lacks appeal compared to other recreational areas. This study identified high visitor satisfaction with the lake and pathways but highlighted the need for better parking facilities and signage. Recommendations include enhancing lake aesthetics, improving pathway accessibility, and upgrading parking and landscaping. Both studies underscore the importance of community involvement in placemaking and call for further research on economic impacts and sustainability. This research gap is crucial, as it can guide future studies and ensure the long-term success of these projects. Further studies could also be carried out through comparison with successful parks to learn from best practices. Implementing these recommendations can transform both parks into vibrant, inclusive spaces that enhance community well-being.

Keywords: Placemaking, Rejuvenation, Community Park, Community Well-being

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INTRODUCTION

Public spaces or parks are crucial to urban social life in meeting human needs and contributing to human satisfaction, encompassing streets, courtyards, and open areas where people can socialise and interact. These spaces enhance the city's liveliness and quality of life, contributing to well-being, political engagement, and crime prevention. They offer physical and emotional health benefits by encouraging activity and fostering a vibrant community. Additionally, placemaking, an ancient practice evolving through the practice of creating culturally rich spaces, is now a modern design strategy to inspire and connect people with nature (Azenan et al., 2021). Effective urban design and creative placemaking strategies improve community engagement and attract visitors, demonstrating the importance of beautiful and functional public spaces in enhancing social interactions and overall well-being.

Research gaps in placemaking and community park rejuvenation often centre around effectiveness, inclusivity, and sustainability, with a limited understanding of effective methods for involving local communities in the placemaking process. The gap also found a lack of comparative studies between different placemaking and park rejuvenation strategies across various contexts. A comparison study helps refine and enhance the effectiveness of rejuvenation efforts. Addressing these research gaps can contribute to more effective, inclusive, and sustainable placemaking and park rejuvenation efforts, ultimately improving the benefits of public spaces for communities.

Therefore, as the paper aims to evaluate community satisfaction in enhancing public spaces' rejuvenation and fostering a more vibrant community, two objectives are outlined: (i) (i) to assess respondents' satisfaction with the community's or visitors' views on the surrounding area and (ii) to make suggestions for improvement using a placemaking approach. The study highlighted the master plans for both community park proposals as a vital outcome of the study. These master plans synthesise the findings from the community satisfaction assessment and placemaking proposals. This helps guide the transformation process and ensures that improvements are well planned and aligned with the community's needs.

LITERATURE REVIEW

What Placemaking is all about

Placemaking focuses on creating vibrant, liveable public spaces that foster community engagement and enhance social connections. Adedayo et al. (2023) define it as actively shaping public spaces to highlight local assets, drive rejuvenation, and address common needs. One significant benefit of placemaking is its ability to foster a sense of community. Ghavampour and Vale (2019) note that placemaking can build identity, encourage social interactions, and strengthen

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community ties. Courage and McKeown (2019) supported the findings that active, engaging public spaces often feel safer and more secure. Additionally, placemaking can benefit communities economically; successful spaces attract businesses and visitors, boosting local property values and economic activities.
There are different approaches to placemaking. The 'bottom-up' approach involves community members designing and developing the space, often leading to more sustainable and successful outcomes. In contrast, the 'top-down' approach relies on professional planners and designers, who can create high-quality spaces but might lack community engagement (Helmy, 2023). By emphasising community engagement, placemaking helps solve social problems, improve well-being, and prevent neglect and safety issues in public spaces. Ultimately, placemaking is a concept and technique that enhances public spaces through active community involvement and thoughtful design.

Placemaking Elements Which Contribute to Community Development and Well-being

The Project for Public Spaces (2021) highlights four (4) critical attributes for successful placemaking. Great locations, whether large city plazas or small parks, share these traits: they are easily accessible and well-integrated with other essential sites, enhance the city's image, encourage community engagement through various programmes, and serve as inviting spaces where people want to meet and return. These elements are interconnected.

Access and Linkages

Highly accessible public spaces attract diverse users and activities, with walkability being key. According to Ortega et al. (2021), four (4) crucial aspects of walkability are desirability, ease, safety, and mobility. Their study highlights how accessible ramps and unobstructed sidewalks affect walking distances and travel times. Hamdan et al. (2017) found that streets with better access to parks and urban amenities are preferred based on their assessment of public space value through pedestrian routes. Meanwhile, Veitch et al. (2021) stress the importance of convenience and connectivity for public spaces. Effective functionality depends on both the presence and accessibility of parks, ensuring all transportation modes can easily reach them. Proximity, connectivity, walkability, and convenience are key to attracting and accommodating the community.

Sense of Place

A place that feels inviting and comfortable is more likely to thrive. Emotional safety, cleanliness, and accessibility are crucial in creating this comfort. Surprisingly, many potentially excellent locations fail due to a lack of comfort. People prefer spaces with various seating options, allowing them to choose sun

or shade depending on the time of day or year. A sense of place encompasses comfort, safety, well-being, and socio-psychological and biophysical characteristics, including sanitation, building conditions, and crime statistics (Mansor et al., 2019 & Chen et al., 2024). Clean, well-organised public areas foster higher engagement, while poorly managed spaces deter community use. Research, including Crime Prevention Through Environmental Design (CPTED), links physical environmental factors to crime rates, and increased vegetation has been shown to reduce crime (Kimpton et al., 2017). Additionally, maintaining heritage buildings' historical and cultural value is essential for preserving their significance while appealing to contemporary audiences (Rossetti et al., 2019).

Uses and Activities

A great public space is built on a foundation of diverse activities, which draw people in and encourage repeat visits. A place will likely be addressed with engaging activities, indicating underlying issues. A well-chosen mix of activities can attract a broad spectrum of the community—children to playgrounds, teenagers to sports courts, and everyone to the evening carnival. The environment heavily influences the quality of social interaction in public spaces. Mao et al. (2020) highlight that the boundary elements of building façades and public spaces significantly affect outdoor engagement. Durante et al. (2018) studied how heritage building facades in smaller public areas influence community activities, noting that many studies focus on materials and structures rather than their social impact. Public spaces like parks and playgrounds are crucial for supporting physical activity and community engagement. Research by Gfelices (2022) emphasises the economic benefits of enhancing sales kiosks or other business activities to boost the local economy in public spaces. Additionally, active recreation spaces like walking paths and sports courts positively impact public space use, with studies showing varying activity preferences among different age and gender groups (Zhang et al., 2023).

Sociability

Placemaking significantly influences sociability, enhancing how individuals engage socially and form relationships. Research indicates that well-designed and maintained public spaces facilitate interactions and social connections. For instance, such spaces in high-density cities like Hong Kong can support active ageing, social inclusion, and overall well-being (Hee et al., 2021). Public areas with pleasant environments and social opportunities help people unwind, ease stress, and build resilience. Elands et al. (2018) and Mohammad Sabri & Ponrahono (2024) note that parks encourage social cohesiveness by motivating outdoor activity, interactions, and public space use. Placemaking creates appealing, functional, and accessible spaces, fostering community building and a

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stronger sense of belonging, leading to a more connected community (Azubuine & Umunnakwe, 2021).

Concept of Rejuvenation

Revitalising or rejuvenating public spaces that no longer connect the community can significantly impact social cohesion and city development. According to Xing and Mohamad (2023), well-designed public spaces enhance movement and foster social interaction, enriching the community and urban environment. Public spaces are crucial for social life, offering venues for diverse groups to gather and engage, making their rejuvenation vital for community well-being. Azubuine and Umunnakwe (2021) emphasise that revitalisation strategies aim to unite intercultural communities.

Effective public space rejuvenation requires attention to various factors. Physical attributes can influence space quality and usage patterns (Mansor et al., 2019). Invaluable locations like royal cities and state capitals, maintaining and improving the landscape is essential for human comfort (Muhamad Farhan et al., 2021). Revitalisation often involves transforming underused areas into functional, accessible, attractive spaces through physical upgrades, programming and community involvement. Studies show that such efforts can enhance space usage and satisfaction (Carmona et al., 2017), and community engagement is vital to addressing local needs (Ingles, 2022). Natural elements can benefit physical and mental health (Southon et al., 2018), while amenities like seating and lighting affect user perceptions (Zhang et al., 2023). Equity and inclusivity are crucial for fair access and benefit (Bekker et al., 2021).

In short, revitalising underused public spaces enhances social cohesion and urban development. Well-designed, accessible spaces encourage interaction, community well-being, and inclusivity. Transforming these areas through upgrades, natural elements, and amenities like seating and lighting increases usage and satisfaction, ensuring fair access and benefits for all community members.

RESEARCH METHODOLOGY

Data Collection and Research Design

This study uses a mixed-method approach, in which site observation and questionnaire surveys were applied to the selected case studies. The site observation method was carried out to assess the condition of existing facilities, accessibility, surroundings, usability, and the quality of each design element in both parks. Additionally, a quantitative approach using a questionnaire survey was employed to gain insights into the community's preferences and perspectives related to this study. These methods allow for a balanced data collection approach, contribute to achieving the study's objectives and offer insights

essential for a good assessment. Convenience sampling was used, focusing on Klang residents (for TPBK), Shah Alam residents (for TLBS) and visitors of each community park, as they were the primary target respondents. The targeted sample size was 99 respondents for TPBK and 379 respondents for TLBS. The difference in the sample size between these two areas was primarily due to contextual factors such as the population size and demographics in each area. TPBK is less densely populated than TLBS, with a higher density of residents and park users.

Due to limitations, the study was able to collect responses from only 271 respondents out of the targeted 379 participants, whereas a 100 per cent response rate was achieved for TPBK. The use of convenience sampling and unequal response rates between the two study areas may limit the representativeness of participants. These factors could affect the balance of comparison and reduce the generalisability of the findings to other urban park contexts. The analysis is expected to reveal respondents' satisfaction levels and gauge the communities' perspectives of the surrounding study area through their suggestions (using a placemaking approach).

A Likert scale of 5 (5: Strongly Agree to 1: Strongly Disagree) was used to assess the responses to the questionnaire survey. Through the observation approach and findings from the questionnaire, master plans for both community park proposals were produced as an outcome of the study. Additionally, for the data analysis, the results of each variable from Section B (satisfaction with community park criteria) and Section C (suggestions for improvement using the placemaking approach) were presented as mean and rank scores.

Study Area

Two (2) community parks were selected for the study. *Taman Pengkalan Batu* (TPBK) was chosen as its location along the Klang River is optimal for serving as a desirable public space for the community. This public space provides a range of amenities and facilities, including fishing platforms, gazebos, playgrounds for children, scenic viewing areas, plazas, walkways and parking areas. TPBK covers approximately 5 acres and is situated in the heart of Klang Royal Town, straddling the boundary between North Klang and South Klang. It provides an ideal setting for recreational activities in line with the Selangor Maritime Gate Development Project.

Meanwhile, *Taman Lembah Bukit SUK* (TLBS), Shah Alam, was selected primarily due to its connectivity to Taman Tasik Shah Alam, its strategic location to the nearest government buildings, and the accessibility of public transportation. Developed as a self-contained neighbourhood, TLBS was established by the State of Selangor in 1978, following Shah Alam's designation as the new state capital. The park is accessible via *Jalan Pegawai* and near key

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government institutions, including MAIS, the *Kompleks Mahkamah*, the *Bangunan Sultan Salahuddin Abdul Aziz Shah*, royal tombs, and the State Monument. TLBS spans 72 acres and was designed to meet the recreational needs of residents from nearby Sections 5, 6, 9, and 11 while also serving as a valuable community gathering space beyond merely fulfilling housing scheme development requirements (Figure 1).

The community parks were chosen based on their context and relevance to urban development. Both are located within Klang Valley, one of Malaysia's most urbanised and rapidly developing regions. These areas are undergoing significant socio-economic and infrastructural changes, which makes them ideal for the study.

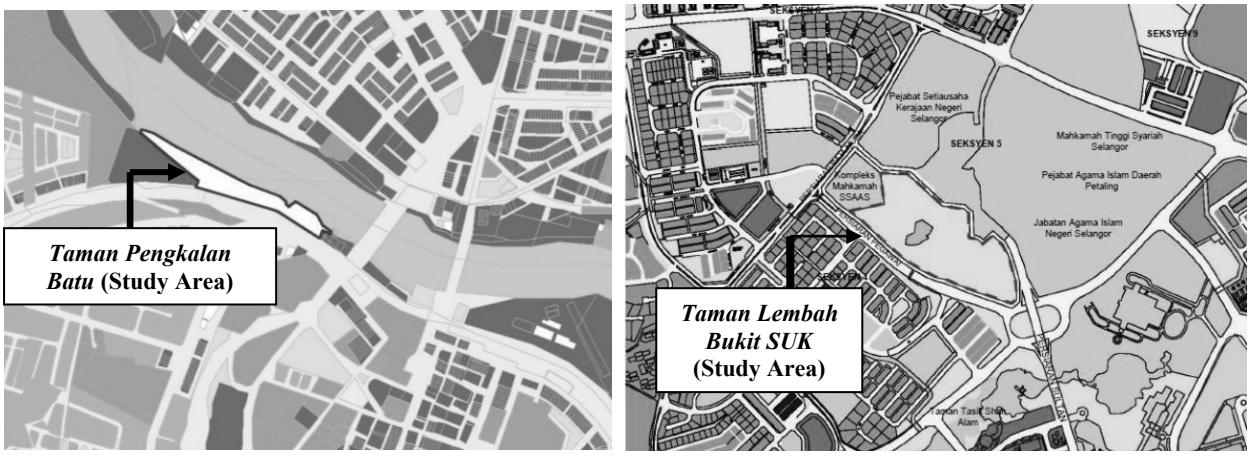


Figure 1: Study Area of Taman Pengkalan Batu, Klang (TPBK), and Taman Lembah Bukit SUK, Shah Alam (TLBS)
***Source**: ArcGIS (2021, 2023)*

ANALYSIS AND DISCUSSION

To foster community engagement, the study surveyed the targeted respondents to gather their suggestions and feedback on improving the parks. Table 1 shows the survey results from Section B, highlighting the respondents' satisfaction with community park criteria in both areas. From Table 1, the analysis highlights TLBS as possessing more comprehensive facilities, superior urban design, and more vibrant social activities. In contrast, TPBK has strengths in specific areas, such as supporting facilities and nearby attractions. Concerning recreational facilities (R), TLBS scores higher (with a mean of 3.81) but ranks lower (rank 4) compared to TPBK for item R1. This indicates that TPBK is perceived as having better supporting facilities, even though TLBS scores higher on average. Other items, such as R2 and R3, were ranked 5, 6 and 9. Regarding R2, both locations are ranked equally, suggesting that neither TLBS nor TPBK stands out regarding

safety, comfort, or maintenance of facilities. Meanwhile, for item R3, TLBS scores higher, with a mean of 3.68 in parking lot facilities, but TPBK ranks better. This suggests that TLBS has better facilities, but TPBK is perceived as providing better parking access or a better location.

Concerning Urban Design and Landscape Elements (UD), the respondents in TPBK ranked items UD1 and UD5 as the second most essential items in the area, with a mean of 2.95. This suggested that TPBK has better designed or more accessible pathways than TLBS. As for UD5, it was suggested that TPBK's park design has a better impact on the city's image and identity than TLBS's. Regarding UD2, TLBS excels in maintaining water features or lakes (with a mean of 3.90) compared to Sungai Klang near TPBK (with a mean of 2.77), indicating better upkeep and management of natural elements. Regarding UD4, TLBS has a higher mean score but ranks lower (ranked 9), suggesting that TPBK's landscape condition is better perceived despite a lower score. Also, TPBK is perceived to offer better street furniture provision, though TLBS scores better overall.

Table 1: Satisfaction with the Community Park Criteria

Recreational Facilities (R)				
Items	TLBS		TPBK	
	Mean	Rank	Mean	Rank
R1: Well-functioning supporting facilities provided	3.81	4	2.96	1
R2: Safe, comfortable and well-maintained facilities provided	3.78	5	2.82	5
R3: Parking lot facilities were provided.	3.68	9	2.77	6
Urban Design and Landscape Elements (UD)				
UD1: Good accessibility of pathways	3.77	6	2.95	2
UD2: The lake/river was well-maintained.	3.90	2	2.77	6
UD3: Street furniture was well-provided.	3.75	7	2.82	5
UD4: Good and well-maintained landscape condition	3.68	9	2.86	4
UD5: A good park design contributes to a better image and identity of a city.	3.74	8	2.95	2
Location (L)				
L1: Good accessibility to the park	3.85	3	2.88	3
L2: Visibility of the park from a distance	3.77	6	2.82	5
L3: Attraction places nearby, i.e., Masjid, Monument, River, Fountain	3.65	10	2.88	3
Social Activities (SA)				
SA1: High probability of forming social interaction	3.92	1	2.86	4
SA2: Public space full of activities	3.58	11	2.77	6
	N=271		**N**=99	

Note: Mean: 5.00 – 4.00 (Strongly Agreed), 3.99 – 3.00 (Agreed), 2.99 – 2.00 (Moderate), 1.99 – 1.00 (Disagreed), 0.99 – 0 (Strongly Disagree)

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Regarding location (L), the respondents for TPBK ranked L1 and L3 as the third most satisfactory elements, with a mean score of 2.88. Similarly, both locations score well for accessibility (L1), implying they are easier to reach. As for item L3, TPBK ranks higher for attractive places nearby, indicating a more appealing or exciting surrounding area than TLBS. Meanwhile, for item L2, TPBK has better visibility compared to TLBS, suggesting it is easier to see or locate from afar. Meanwhile, for Social Activities (SA), respondents for TLBS ranked item SA1 as the highest rank, with a mean score of 3.92. The area is seen as much better at facilitating social interactions, whereas TPBK lags significantly behind with a mean score of 2.86, ranking 4. As for item SA2, TLBS scores higher in activity levels in public spaces, indicating more vibrant or engaging public areas than TPBK.

To summarise, TLBS generally scores higher in most categories, particularly in maintaining recreational facilities, urban design and social activities. Meanwhile, TPBK excels in specific areas like the provision of supporting facilities and the presence of nearby attractions but generally scores lower in aspects related to facility maintenance and social interaction. Table 2 shows the recommendations for enhancing public places in TLBS and TPBK. The result shows three (3) elements of the placemaking approach: 1) Access and Linkages (A), 2) Sense of Place (S), and 3) Uses, Activity and Sociability (U).

Table 2: Recommendations for Enhancing Public Places through the Placemaking Approach

Access and Linkages (A)				
Items	TLBS		TPBK	
	Mean	Rank	Mean	Rank
A1: Encourage pedestrian- and bike-friendly facilities.	3.75	2	4.64	1
A2: Safe path and routes	3.77	1	4.64	1
A3: Increase lighting on pedestrian and bicycle lanes.	3.74	3	4.62	2
A4: Easy access, reasonable distance, clear signage	3.77	1	4.60	3
Sense of Place (S)				
S1: Combination of royal town concept and modern concept (*applicable for TPBK)	-	-	4.69	1
S1: Combination of the administrative and modern concept (*applicable for TLBS)	3.90	1	-	-
S2: Planting trees and shrubs to lower temperature and appreciate nature	3.69	5	4.61	2
S3: Additional new activities	3.85	2	4.59	3
S4: Increase monitoring/maintenance	3.77	3	4.55	4
S5: Setting the speed limit for motorised vehicles	3.75	4	4.53	5
Uses, Activity and Sociability (U)				
U1: Provide covered spaces to enjoy community activities.	3.79	1	4.69	1

Access and Linkages (A)				
Items	TLBS		TPBK	
	Mean	Rank	Mean	Rank
U2: Provide space and facilities for recreational activities (jogging, cycling, active sports).	3.75	2	4.67	2
U3: Prepare monthly carnival	3.60	3	4.65	3
U4: Improve or provide kiosks	3.57	4	4.57	4
	N = 271		**N**=99	

Note: Mean: 5.00 – 4.00 (Strongly Agreed), 3.99 – 3.00 (Agreed), 2.99 – 2.00 (Moderate), 1.99 – 1.00 (Disagreed), 0.99 – 0 (Strongly Disagree)

Regarding Access and Linkages (A), the results show that item A2 ranked 1 for both study areas (TLBS with a mean of 3.77 and TPBK with 4.64). Both locations place equal importance on safety, with TPBK slightly outperforming TLBS. This suggests that both locations prioritise safety equally, but TPBK may have implemented more effective measures. In addition, item A4 was ranked 1 for TLBS with a mean score of 3.77, suggesting better overall accessibility than TPBK.

Meanwhile, TPBK ranks highest in item A1, indicating a stronger emphasis or better implementation of pedestrian and bike-friendly infrastructure than TLBS. Regarding item A3, TPBK, with a mean of 4.62, has a higher rating, indicating better lighting for pedestrian and bicycle lanes than TLBS. Concerning Sense of Place (S), item S1 ranked the highest in both study areas, with a mean score of 3.90 for TLBS and 4.69 for TPBK. TPBK rates higher in integrating royal and modern concepts, while TLBS excels in combining administrative and modern concepts, indicating a strong sense of place tailored to each location's identity. Meanwhile, for item S3, both locations value new activities, but TPBK, with a mean score of 4.59, ranks slightly lower, indicating a minor difference in how each location addresses this aspect. TPBK ranked 2 for item S2, suggesting better greening and environmental enhancement efforts than TLBS. Also, TPBK has a higher mean (4.55 with a total ranking score of 4) for monitoring and maintenance, suggesting more effective or frequent maintenance than TLBS.

Regarding Uses, Activity, and Sociability (U), both locations had item U1 ranked first, 2 for item U2, 3 for item U3, and 4 for item U4. Specifically, for U1, both locations ranked highest (TPBK with a mean of 4.69 and TLBS with a mean of 3.79) in providing covered spaces for community activities, indicating that both place significant importance on creating sheltered areas for social and community events. Meanwhile, both locations also prioritise providing space and facilities for various recreational activities, though TPBK slightly outperforms TLBS with a mean of 4.67 and 3.75, respectively. This suggests that TPBK might have better or more diverse recreational facilities. Also, both locations have similar rankings for preparing monthly carnivals, with TPBK again scoring

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higher (a mean of 4.65). This indicates that TPBK may have more frequent or better-organised community events that create social interaction.

In summary, TPBK generally scores higher in most aspects of pedestrian and bike-friendly infrastructure, lighting, planting, and overall sense of place. Meanwhile, TLBS performs better in access, new activities, and speed limit settings. Both locations exhibit strengths and areas for improvement, with TPBK excelling in design and environmental enhancements, while TLBS shows more robust performance in accessibility and speed regulations. Also, TPBK consistently scores higher across all categories related to uses, activities and sociability, which indicates the area offers better facilities and organisation for community activities, recreational use and events. However, both locations show a commitment to enhancing community-orientated features.

As the outcome of the study, Figures 2 and 3 show the master plan of the proposals for TLBS and TPBK. Based on Figure 2, the TLBS master plan comprises four (4) strategic proposals aimed at preserving and enhancing the area's existing features. Firstly, maintain the lake's aesthetic appeal (**P1**). This proposal focuses on preserving and enhancing the visual attractiveness of the lake. It may include improving the water quality, shoreline beautification, and landscaping maintenance to ensure the lake remains a focal point of natural beauty. Secondly, pathway accessibility should be enhanced (**P2**). To improve connectivity and ease of movement, this proposal aims to enhance the accessibility of pathways around the area. This might involve upgrading existing pathways, ensuring they are well-maintained and accessible to people of all abilities. Also, maintaining and enhancing existing surroundings and greenery (**P3**) is focused on preserving and improving the existing green spaces and natural surroundings. Lastly, parking facilities should be enhanced (**P4**). This proposal aims to upgrade existing parking facilities by expanding the areas and improving signage and overall usability to better accommodate visitors.

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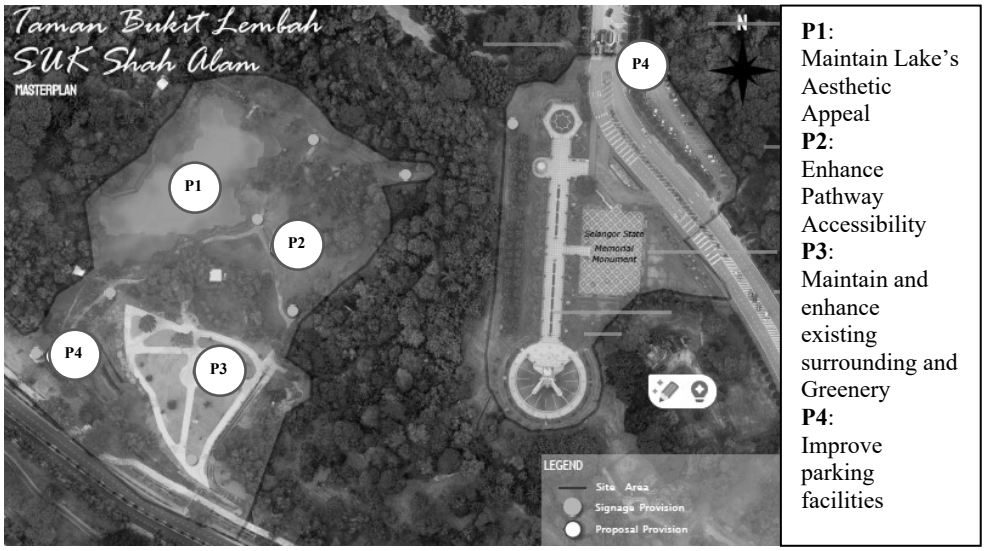


Figure 2: Master Plan for TLBS's Proposal

Meanwhile, the TPBK Master Plan encompasses six (6) proposals designed to enhance the area's functionality, aesthetics, and recreational opportunities. These proposals include new riverfront activities (**P1**), which aim to develop and introduce new activities along the riverfront, enhancing its appeal as a vibrant social and recreational hub. This could include waterfront events, boating, or outdoor performances to attract visitors and foster community engagement. Also, new soft- and hardscape additions (**P2**) could focus on integrating new landscaping elements and durable hardscaping features. This includes new planting, green space (softscape), and enhancement of paving and seating (hardscape). Meanwhile, the beautification of the area (**P3**) aims to enhance its aesthetic appeal, which includes street art and decorative lighting. New commercial activities (**P4**) seek to stimulate local economic growth by introducing new commercial ventures such as cafes and shops. Additionally, pedestrian and bicycle path improvement (**P5**) should focus on upgrading the existing paths for pedestrians and cyclists to ensure safer, more accessible and enjoyable routes. Lastly, new sports and recreational activities **(P6)** are proposed to cater to a broad range of interests, which involve the construction of new sports courts or fitness stations to promote active lifestyles in the community.

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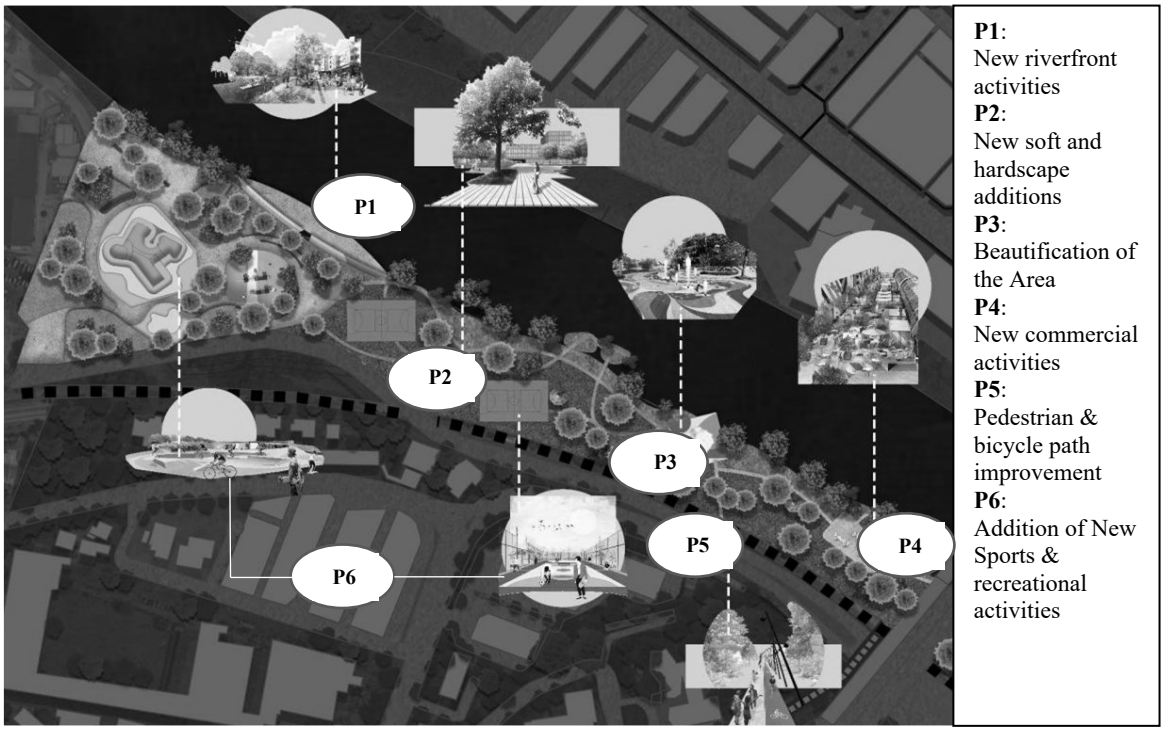


Figure 3: Master Plan for TPBK's Proposal

CONCLUSION

This study was able to compare and highlight the different strengths of TLBS and TPBK and can guide targeted improvements based on each location's specific needs and goals. The TPBK proposal is characterised by a broad range of new initiatives, focusing on enhancing various aspects of the area, from recreational activities to commercial ventures. Its approach is to rejuvenate and diversify the area to attract more visitors and to improve community interaction. In contrast, the TLBS plan emphasises maintaining and enhancing existing features, preserving the lake's appeal and improving accessibility and functionality.

Based on the study's aims and findings, it can be concluded that the suggestions, recommendations, and proposals reflect the different priorities of the study areas. TPBK aims at dynamic growth and modernisation, while TLBS focuses on conservation and incremental improvements. Each approach is tailored to the unique needs and characteristics of the respective study areas. The analysis concludes that modifying public spaces' design and improving the availability of supporting facilities could be crucial in enhancing how communities use their leisure time. By implementing thoughtful changes in these areas, the community in both study areas could experience more fulfilling and

enjoyable recreational activities. The adjustments in the design of these public spaces may serve as a key factor in fostering greater community engagement and satisfaction.

Placemaking and rejuvenating public spaces or community parks are significant and expanding research areas with numerous opportunities for further study. Several promising directions for future research exist in this field. Firstly, it is essential to assess the economic impacts of placemaking; secondly, future studies should investigate the long-term sustainability of placemaking projects, focusing on maintenance, community involvement, and the potential for replicating successful initiatives in other areas. Future studies should explore practical methods for incorporating placemaking into urban planning to ensure that public spaces and community parks meet the community's needs and are managed sustainably. The rejuvenation of community parks highlights Malaysia's placemaking approach by combining government-led initiatives, community engagement, and multicultural inclusivity. It localises global placemaking ideas by showing how revitalised urban spaces can strengthen social connection, identity and well-being within Malaysia's diverse and policy-driven urban context.

ACKNOWLEDGEMENT

The study complied with all relevant ethical research guidelines involving human survey respondents. Each participant provided their informed consent, and participation was voluntary. The respondents were kept anonymous, ethical procedures were adhered to, and UiTM REC was followed.

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THE INFLUENCE OF URBAN SPATIAL CONFIGURATION AND PHYSICAL ENVIRONMENT OF STREET SPACE ON PEDESTRIAN BEHAVIOUR, CASE STUDY: SHAH ALAM (SACC WALK) AND KUALA LUMPUR (KASTURI WALK)

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Abstract

The global phenomenon of climate change has urged countries to take action and measures toward a more sustainable and green approach. Malaysia is one of the countries that is now slowly making its steps towards more sustainable development with a greener approach. Encouraging active transportation and providing a sufficient pedestrian environment can help reduce dependency on vehicles, further improving the environment in a sustainable manner. This research intends to study pedestrian behaviour in two different cities, Shah Alam and Kuala Lumpur, focusing on a smaller context of streets. The objectives of this study are, firstly, to study the correlation between urban spatial configuration and pedestrian behaviour. Secondly, to study the relationship between physical attributes of street space and pedestrian behaviour. Thirdly, to propose recommendations that encourage foot mobility in the research area. This research employed a mixed-method approach. The quantitative data is presented using the global (Rn) and local integration (R3) values using axial line analysis, whereas the qualitative data is used to collect Social variables represented as Necessary, Optional and Resultant (N, O, R) for pedestrian behaviour and Social-Physical variables represented as Street Element, Building Element and Landuse Element (SE, BE, LE) for physical environment. The results are then presented using descriptive analysis and behavioural mapping from direct observation based on these variables. The main findings of this research paper conclude three main findings. First, the analysis of spatial configuration using the axial lines map showed that the R3 value is higher for Kasturi Walk, predicting it as a highly accessible street to pedestrians. Second, the spatial configuration and pedestrians do have a highly significant correlation with a p-value of 0.003. Third, SE, BE, and LE are the main factors that drive the behaviour of static and dynamic pedestrian activities. As a conclusion, this study uncovered the factors influencing pedestrian behaviour in Shah Alam and Kuala Lumpur. It is fundamental that further research needs to be done with a larger sample size with more streets to establish a stronger understanding and importance of this study. This study is useful for local authorities and policymakers to improve placemaking strategies and urban design as well as establish more pedestrianised streets.

Keywords: Pedestrian Behaviour, Foot Mobility, Carbon Footprint, Placemaking, Sustainable Development Goals

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INTRODUCTION

Streets are often used for placemaking due to their role as key spaces for human movement. When used this way, they become hubs of social activity, reflected in everyday actions like strolling, talking, and observing urban life (Zaidin, 2016). However, increasing urbanisation has shifted the use of streets toward vehicle traffic, raising carbon emissions, intensifying the urban heat island effect, and lowering urban quality of life. To counter this, placemaking strategies that support pedestrianised streets should be implemented to reduce car dependency and promote active transport, helping mitigate climate change impacts.

Ideally, well-connected urban streets with adequate facilities should support comfortable pedestrian use. Yet, this is not the case with SACC Walk in Shah Alam. Unlike Kasturi Walk in Kuala Lumpur, which thrives socially, SACC Walk lacks vibrancy despite having elevated walkways, good connectivity to commercial and recreational areas, and sufficient amenities provided by Shah Alam City Council (MBSA). The low pedestrian presence and limited activity raise questions about spatial factors influencing pedestrian behaviour. This study aims to explore these factors by comparing streets based on urban mobility, pedestrian flow, and connectivity.

The paper investigates how urban spatial configuration and physical street environments affect pedestrian behaviour in Kasturi Walk and SACC Walk. Its objectives are: (i) to examine the link between spatial configuration and pedestrian behaviour, (ii) to explore how the physical street environment affects behaviour, and (iii) to propose strategies that encourage walking. The findings will support recommendations for better pedestrian-friendly streets as well as contributes to the current knowledge on pedestrian behaviour and urban spatial configurations especially in the case of cities in Malaysian context which remained underexplored. The findings from this research further offers evidence-based insights for urban design and planning practice through an in-depth apprehension between the convergence of spatial and behavioural dimensions in designing pedestrian-oriented urban environments.

LITERATURE REVIEW

Physical Environment and Pedestrian Behaviour

The physical environment shapes urban form and spatial configuration through the interaction of natural features, built structures, and spatial organisation, affecting a city's function and appearance. According to Gerike, R. et. al. (2021) the built environment can be categorized as three key elements: (1) destinations and land use, (2) street scape, and (3) aesthetics and social aspects. These attributes influence pedestrian behaviour and its relationship with spatial configuration which can promote static activities that enhance social interaction and sensory experiences.

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Pedestrian behaviour involves decisions and actions between two points (Yıldırım, 2023), and is categorised as static (e.g., sitting, eating, observing) or dynamic (e.g., walking, transporting goods) (Gehl, 2011; Sulaiman, 2019). Research shows that urban form and spatial layout significantly shape these behaviours (Yıldırım & Çelik, 2022). Streets should therefore be designed to support walking and ensure safety and comfort, encouraging both static and dynamic activities that foster social interaction and street vibrancy.

As vital urban spaces, streets support sociocultural life and should reflect a strong connection between physical and spatial design. Well-designed streets enhance identity, pedestrian perception, and aesthetic appeal. Pedestrian linkages, connecting various spaces such as subway stations and attractions are essential for walkability, supporting local businesses and boosting tourism (Liu, W., Yan, J., Sun, X., & Song, R., 2025) as well as integrating public transport. Tashakor (2018) identified that successful pedestrian linkages are driven by physical features that reduce disparity, promote diverse uses, visual appeal, permeability, and pedestrian-based functions. These attract people, create vibrant spaces, and foster a sense of safety and community, encouraging greater use of street spaces.

Linking Places and People

Today, street spaces are seen as shared areas that connect communities and locations within a city by promoting social interaction, mobility, and a sense of belonging (Sulaiman, 2019). Urban design and planning play a key role in linking people and places, creating environments that encourage connection and engagement.

Successful streetscapes require careful planning, especially in terms of spatial configuration, which is essential for connecting different parts of the city (Mahdzar, 2013). Well-connected streets enable smooth travel between neighbourhoods, commercial areas, parks, and public spaces (Karimi, 2012). Streets should also support pedestrians, cyclists, and public transit users for greater accessibility.

Another key factor is mixed-use development, which strengthens connections between places and boosts community interaction. Studies show that diverse land uses along streets promote walking and social activity (Seong, 2021). Higher land use mix—characterised by services, shops, and amenities—creates a more walkable and engaging environment (Roozkhosh, 2022).

Applying Space Syntax as an Analytical Approach in Planning Pedestrian Streets

The process of urban design can be enhanced through space syntax, an analytical tool that views space as a system of patterns and configurations influencing the

efficiency of urban spatial networks. It explores how the physical layout of a place affects social behaviour, walking, and interaction (Askarizad & Garau, 2024). The arrangement of buildings and spaces plays a major role in forecasting pedestrian behaviour (Roozkhosh, 2022).

Spatial configuration variables in space syntax, known as syntactical variables, are key determinants of pedestrian movement (Yıldırım, 2023). These include integration, selection, connectivity, control, and depth (Roozkhosh, 2022). Local integration (R3) and global integration (Rn) are used to measure how connected a street is—R3 for pedestrian pathways and Rn for vehicular routes (Khalid, 2020). This is part of "natural movement," where human activity patterns reflect spatial configurations (Koohsari, 2019). Streets with high R3 are more pedestrian-friendly, while high Rn and R3 indicate potential for pedestrianisation (Khalid, 2020).

This analysis helps evaluate how urban layouts, including land use and roads, impact pedestrian behaviour at both global and local scales. Axial line maps, showing connectivity and integration values, are used to predict pedestrian movement and activity intensity by linking R3 with behavioural data.

In addition to space syntax, social and socio-physical variables provide further insight into pedestrian behaviour (Mahdzar, 2013). Social variables include Necessary (N): everyday walking tasks; Optional (O): voluntary leisure activities; and Resultant (R): spontaneous social interactions. On the other hand, socio-physical variables include land use (LE), street elements (SE), and building elements (BE). These are validated through observation, interviews, and cross-check analysis to understand how physical environments shape street activity.

Studies show cultural differences affect street behaviour. Factors supporting activity in Western contexts may not apply in Malaysia. Thus, this study examines how Malaysian street characteristics relate to user behaviour to identify features that support vibrant, user-friendly streets.

RESEARCH METHODOLOGY

This paper intends to employ a mixed-method approach to explore the relationship between the built environment and pedestrians' social behaviour using both quantitative and qualitative approaches.

Research Area

The study area consists of two streets from different cities, selected based on several key criteria. According to previous research, streets in urban areas surrounded by commercial activities are ideal for observing pedestrian behaviour, as they attract higher foot traffic and diverse activities (Mehta, 2006). Well-connected linkages are also crucial for spatial configuration and pedestrian.

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Additionally, the streets must hold commercial, heritage, and cultural value (Mehta, 2006). Kasturi Walk in Kuala Lumpur is a vibrant cultural attraction with street designs that reflect Malaysia's heritage. SACC Walk in Shah Alam embodies cultural value through artistic expression, featuring bicycle lanes, elevated walkways, colourful pavements, and decorative elements like murals and planting boxes.

Despite similar characteristics, SACC Walk lacks the social vibrancy seen in Kasturi Walk. Pedestrian presence and activity are noticeably lower, even with good connectivity and design. This highlights the study's purpose: to explore how spatial configurations influence pedestrian behaviour. The streets were chosen with consideration for urban mobility, pedestrian movement, and their connectivity.

Sampling Strategy and Data Validation

To establish the representation of spatial, functional and social characteristics in the street segments, a purposive sampling strategy is conducted to distinguish specific observation zones within the two study areas. The sample size for pedestrian observations is determined based on preliminary counts to present ample statistics and accuracy across temporal variations.

The reliability of the study findings is established through data collection which occurred on both weekdays and weekends during three specific time intervals which are during the morning, afternoon and evening. Possible bias such as subjective interpretation, time variation, environmental factors are mitigated through standard observation procedures and constant recording procedures. Furthermore, to establish consistency and accuracy in behavioural profiling, photographic and video documentation were conducted to support the validation of observed activities. These recordings were used solely for analytical verification without capturing or storing any identifiable personal information. Ethical considerations were addressed in line with standard research protocols, ensuring the participants' anonymity during the data collection and analysis. These approaches help to improve the methodology of this study and the credibility of the study findings.

Types and Methods of Analysis

There are three methods of analysis involved in this study, which are analysis of spatial configuration using axial line analysis, chi-square analysis to describe the correlation between variables, and analysis of physical attributes based on observation. Table 1 below describes the method of analysis.

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Table 1: Summary of types of analyses and related details

Type of Analysis	Method of Analysis	Variables	Concept Theory and Hypothesis
1. Analysis of spatial configuration	Axial line analysis using space syntax	1. Urban spatial configuration: - Global (Rn) - Local (R3) 2. Pedestrian behaviour: - Connectivity	- To study the correlation between urban spatial configuration and pedestrian behaviour. - The higher integration of global (Rn) value means the streets are catered towards vehicles. Higher integration of local (R3) value means the streets are catered towards pedestrians. An equally high number of both integration values means the streets are still used by vehicles but have the potential to be pedestrianised streets.
2. Descriptive analysis	Chi-square test using SPSS	1. Independent variable: local integration level of the streets (R3) 2. Dependent variable: pedestrian behaviour engaging in static activities	- To study the significance of the correlation between local integration and pedestrian behaviour - The higher the local integration (R3) value, the more static activities are present, and the more pedestrianised the street is. - This analysis will determine whether these two variables are independent or dependent on each other and how significant the correlation between these two variables is.
3. Analysis of physical attributes	Observation	1. Social-physical variable (V2): land-use element (LE), street element (SE), building element (BE) 2. Social variable: - Necessary (N) – these activities	- To study the relationship between the physical environment of street space and pedestrians' static behaviour. - The presence and availability of physical attributes in a street space

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Type of Analysis	Method of Analysis	Variables	Concept Theory and Hypothesis
		extend from people's use of space via walking, such as doing everyday tasks. - Optional (O) - occurs when there is a desire to participate in these activities at a suitable time, favourable place and weather, such as sitting outside and eating. - Resultant (R) – spontaneous activities emerging when people congregate in a place and socialise, such as talking or greeting. 3. Pedestrian activity depending on day & time: - Weekend & weekdays - Morning: 8 – 10 am - Afternoon: 12 – 2 pm - Evening: 4 – 6 pm	influence a pedestrian's behaviour. - Pedestrians would exhibit optional and resultant static activity that leads to social interaction and liveliness on the street.

ANALYSIS AND DISCUSSION

The results are obtained based on the three types of analysis performed while considering the related variables. Table 2 shows the summary of results based on the three types of analysis performed.

Table 2: Summary of Results based on the three analyses

Analysis	Kasturi Walk	SACC Walk
Analysis 1: Analysis of spatial configuration		
- Global Integration (Rn)	0.777	0.904
- Local Integration (R3)	3.070	1.920
- Connectivity	11.000	4.000
Analysis 2: Chi-square test		
- Local integration level of the streets (R3) - Pedestrian behaviour engaging in static activities	The relation between these variables was significant, X^2 (2, N = 139) = 11.345, p = .003. The R3 value of a street does influence the static activity of pedestrian behaviour. The higher the local integration (R3) value, the more static activities are present, and the more pedestrianised the street is.	
Analysis 3: Analysis of social and physical attributes		
i. Social-physical variable (V2)		
1. Land-use element (LE)	- Adjacent commercials and offices	- Adjacent shopping mall and complex contribute to people just passing by from across the street
2. Street element (SE)	- Decorative street element - Street light with unique features - Provision of vendor to open pop-up booths/stalls	- Decorative elements, such as painted barrels for plants - Casual street light - Provision of a bicycle lane - Provision of a seating wall but obstructed by motorcycle parking
3. Building element (BE)	- Heritage facades and building use (e.g., eateries and souvenir shop) - Provision of an unintentional seating area on a walkway	-
ii. Social variable		
1. Necessary (N)	17.26%	28.05%
2. Optional (O)	15.82%	5.03%
3. Resultant (R)	17.26%	16.54%

Source: Author's Findings

Analysis 1 using the axial lines map shows that SACC Walk has a higher Rn (global integration) value, indicating the area is more vehicle-oriented. This is expected, as the adjacent street in Shah Alam is a one-way road connecting to Persiaran Dato Menteri, with ample parking. The businesses at SACC Walk

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mostly serve locals with daily needs and services. Public transport is less accessible, with only buses available and the nearest stop about 100 m away at Kompleks PKNS Shah Alam. Figure 1 illustrates the results of Analysis 1 for both streets.

In contrast, Kasturi Walk has a higher R3 (local integration) value, suggesting strong pedestrian accessibility. Its proximity to the MRT Pasar Seni Station (about 100 m away), the adjacent Central Market, and a pedestrian-friendly environment with shaded roofs and amenities attract more visitors. Parking at Central Market also enhances accessibility, especially for less mobile individuals. Figure 2 presents the space syntax results for both streets.

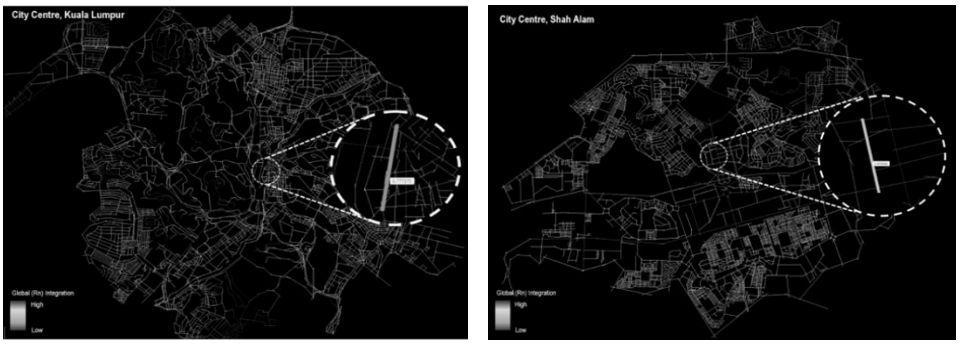


Figure 1: *Map depicting the global integration (Rn) of both study areas for Analysis 1*



Figure 2: *Map depicting the local integration (R3) of both study areas for Analysis 1*

The second analysis, a chi-square test, revealed a highly significant correlation ($p = 0.003$) between spatial configuration and pedestrian behaviour. This confirms that these variables are interdependent, with higher local

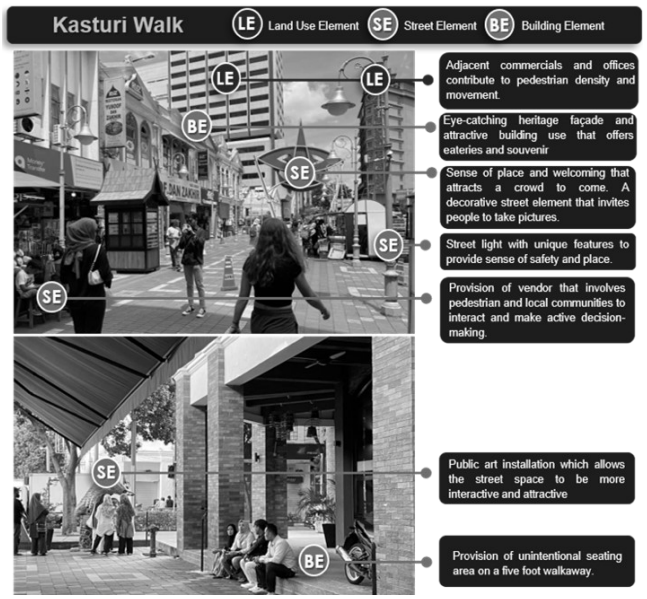


Figure 3: *Surrounding environment of Kasturi Walk*

integration (R3) values associated with increased static activities and greater pedestrianisation.

The third analysis explores key factors influencing static and dynamic pedestrian behaviour. It supports the theory that well-designed physical environments encourage optional and resultant static activities, fostering social interaction and street vibrancy. This analysis compares the social-physical variables (LE, SE, BE) in Kasturi Walk and SACC Walk to assess how physical attributes shape pedestrian behaviour.

Kasturi Walk features interactive physical elements that engage pedestrians' visual and auditory senses (Figure 3). In contrast, SACC Walk offers basic street facilities with minimal sensory appeal, resulting in fewer activities and interactions. Despite having well-designed street elements (Figure 4), SACC Walk struggles to attract pedestrians.

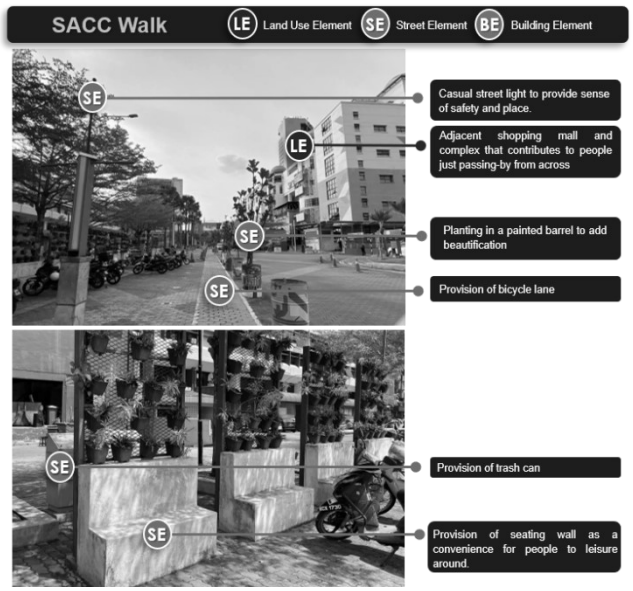


Figure 4: *Surrounding environment of SACC Walk*

Two factors contribute to the fewer pedestrian activities and interactions at SACC Walk: (1) the facilities do not encourage social interaction as

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effectively as commercial activities like street vending, and (2) poor spatial configuration reduces pedestrian use. Furthermore, both streets are in commercial city centres, but their building layouts differ.

Kasturi Walk is densely built, with connected buildings and distinct façades, fostering a seamless pedestrian experience. In contrast, SACC Walk follows a planned layout where roads separate buildings, reflecting its zoning-based urban design. Moreover, the social variables under the third analysis (social-physical variables) will examine the behaviour of pedestrians who perform static activities based on three categories, which are necessary, optional, and resultant.

Table 2 shows that Kasturi Walk has more optional and static activities, reflecting a well-designed urban environment that enhances street vibrancy. In contrast, SACC Walk has a 10.76% higher percentage of necessary activities, suggesting fewer engaging elements and lower pedestrian interaction (Photos 4.9, 5.0). At Kasturi Walk, pedestrians engage in activities like window shopping, sitting, and socializing, enhancing liveliness. This supports the idea that well-planned environments encourage vibrant street life, while less engaging spaces primarily serve functional movement.

Observations reveal that Kasturi Walk attracts more pedestrians with varied activities, whereas SACC Walk sees repetitive behaviours, mostly walking between SACC Mall and PKNS Complex. On weekdays, Kasturi Walk serves office commuters in the morning but shifts to tourism and shopping later. SACC Walk is busiest during lunch hours, with people eating, resting, or smoking, but quiet in the evening. On weekends, Kasturi Walk hosts events like "KL Car Free Day" and market activities, drawing crowds, while SACC Walk remains quiet without similar attractions.

Kasturi Walk exemplifies environmental probabilism, where DBKL's initiatives such as providing seatings, vendor stalls, shaded canopies has successfully encourage pedestrian use. In contrast, SACC Walk's underutilized bicycle paths and playgrounds show that physical attributes alone do not guarantee engagement among the pedestrians.

This further highlight how spatial configuration and physical design elements influence pedestrian social behaviour. Beyond statistical correlations, the results of the study suggest that space syntax measures such as integration and connectivity play a significant role in shaping how people interact within urban spaces. This proves that spatial structure not only reflects but also drives patterns of social activity.

From an urban planning perspective, the findings emphasized the importance for more pedestrian-oriented designs that integrate spatial configuration with physical design interventions. A deeper understanding of the relationships between spatial structure and behavioural patterns could help planners anticipate how shaping street networks or public spaces might influence

social liveliness and urban vitality. Previous research by Sulaiman (2019) showed that pedestrians prefer lively environments over comfortable street conditions. This suggests planning should prioritize pedestrian movement over beautification. Local authorities must create engaging activities such as DBKL's vendor support and weekly events at Central Market which attract crowds. Proximity to public transport also matters, as many visitors use the nearby LRT station.



Figure 5: *Surrounding pedestrian facilities of Kasturi Walk*



Figure 6: *Pedestrian amenities of Kasturi Walk*



Figure 7: *LRT station within 4 minutes walking distance from Kasturi Walk*



Figure 8: *Kasturi Walk fully pedestrianised street with shaded rooftops*



Figure 9: *Surrounding environment of SACC Walk*



Figure 10: *Surrounding environment of SACC Walk*

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CONCLUSION

This study has highlighted the importance of applying the space syntax analytical approach and then integrating it with the evaluation of the physical environment of the built environment when trying to understand pedestrian behaviour and movement.

If these two approaches are integrated and used to study and understand pedestrian movement and behaviour, the authorities involved or decision-makers in creating a holistic approach that does not only take into account technical matters in pedestrian behaviour, such as distance, but also takes into account their psychology, enjoyment, and fulfilment in using foot mobility. Malaysian local authorities or decision-makers can also produce a better outcome of planning for pedestrians by understanding the role of space syntax in the design process as an analysis tool that can help the selection of street selection to be pedestrianised based on the predicted pedestrian movement and behaviour. Meanwhile, the physical environment plays a role in making a street space more attractive and accommodating to pedestrians.

This study has found that urban spatial configuration has a significant correlation with pedestrian behaviour. Where it means that street pattern or spatial layout has a very significant impact on pedestrian behaviour and movement in terms of their choice of path. Meanwhile, the physical environment has an impact on the behaviour exhibited by pedestrians when they are in the street space; for example, are there more dynamic or static activities? What are the physical attribute elements that contribute more to static activities? and so on. By investigating these relationships in Malaysian cities context, this study contributes to existing knowledge related to the interrelation between spatial configuration and pedestrian behaviour which remained underexplored especially in Southeast Asian cities. Moreover, the finding of this study further offers evidence-based insights on how spatial and physical environment influence pedestrian's walking behaviour in Malaysian cities

Based on the analysis and literature reviews, this research has several recommendations to suggest a more practical approach in pedestrianising a street and studying pedestrian behaviour and how to encourage foot mobility. These are applying space syntax as an analytical approach in planning for the pedestrianisation of streets; provision of events and activities that actively involve pedestrians and local communities; provision of pedestrian linkages of urban spaces; stimulation of pedestrians' sensory experience; and provision of good urban mobility.

However, there is a limitation to this study based on the chosen methodology. Space syntax methodology is unable to take into account the perception of the city, which is a critical limitation when estimating or predicting pedestrian behaviour (Filomena, 2019). The perception of the society is a

significant indicator in determining how successful the streets are in the view of the society. Pedestrians' and business owners' perceptions, such as feeling safe, welcoming, and comfortable, should be taken into account in future pedestrian behaviour studies while considering space syntax measures.

In conclusion, this study hopes to shed light on the study of pedestrian behaviour and pedestrianised streets by emphasising a more systematic approach to identifying streets that can be pedestrianised and what initiatives can be taken to enhance the existing pedestrianised streets. In return, this will encourage and promote foot mobility towards achieving the national goal of sustainable development and sustainable city, town, and nation. Eventually, the findings of this study present a specific perspective tailored to the specific Malaysian cities, further extending the theoretical and empirical understanding of this research topic.

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EXPLORING PEDESTRIAN NETWORK CONNECTIVITY THROUGH SPACE SYNTAX

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Abstract

The quality of the pedestrian environment is influenced by factors such as safety, comfort, attractiveness, and accessibility, collectively referred to as walkability. Walkability encompasses both the physical infrastructure and the social and cultural dimensions of walking. This study evaluates pedestrian network connectivity along three primary routes, namely Persiaran Bestari, Jalan Plumbum, and Persiaran Permai, using the space syntax approach with an axial map. The axial map, derived from Open Street Map (OSM) and supplemented with site inventory data, represents spatial connectivity through axial lines that illustrate relationships between spaces within the network. Integrating primary and secondary data facilitated a comprehensive assessment of pedestrian volume and spatial configuration. The findings indicate that Persiaran Bestari records the highest pedestrian volume, attributed to its proximity to schools and residential areas that sustain continuous foot traffic. Axial analysis further demonstrates that Persiaran Bestari and Persiaran Permai possess the highest levels of connectivity, particularly in zones characterised by dense residential and commercial land use. This study highlights the correlation between infrastructure, facilities, and land-use zoning, offering valuable insights for urban planners and policymakers seeking to design walkable cities that prioritise connectivity, accessibility, and social interaction.

Keywords: pedestrian, space syntax, axial analysis, connectivity, pedestrian movement

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INTRODUCTION

Pedestrian network connectivity is a critical element of urban planning, presenting considerable challenges for planners and designers (Lerman et al., 2014; Monokrousou & Giannopoulou, 2016; Jabbari et al., 2018; Nag et al., 2022). Improving pedestrian infrastructure, particularly in urban areas, is essential to mitigate the substantial environmental costs of motorised transport, which remains the primary mode of urban and regional mobility. Accordingly, pedestrian pathways should be designed with spatial continuity, while network properties must determine accessibility and permeability in relation to specific locations and surrounding land use activities (Özbek et al., 2022). These spatial characteristics influence pedestrian movement patterns and behaviour (Monokrousou & Giannopoulou, 2016). Well-designed pedestrian networks not only improve accessibility but also promote healthier lifestyles, reduce carbon emissions, and foster social interaction within residential communities (Litman, 2024; Gehl, 2013).

Building upon this notion, the present study evaluates pedestrian network connectivity using the space syntax approach, which provides a robust framework for interpreting and predicting pedestrian movement through spatial configuration (Nag et al., 2022; Lee et al., 2020). Specifically, this research examines how space syntax, as a spatial analysis tool, can deepen understanding of pedestrian network performance. This section establishes the significance of pedestrian connectivity and the relevance of the space syntax methodology in advancing walkable and sustainable urban planning. The following section details the research methodology, succeeded by an analysis of findings from the designated study area and their wider implications. The final section discusses potential applications and suggests avenues for future research.

This study makes a distinct contribution to the growing body of literature on pedestrian network connectivity by situating the space syntax approach within the Malaysian urban planning framework (Fan et al., 2024). Unlike most international studies centred on dense urban environments in developed contexts, this research offers empirical insights into how local urban morphology, mixed land use, and pedestrian infrastructure influence connectivity and movement patterns in a medium-density Malaysian city such as Shah Alam. These findings advance the understanding of walkability and connectivity within Malaysia's urban design and planning discourse.

Pedestrian behaviour, perceptions, and attitudes

Walking plays a vital role in promoting health, improving societal well-being, and reducing greenhouse gas emissions. The concept of walkability is therefore central to achieving sustainable urban environments (Karwand et al., 2024). Walkability extends beyond the physical act of walking and its health benefits; it also encompasses the "social environment", "perceptions of place", and

"pedestrians' comfort" (Lo, 2009). The notion of walking in cities highlights the importance of providing safe, comfortable, and engaging settings. Pedestrians value attributes such as usefulness, a sense of belonging, and enjoyment – distinct needs that must be addressed to enhance the overall walking experience.

Street walkability reflects how well the built environment accommodates walking. A walkable street prioritises pedestrian safety and comfort, fosters an inviting atmosphere, and reduces the dominance of fast or heavy vehicular traffic.

The proper design and construction of pedestrian environments are therefore crucial to enhancing walkability. By accommodating diverse preferences and behaviours, well-designed streets become more attractive, convenient, healthy, and efficient (Quednau, 2018; Ewing et al., 2016)). Like other forms of human behaviour, walking is influenced by cultural factors, individual circumstances, preferences, and environmental conditions.

Environmental determinants of walking in urban areas include compact urban form, residential density, and land-use mix. Design features such as shading, aesthetic quality, scenic value, and proximity to retail or leisure amenities significantly affect street walkability (Navastara et al., 2018; Mehta, 2008). Behaviour related to street activities reflects individuals' perceptions of the street environment and shapes their engagement with public spaces (Cambra, & Moura, 2020). The concept of street image links the physical identity of a place to how it is perceived through emotions and impressions. These perceptions are formed through a blend of cognition (comprehension or understanding), and cultural interpretation, generating a collective sense of place or spatial personality (Lynch, 1960; Montgomery, 1998).

Attitudes towards walking are similarly shaped by cultural, personal, and environmental factors. Such attitudes, informed by both physical and emotional responses, influence perceptions of pedestrian movement and behaviour. Perceptions of city streets, particularly regarding pleasantness, attractiveness, safety, liveliness, and cleanliness, offer valuable insights into how people experience urban spaces (Papadimitriou et al., 2009). The integration of street characteristics, including morphology and performance, contributes to a distinctive street environment. These attitudes are critical in shaping inclusivity, safety, and attractiveness in public spaces (Fonseca et al., 2022; Tibbalds, 2012).

Integrating Pedestrian Movement and Space Syntax

As cities adopt low-carbon initiatives, non-motorised transport planning has gained prominence, with an increasing emphasis on walkability. Walking has become a central concept and priority among urban planners (Rashid et al., 2024; Sharmin & Kamruzzaman,2017; Monokrousou & Giannopoulou, 2016). Such efforts not only revitalise urban centres but also help alleviate automobile congestion and reduce dependence on fossil fuels (Lerman et al., 2013).

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Consequently, contemporary transport planning prioritises the development of pedestrian-friendly cities. Establishing a high-quality pedestrian environment is vital for optimising pedestrian flow, while identifying the spatial characteristics and distribution of neighbourhood pedestrian networks is key to encouraging greater walking activity. Furthermore, predicting pedestrian movement within urban areas can significantly influence transformations in the urban fabric and spatial configuration (Iliyasu, Abdullah, & Marzbali,2023).

Space syntax, introduced by Hillier (1996), offers a robust analytical framework for understanding how spatial configuration shapes pedestrian movement. Using axial maps, it is possible to evaluate connectivity and movement patterns in relation to human activity, pedestrian flow, and land use (Özbek et al., 2022; Lee et al., 2020; Khalid, Othman, & Marzukhi, 2020). This method supports the analysis of pedestrian behaviour and guides investment in enhancing the quality of walking environments. For instance, Özbek et al. (2022) used space syntax analysis to examine how urban grid configurations affect pedestrian movement, while Yıldırım and Çelik (2023) employed behavioural mapping to correlate pedestrian density with space syntax simulation outcomes (Rashid et al.,2024).

Integrating pedestrian perceptions, behaviour, and environmental factors strengthens both the physical and functional connectivity of urban spaces. Such integration enhances walkability and enables planners to leverage the potential of space syntax to bridge the gap between spatial design and pedestrian experience, ultimately contributing to more walkable and sustainable cities (Fan et al., 2024; Mona et al., 2017).

RESEARCH METHODOLOGY

Study area

This study focuses on three primary routes – Persiaran Bestari, Jalan Plumbum, and Persiaran Permai – located in Seksyen 7, Shah Alam, under the jurisdiction of the Shah Alam City Council. These routes were selected for their diverse land uses, encompassing residential, commercial, institutional, and recreational zones that generate varied pedestrian needs and movement patterns. The area experiences moderate pedestrian activity but is constrained by limited functional walking infrastructure. This context provides an ideal setting for assessing pedestrian network connectivity and examining how infrastructure design influences pedestrian volume and spatial connectivity within mixed-use urban environments.

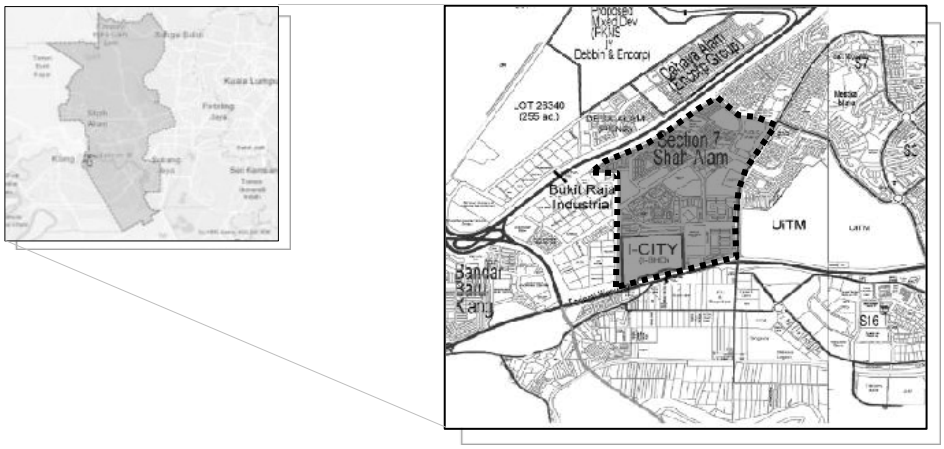


Figure 1: Location of study area

Materials and Method

This study employed a site inventory and GIS-based spatial databases to assess pedestrian connectivity. These tools facilitated the identification of existing conditions in the study area and provided insights into how pedestrians navigate within the neighbourhood context.

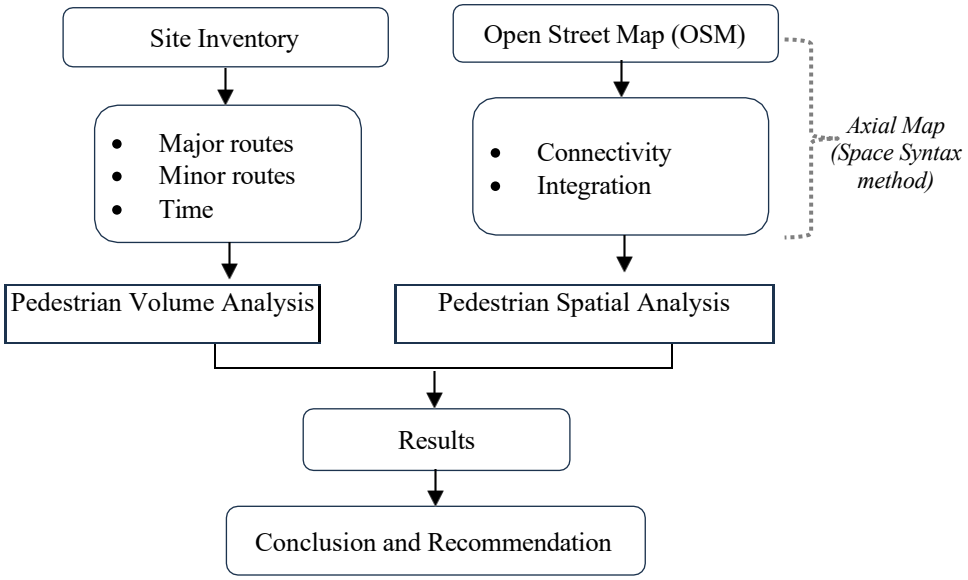


Figure 2: Flowchart of methodology for this study

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a. Site Inventory

The site inventory guided the selection of pedestrian routes and the assessment of pedestrian infrastructure performance. Manual pedestrian counts were conducted to evaluate how effectively the infrastructure accommodates varying pedestrian volumes. Observers were strategically positioned along selected routes and recorded counts during predefined time intervals. Data collection took place during peak morning and afternoon hours on both weekdays and weekends to capture temporal variations in pedestrian activity. The pedestrian counts were based on a set of parameters designed to reflect the spatial and behavioural diversity of movement patterns.

Table 1: List of parameters

Parameter	Description
Routes	Consist of three major and minor routes namely; • Persiaran Bestari • Jalan Plumbum • Persiaran Permai
Pedestrian volume	• High volume • Low volume
Time intervals	• Weekdays (0700-0800; 1600-1830) • Weekends (0700-1800)

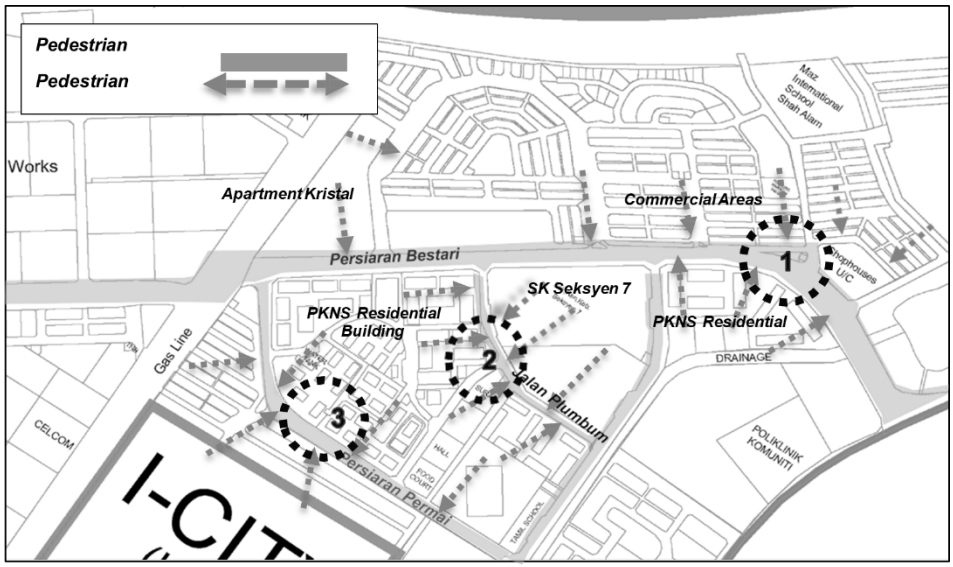


Figure 3: Pedestrian or route that are used in this study area; (1) Persiaran Bestari, (2) Jalan Plumbum dan (3) Persiaran Permai.
Source: Author's work

b. Open Street Map (OSM) and Axial Map

Open-source spatial data from Open Street Map (OSM) were used to analyse pedestrian spatial dynamics within the study area. The data were digitised and analysed using the space syntax approach via the axial map technique, which represents urban spaces as the longest straight lines that can be drawn through open space without interruption (Sharmin & Kamruzzaman, 2017). This method enables the evaluation of spatial connectivity by examining how these axial lines intersect and relate to one another within the network.

The analysis was performed using DepthMapX version 0.7 to assess pedestrian network accessibility and connectivity. The software generates two key indicators: connectivity, which measures the degree to which each axial line links to other lines, and integration, which indicates the level of localised accessibility between an axial line and its adjacent connections (Lee et al., 2020). These outputs were interpreted to assess spatial accessibility, correlating areas of high connectivity and integration with observed pedestrian behaviours such as increased foot traffic and greater walkability.

A 400-metre radius – approximately a 10-minute walk – was adopted as the standard walkable distance, consistent with common pedestrian mobility patterns. This radius, while indicative, also considers variations in pedestrians' physical capabilities. Major and minor pedestrian routes were identified as analytical parameters: major routes refer to wider streets or pathways with higher pedestrian volumes and stronger network connections, whereas minor routes are narrower, serving more localised areas within the neighbourhood.

ANALYSIS AND DISCUSSION

Pedestrian Volume Analysis

Persiaran Bestari recorded the highest pedestrian volume during the morning peak hour, largely influenced by daily routines and the proximity of the nearby school and PKNS residential complex. Morning activity, particularly between 7.00 a.m. and 8.00 a.m., significantly increased usage of the pedestrian network (Figure 4).

In contrast, pedestrian numbers along Jalan Plumbum rose gradually from Point A to Point B, indicating a more stable flow throughout the day. During the morning period (7:00 a.m. to 8:00 a.m.), 24 pedestrians were recorded – lower than Persiaran Bestari but indicative of consistent utilisation. The flow remained steady during the day, with a minor peak in the evening (4:30 p.m. to 5:30 p.m.), when 18 pedestrians were observed.

Table 1 summarises the pedestrian volume across the three study routes –Persiaran Bestari, Jalan Plumbum, and Persiaran Permai – at various times of the day. The data highlight distinct movement patterns, with Persiaran Bestari consistently experiencing higher pedestrian numbers, particularly during peak hours, compared with the other two routes. For example, during the afternoon

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interval (1:00 p.m. to 2:00 p.m.), Persiaran Bestari recorded 55 pedestrians, whereas Jalan Plumbum and Persiaran Permai recorded only 13 and 20, respectively.

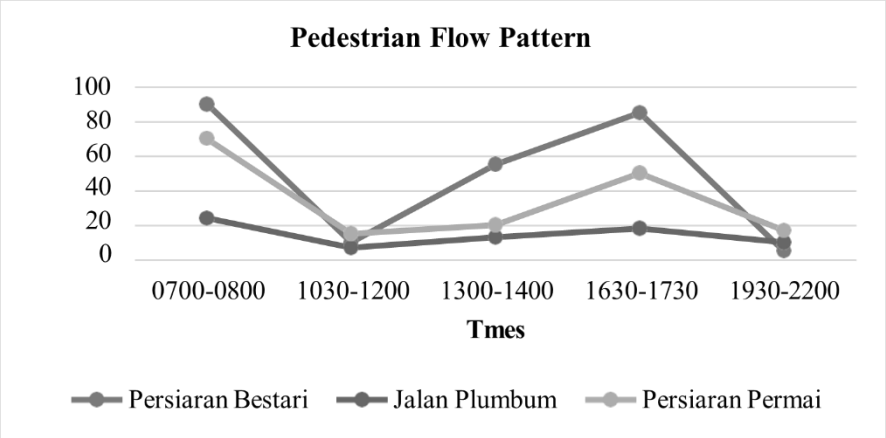


Figure 4: Pedestrian flow pattern in the study area.
Source: Author's work

Table 2: Pedestrian Volume Data for Persiaran Bestari, Jalan Plumbum, and Persiaran Permai

Time Range	Persiaran Bestari	Jalan Plumbum	Persiaran Permai
0700-0800	90	24	70
1030-1200	10	7	15
1300-1400	55	13	20
1630-1730	85	18	50
1930-2200	5	10	17

Source: Author's work

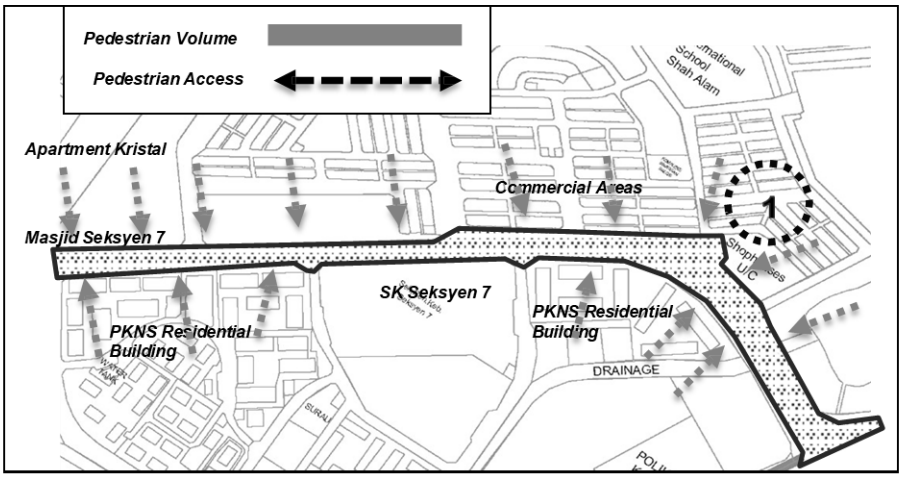


Figure 5: Pedestrian flow pattern at Persiaran Bestari (route 1).
Source: Author's work

The high pedestrian flow along Persiaran Bestari (Route 1) can be attributed to its surrounding land-use composition. The mixed-used development, which integrates residential and commercial activities, strongly influences walking behaviour. Proximity to institutional facilities such as SK Seksyen 7 Primary School further encourages pedestrian movement. The diversity of land uses within the area reduces reliance on private vehicles, promoting walking and cycling for daily activities, including trips to grocery stores, eateries, parks, schools, and other public spaces.

Conversely, Jalan Plumbum (Route 2), as shown in Figure 6, exhibits a gradual increase in pedestrian volume from Point 1 to Point 2, reflecting a distinct movement pattern dominated by workers and residents. Average pedestrian counts ranged from 10 and 20 individuals. The forthcoming operation of the LRT 3 line, scheduled for completion in 2024, is expected to enhance connectivity and potentially increase pedestrian movement in this area.

Persiaran Permai (Route 3), however, shows moderate pedestrian activity, constrained by insufficient walking infrastructure and disruptions caused by ongoing LRT3 construction works. Inconsistent and discontinuous sidewalks compel pedestrians to navigate obstructed paths, while inadequate lighting and poor maintenance further deter walking. These deficiencies contribute to low pedestrian volume and limited accessibility during the construction phase.

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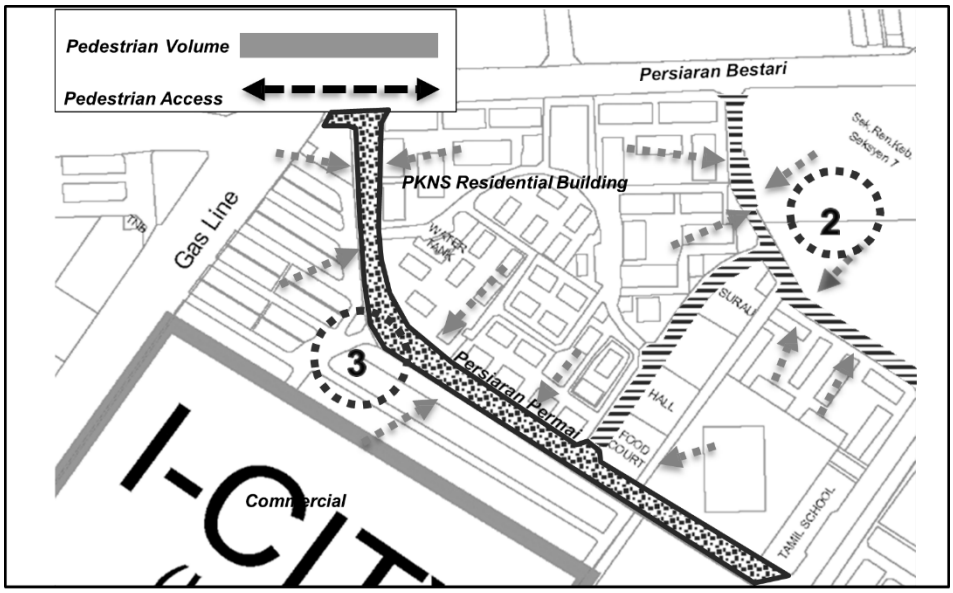


Figure 6: Pedestrian flow pattern at Jalan Plumbum (route 2) and Persiaran Permai 9 (route 3).
Source: Author's work

Pedestrian Spatial Analysis

A substantial network of medium local integration scores was identified within the study area, suggesting that Persiaran Bestari, Seksyen 7, has significant potential to improve pedestrian circulation. The primary and secondary road networks represent the most locally interconnected components. However, the surrounding residential and institutional arterials, although well-integrated in terms of walkability and their ability to support local movement, are often perceived as pedestrian "barriers" due to inadequate infrastructure and restricted accessibility.

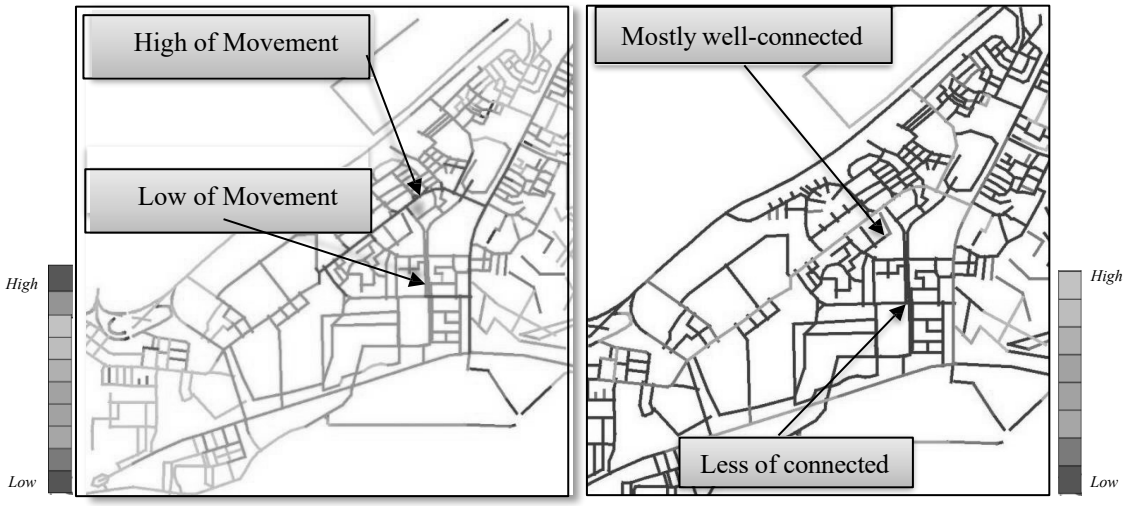


Figure 7: Total depth of connectivity (left) and choice of connectivity potential (right)
Source: Author's work

Node counts, connectivity, and integration values were classified according to thresholds derived from the study's specific dataset and context. Following Hacar et al. (2020), the Jenks Natural Breaks Classification method was used to categorise variations within the data into three classes – low, medium, and high – facilitating the analysis of space syntax measures that influence pedestrian density. For example, node counts were classified as low (<300), medium (300- 700) and high (>700); connectivity values as low (<500), medium (500-1000), and high (>1000); and integration values as poor (<0.3), moderate (0.3-0.7), and good (.0.7).

Using a metric segment map with a 400m radius, Total Depth and Choice values were computed. These values typically peaked near the city core, where numerous residential areas recorded a maximum integration value of 1402 (average 0.589; minimum 1) and a maximum choice value of 145,304 (average 58,823; minimum 0). Overall, the study area exhibited a total node count of 496.794 and total connectivity of 1,219.59.

Figure 7 illustrates the special distribution of Choice and Total Depth values for the street network of Seksyen 7, Shah Alam. The highest integration levels were observed along Persiaran Bestari, with notable concentrations along major routes linking schools and residential zones. The corresponding colour range on the map (Figure 7) highlights Persiaran Bestari and Persiaran Permai as the most integrated and active streets, reflecting dense residential populations and heightened social and commercial activity in these areas.

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Future Statistical Validation

Although this study reveals clear spatial correlations between integration values and pedestrian volumes, future research could incorporate statistical techniques – such as correlation or regression analysis – to quantitatively validate the relationship between axial values and pedestrian movement. Such methods would strengthen the analytical rigour of space syntax applications and provide a more robust understanding of pedestrian dynamics within local urban contexts.

CONCLUSION

This study demonstrates that the integration and connectivity of pedestrian networks strongly influence walking patterns, shaped by both the spatial configuration of the built environment and individual behavioural factors. Building functions – such as institutional, residential, and commercial uses – exert a pronounced effect on pedestrian flow, while personal variables including lifestyle, preferences, and trip purpose further define movement dynamics.

This analysis establishes a clear relationship between pedestrian activity and spatial integration in Shah Alam, with Persiaran Bestari and Persiaran Permai emerging as key pedestrian nodes. Their centrality, coupled with proximity to schools, neighbourhoods, and commercial areas, contributes to vibrant social and economic activity.

The results also show that a higher number of intersections enhances route options and accessibility, underscoring the need to improve infrastructure in high-traffic and underperforming areas through continuous sidewalks, better lighting, and clearer wayfinding.

The application of space syntax provides a robust analytical framework for understanding urban connectivity and its influence on pedestrian movement and economic vitality.

However, future research should integrate user-based data, such as behavioural patterns, perceived safety, and route preferences, to deepen insights into pedestrian behaviour.

Certain methodological limitations are acknowledged. Manual pedestrian counts, although systematic, may be affected by temporal factors, weather, and observer bias, potentially limiting data accuracy. Future studies could employ automated or sensor-based data collection techniques to enhance precision and reliability.

Overall, the findings offer valuable evidence for urban planners and policymakers seeking to enhance walkability. By aligning pedestrian infrastructure improvements with sustainable mobility and community engagement objectives, this research contributes to the development of more inclusive, connected, and liveable urban environments.

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ETHICAL CONSIDERATION
This research involved non-intrusive pedestrian observations conducted in publicly accessible areas. No personal data or individual identification was recorded during fieldwork. All observations adhered to institutional ethical guidelines and ensured the privacy, anonymity, and safety of individuals observed.

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REVIVING LOST SPACES BENEATH ELEVATED RAIL LINES IN URBAN AREAS

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Abstract

Elevated highways and rail lines create a vertical split, obstacles, and divisions at ground level, whereby the space above is used exclusively for transit. Conversely, the space below often becomes a void or is identified as lost space. Law enforcement has largely overlooked the area below the elevated highways and rail lines, which has become a hot spot for criminal activities and consequently, a location many people ignore due to its perceived safety. The residual spaces, also known as the leftover spaces under the elevated highways and rail lines, are often perceived as the negative aspects of urban spaces. Many relevant parties, such as urban planners, landscape architects, and urban designers, have been attempting to transform the spaces for various purposes which are community-friendly. This paper aims to examine the lost spaces beneath elevated rail lines in an urban area. The main intention is to evaluate the potential of converting these lost spaces into useful areas for the public. The results of this paper identified the potential design strategies for promoting public activities. The study applied a qualitative method, using a case study as the subject matter. The approach also included a detailed site investigation and purposive sampling of interviews at the site. Results concluded that the lost spaces can be repurposed following the suggestions of the participants. The outcome of the analysis highlighted the potential activities for the public, which can serve as a useful reference to local authorities and urbanists.

Keywords: lost spaces, elevated rail lines, design strategy, placemaking

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INTRODUCTION

This paper offers a unique approach to solving lost spaces beneath elevated roads and rail lines. Since placemaking is our new approach to enhancing urban image and wellbeing, this study is thought to be crucial in providing recommendations for placemaking at unutilised spaces beneath elevated infrastructure. Elevated roads have been a cornerstone of urban design and planning for nearly a century. They thread their way through the suburbs, cities, and the countryside. By enabling access to the growing population of people travelling to and from the expanding suburbs, they were meant to boost the economies of the cities. Furthermore, the urban landscape has been divided into largely functioning zones above and largely ignored regions due to these elevated roadways and rail lines. While they have driven business and employment out of the city, they have isolated certain regions and divided or separated communities. Landscape architects, city planners, and architects are progressively remodelling the areas below urban highways and rail lines to develop workable pedestrian-focused activity zones to bring the divided population back together. Elevated highways and rail lines create a vertical split, obstacles, and divisions at ground level; the space above is used exclusively for transit, while the space below is frequently a void. The area below the elevated highways and rail lines, which has gone largely unnoticed by law enforcement, has become a hot spot for criminal activities and, as a result, a location that many people would avoid due to safety reasons.

The residual spaces or leftover spaces under elevated highways and rail lines are often seen as the negative aspect of urban spaces. Many urban planners and designers have been attempting to convert urban spaces for a variety of purposes that could benefit society (Hamzah, Sinniah and Rusli, 2024). However, authorities are most likely to classify these spaces as a grey area for maintenance. Hence, numerous action plans or initiatives have been forwarded to the respective parties to transform the unofficial and unregulated dead spaces under those elevated highways and rail lines to create a viable community place. Areas beneath the freeway are also commonly regarded as unstructured areas (i.e., free zones) with impromptu user groups and unscheduled functions. Lost spaces or dead spaces frequently have unclear boundaries and limitations, comprising parts of zoning, programming, and regulations, and these factors are often not clearly understood.

Highways and rail lines are essential features for any city responding to population growth. As a result, it is critical for urban expansion, economic support, and connecting city cores. Elevated roadways, rail lines, and bridges are necessary for improving the automobile flow within cities in congested locations and for promoting transit between urban and rural areas. Designing or changing the usage of the spaces can be rather complex due to the factors and limitations that need to be considered, as some parts of the spaces might work within different rules and regulations. For example, Area A has been utilised with certain

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rules or living styles, while Area B has been utilised with a different set of regulations or living styles; these areas may have also been used illegally by some. Hence, this could create some limitations and difficulties when converting or changing the said spaces into a place that can function in an orderly manner for the community. The limitations and difficulties involve the sensitivity and the culture of the current space (i.e., the current occupant behaviour), whereby the solutions will have to meet the needs of the communities. Thus, decisions in which programming and design are included will affect the current occupant or the involved populations, as well as the overall development of the areas. Unlike other public spaces, the functions, physical characteristics, circulation, and activities are very definite in their usage. Hence, these contradictions or complexities can create heightened and controversial difficulties between the functions and user groups. As lost space is a borderline area, certain zoning and land use can be tolerated based on the circumstances.

The objective of this paper is to examine lost spaces beneath elevated rail lines in an urban area. The main intention is to evaluate and establish the potential of design strategies to convert these lost spaces into functional spaces for the public.

LITERATURE REVIEW

Lost space is described as a leftover of an unconstructed or undesirable urban area that requires redesigning of the space (Trancik, 1986). Unattended areas between districts, buildings, or streets emerge undetected until they are physically constructed on the ground (Mseddi, 2020). These sites could be empty or have remains of built infrastructure in them (Khalid et al., 2018). Simon et al. (2020) defined urban void as the absence of a physical entity, such as a built structure, a natural element, or both. It could also refer to an absence of an assigned function for various reasons, regardless of physical presence, as well as the absence of users or an activity space, irrespective of whether a function is present or not. The issue of lost space encompasses not only the physical aspects but also the social and economic dimensions (Yalcin and Kurkcuoglu, 2023).

The various terms used, such as “lost,” “void,” or “vacant” while connected to space, area, land, or a plot, often carry a negative connotation that creates a social and mental image of dereliction, decay, loss, and danger (Mseddi, 2020). This image often reflects the reality of these perceived spaces. Ultav et al. (2016) reported that the modern movement in architectural design, high-rise building design, and infrastructure are critical factors. This movement has proven to be insufficient for the need to create physical connections and meaningful places. Meanwhile, Trancik (2007) argued that the purpose of this movement is to remove itself from the street, distancing it from the activities of street life and as a result, street space is increasingly overlooked. He believed that architects rarely design the space between buildings and create an “anti-space.”

Investigating the underlying causes of lost spaces is an essential component of the puzzle to eliminate, identify, and improve them (Topçu and Ünal, 2022). In the book titled "Finding Lost Space: Theories of Urban Design," Trancik's theories of urban space design apply three (3) approaches to urban design theories: (1) Figure-Ground Theory; (2) Connection Theory; and (3) Place Theory. The third approach, which is the Place Theory, will be adopted in this study. The Place Theory distinguishes itself from the other two theories by incorporating human needs and cultural, historical, and ecological background to attain economic gain and offer greater social benefits to the urban fabric of the city centre (Trancik, 1986).

A space will only become a place through the abstract context when the said space is given a contextual meaning from a cultural or regional context (Trancik, 1986, p.112). Every space can be categorised and classified based on its physical characteristics and typologies, as each location is distinct and adapts to its surroundings (Khalid et al., 2018). Characters also have intangible cultural connotations, such as shape, texture, and colour, and people need a solid structure to develop themselves in their social lives and cultures. The making of places, also known as architecture, entails visualising the genius loci, or spirit of place, and the architect's responsibility of creating a meaningful space in which man can live (Norberg-Schulz, 2019). As a result, it is the responsibility of every designer to create a place through analysis or synthesis of its social and cultural components rather than simply developing new things and manipulating objects to create space (Topçu and Ünal, 2022; Yalcin and Kurkcuoglu, 2023). The results and consumption of the outcome should be tailored to the demands and preferences of the users, such as the history, feelings, and traditions of the community, as well as the political and economic realities (Topçu and Ünal, 2022).

Therefore, for designers, how they respond to time and place when overdesigning and overplanning is almost as detrimental as letting the market construct ad hoc cities. In this study, the authors have discussed the consequences of 'under-designing' and the outcomes of allowing individual developers to shape today's city. Concurrently, this work investigated the issue of overdesigning too much zoning and planning, which obstructs future change and denies historical continuity. The cities must be fluid and dynamic, both historically and physically, and designers must not lose this flexibility by pushing their ideas. Even beyond engaging with the urban environment, the central issue here is how designers, architects, and landscape architects should perceive their work. Perhaps, the most destructive aspect of the Modern Movement and later planning tendencies is the self-aggrandisement of design. New and old, lower and higher, stone and glass, black and white, all of these come together to form a favourable public entity.

Since the study on Lost Space involves physical spaces and social dimensions connected to these spaces, it is ideal to gather quantifiable data to

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evaluate the changes so the results can prove whether "it has improved" or "it has worsened." Various global research and initiatives have shown that unused spaces can be put to use in a variety of ways, leading many design professionals and scholars to study aspects of their planning design potential (Németh & Langhorst, 2014; Kim et al., 2018). These spaces may be used for anything, such as a neighbourhood garden on a single plot, public plantings, or small-scale urban agricultural projects. Additionally, when frameworks for comparable projects, including commercial operations, exist, they have been subjected to adaptive reuse. Furthermore, abandoned spaces have been transformed into community gathering places or recreational areas for neighbourhood activities and public infrastructure. Moreover, research showed that long-forgotten locations have been successfully converted into centres for ecological services. For instance, paving fractures can make it easier for rainwater to enter, and plants can help climate change efforts by purifying the air and reducing soil pollution (Anderson and Minor, 2017).

The notion of temporary use suggests that something is used temporarily, but what does it mean for a use to be temporary, as all uses can be considered temporary (Németh and Langhorst, 2014)? Németh and Langhorst (2014) define temporary use as a use that is explicitly and intentionally time-limited. De Girolama (2013) defines temporary use as explicitly and intentionally time-limited. This use can be transient, occurring only once for a limited time, or recurrent, occurring multiple times. The remaining areas, or those with several purposes, are appropriate for short-term use. It could be illegal, political, informal, impromptu, or official. Additionally, one may plan temporary use to highlight specific features of vacant or underutilised areas (De Girolama, 2013). According to Kim et al. (2018), it offers a changing environment for users while providing new and exciting experiences that activate underutilised areas. Temporary use is a tool that can transform an empty plot or vacant land into more than just a testing ground. It allows urbanists to explore longer-term development strategies while offering short-term, exciting, attractive, and sustainable urban design with limited financial risks. For instance, installing landscapes or benches in the underutilised pocket park could serve as a valuable public space within the urban environment. Another example is the space alongside the railway, which is the most extensive form of informal gardening. In Porto, Portugal, the metro that heads in the direction of the city's outskirts has many garden plots alongside it. This example has attracted more visitors or users and provided a testing ground for temporary urbanism (De Girolama, 2013).

RESEARCH METHODOLOGY

The study applied a qualitative approach using a case study as the subject matter. It was determined to select only one (1) case study since the area is valued as a popular site with a variety of surrounding activities, making it a common area for

many pedestrians to pass by. Furthermore, the researchers had no intention to undergo a comparative study, as it would result in different designs to accommodate the urban setting and physical state of the areas. Having just one (1) specific site as the case study will enable a rather focused analysis for recommendations. The space beneath the Light Rail Transit rail lines at Pasar Seni, Kuala Lumpur, was selected as the case study. The study involved detailed site investigations and interviews of the public in the space beneath the rail lines. The first part of the study involved a detailed literature review to understand the historical background of the Kuala Lumpur urban areas, and the definitions of key terms related to urban space, social space, sense of place, identity, and authenticity. The analysis of theoretical frameworks for the important themes was done in the following phase, which involved conducting critical evaluations of specific literature. Journals, books, conference papers, government records, archival records of maps and aerial topography, newspapers, online resources, and more were used in this procedure. The gathered information was subsequently examined in further detail following several issues related to the standard of public space.

The second part was the fieldwork at the site, examining the physical and sociological contexts of the space. The space below the Light Rail Transit (LRT) rail lines at Pasar Seni was selected as the focus of the study because the local environment offered the ideal backdrop for the study's fundamental ideas, which centred around significant commercial areas that had successfully fostered social spaces, a feeling of community, and authentic identities (Figure 1). The method of gathering and analysing relevant data involved making on-the-spot observations. The chosen site was studied on the area's form, context, and characteristics, and all these elements were identified during fieldwork through analytical observations and inspections. Pictures were also taken to document and analyse the site's physical environment and activities, among others. Furthermore, the study investigated how the study location had changed and how the surrounding area had been developed and run. The primary idea behind this was to map the elements and characteristics throughout the site, identifying the source and the activities, and the link to the intangible feeling of identity, sense of belonging, and authenticity that are only present at the site.

Following the abovementioned procedure, the third exercise was to gather the opinions and perceptions of the public users beneath the rail lines. Since the space beneath the LRT line did not offer specific social activities, therefore, the area lacked a number of users and became accessible to passersby. For that matter, the study chose to apply the purposive sampling method, targeting 30 individuals at the site. The purposive sampling was conducted for the study as it requires personal opinions from the users of the lost space (the pedestrians). A set of interview questions was outlined, which included the main themes, defining leftover spaces and recognising them, outlining approaches to

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change these spaces, and identifying areas in the city that will cease to serve their current purpose. Due to the study's position amid Pasar Seni, enquiries included the participants' opinions based on the context's components, including its geography, culture, history, and demographics. However, the key question was to seek the participants' suggestions for the lost space. To ensure the greatest possible age and gender variety, a simple random sampling method was used in the selection of the 30 participants for in-depth interviews. In doing so, the researchers had set a rule that only targeted pedestrians who agreed to be interviewed would be interviewed. On top of that, the ethical procedures were exercised whereby the survey (interview) would only be conducted if consent was given by the respondents, and all respondents were maintained as 'anonymous'.

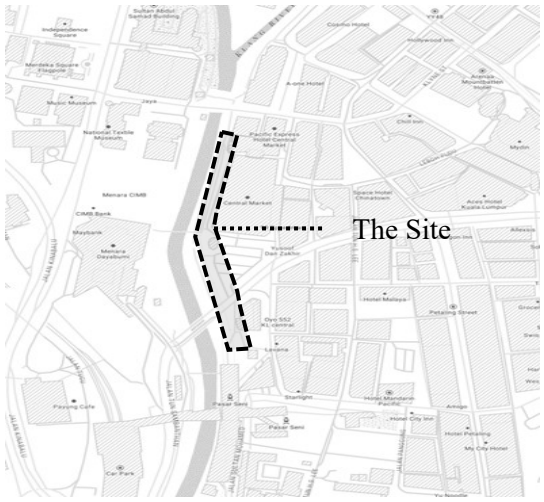


Figure 4: Site Location

RESULTS AND DISCUSSION

The Kuala Lumpur Central Market, also known as Pasar Seni, is located in the city centre. Originally a wet market, it now serves as a gathering place for locals and visitors for entertainment and relaxation. Nevertheless, the arts and crafts offered in this area have been preserving a significant amount of Malaysian culture despite its partial commercialisation by nearby rapid urbanisation. It occupies a unique space amid other contemporary metropolitan skyscrapers, reflecting the usual active streets of urban life. Because it is close to the railway station, Kuala Lumpur's bus service centre, and the Klang bus stand, the site of the wet market is deemed highly convenient for early city residents. Moreover, the position of this Central Market currently offers accessibility for tourists to key destinations, hotels, and Kuala Lumpur International Airport (KLIA).

Due to the presence of the Pasar Seni LRT Station, Pasar Seni has become one of the major transportation hubs in the modern era and has generated a significant amount of interest among working people to use the spaces on weekdays. On the other side, weekends draw large numbers from a tourism standpoint, including young people and visitors who visit Pasar Seni for its historical and cultural attractions at the neighbouring Central Market and Petaling Street buildings, among others. The space beneath the LRT lines at Pasar Seni is, therefore, seen as having potential, since the site is associated directly across from Central Market, which is on the other side of Dayabumi that is divided by the Sungai Klang. The site proposed is also located near one of the main LRT and bus hubs, which is the Pasar Seni Hub station. This facility will create and provide a good attraction and crowds to the location and spaces. However, one of its disadvantages is that the location lacks a greenscape. Although the site location is near the River of Life, the spaces there have failed to provide such privilege to the area, and this could be seen as a waste of space (Figure 2).



Figure 2: Visuals of the Site

The density of the spaces was determined via site investigations throughout the week, including the weekends. The places suggested were used mostly on that determined during weekends when crowds were significantly greater than on weekdays. According to Figure 3, the right figure depicts the density during the weekdays; the majority of the red regions are mostly found

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near commercial locations, some of which include trade places and offices. Meanwhile, places like Central Market, Dataran Merdeka, and Petaling Street are peaceful and hardly populated. On the other hand, on weekends, unusual patterns of density can be noted. The commercial district has the densest population on weekends, whereas the business area is more passive and less active. It appears that the information presented is consistent in revitalising and reactivating the vacant places (Figure 3). The accessibility for pedestrian pathways and their behavioural movement can be accessed throughout the site. The site has good pedestrian access; however, some of the places are not well-maintained and are unsafe for pedestrian use. Some places can be accessed by taking shortcuts, while others would force pedestrians to make a big round to head towards their direction (Figure 4).

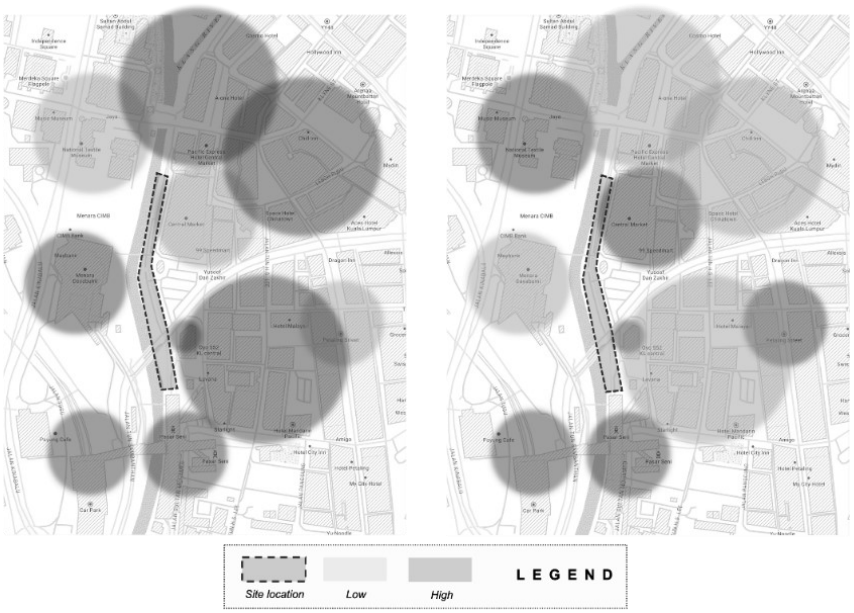


Figure 3: Density During Weekdays (Left) and Weekends (Right)

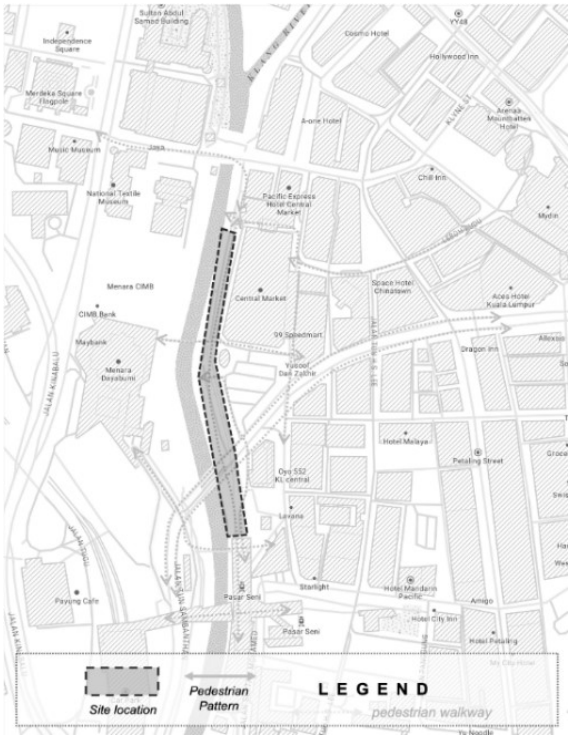


Figure 4: Pedestrian Movement and Behavioural Pattern

Perceptions of Participants

This study area includes information on the relevant everyday activities or major pursuits and how people perceive the place. Activities, time spent, perceptions, and other pertinent aspects are crucial for the study since its primary goal is to comprehend how people view empty spaces and find the best solutions to the problem. Since the majority of the participants have visited the site more than ten times, therefore, their responses to the investigation are legitimately considered as a good validation for better comprehending the issue of lost spaces. Most of them accepted the site's presence, and they recognised the problem and expressed concerns about improving the spaces. The findings showed that security and safety, physical coherence, visibility, liveliness, richness, a sense of belonging, and comfort are design characteristics that consumers choose when designing lost spaces. The lack of safety and security was the main concern, particularly at night when there is insufficient lighting and hidden corners that result in people's fear of being harassed on the street and the physical risk posed by moving vehicles. The following issue is the disdain for aesthetics, particularly when a large amount of concrete is used to build elevated rail lines without any thought given to aesthetics or accessibility for pedestrians. The main issue was how the abandoned

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spaces have turned into illegal parking spaces and garbage dumping areas. Consequently, the spaces tend to create unnecessary and unsafe attraction for the homeless and drug addicts, thus creating a negative space towards the city. As such, the participants have emphasised the need for good lighting and public art.

Based on the features of the local setting and users' thoughts, this study investigates the concepts of leftover spaces. The findings offer design recommendations for enhancing the quality of areas beneath elevated rail lines based on the preferences of the participants. Such public opinion-based policies offer prospects for improved utilisation of underutilised spaces in various contexts. According to claims, the most crucial elements boosting how consumers view their surroundings in the leftover places are safety and security. Participants thought that increased public monitoring and surveillance could help people feel less afraid. Restricting pedestrian movement, utilising natural elements, creating a network of pedestrian access points, utilising traffic-calming techniques, enforcing social monitoring (eyes on the street), incorporating nighttime activities, using the appropriate lighting, and eliminating hidden areas are design strategies that can promote safety and security.

Lighting has the biggest impact on people's feelings of security because most locations beneath elevated rail lines lack enough lighting. At any location beneath elevated structures or rail lines, paying attention to its physical conditions can be crucial. A comprehensive place-shaping strategy that is in harmony with the surroundings is what is meant by physical coherence. It is easier to comprehend the qualities of space in people's minds when such locations are integrated with their surroundings (both physically and visually). Similar studies cite the physical coherence of urban street areas as a crucial element in assessing street imagery's aesthetic quality. To create a uniform urban environment, lost spaces beneath elevated structures or rail lines must be integrated with the surrounding landscape. The physical components' harmony and unity, the space's design's unity, the materials' colour harmony, and the utilisation of iconic and symbolic structures make it possible to create in the minds of users a holistic perception of the environment.

The inclination of potential users for sensory richness in lost space design is another. Graffiti and murals are examples of eye-catching public art that can improve the aesthetic appeal of these locations. Apart from that, the hearing senses can be stimulated by water, and variations in the pavement's construction materials can also enhance the tactile experience. Additionally, the presence of vegetation might cause favourable odours associated with the location to be released, making the setting more appealing to passersby. The temporary uses of fragrance and sound (music, perfume, alcoholic beverages, etc.) to draw people in have the biggest influence towards the spaces. People might develop a sense of belonging in a better setting. For instance, public art and other visual elements may help people feel more at home in a certain place. This can have a good effect

by piquing people's interest in the design procedure and inspiring their concern for the future of a particular location. Furthermore, one of the most crucial elements for enhancing the feeling of community that these locations may foster among residents is giving the neighbourhoods located beneath elevated highways and bridges a distinct identity.

Design Strategy

The design strategy divides the area into three (3) zones (Figure 5). Different programmes and activities are offered in each of these three zones, with a focus on the creative exercise area for Zone A. The large area provided and its proximity to the River of Life make this place ideal for promoting healthy living and exposure to the outdoors. Additionally, improvements to the streets are made in the neighbourhood. Space for children and adults to practise their creativity that faces the river of life is suggested. People may enjoy their leisure time, especially families with children or young people, thanks to the amenities that have been offered. A few people can jog or run in this region as well. In combination with the ongoing River of Life project at the next location, this offers the public or communities beautiful views to enjoy their evening. Additionally, this area is home to four different Sustainable Development Goals, namely, Goals 3, 4, 9, and 13.

In Zone B, the emphasis is mainly on safety concerns, and installing lighting is a key component of enhancing the areas to increase their visibility to onlookers at night. For safety and aesthetic reasons, the ceiling of the pillar and railway structures will be covered with an art piece. Zone B also supports the five SDG categories of 5, 8, 9, 11, and 17, respectively. This area may also be used as part of a project to paint a mural or put art on the crossing road in partnership with local artists. This may also provide the artists with a chance to work together seasonally.

The last zone, Zone C, will attract and accommodate more people and activities than the other zones due to its larger capacity. This area will serve as the primary draw for the general public because it houses placemaking amenities, including a market, entertainment venues, and food vendors. The area will be used seasonally for a variety of events and occasions. Given that this area is located in front of the Pasar Seni LRT and bus hub, it is deemed to have good accessibility. To protect the people and other users of the area from harm, the exposed services on the railway structure ceiling were also covered with artwork. Additionally, serving as a shelter on hot and wet days, this installation. It is observed that three SDG goals were implemented: Goals 2, 8, and 17.

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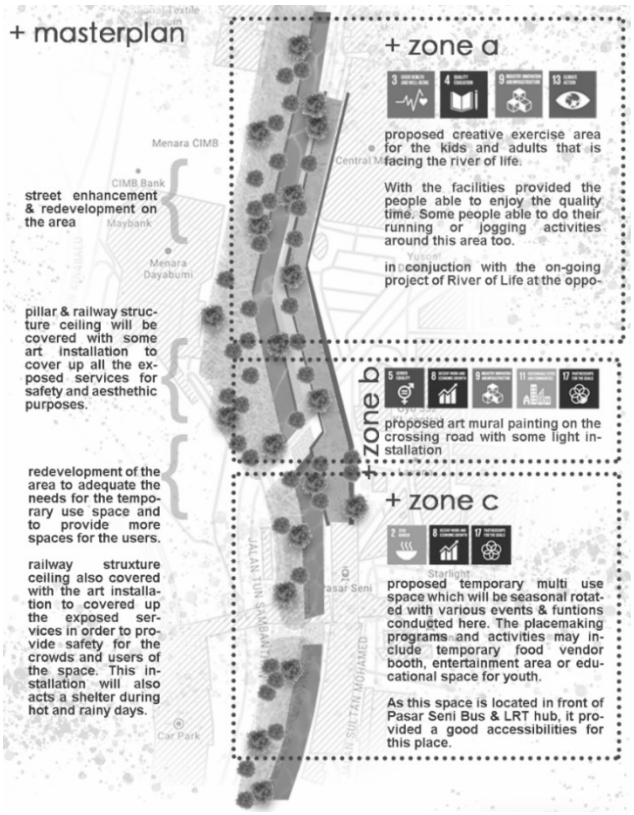


Figure 5: Design Strategy for the Lost Space

Due to the spaces which are surrounded by historical and cultural aspects, the view element must be present in all three zones. For instance, Zone A, which included the creative exercise area, provided views of the Central Market, the River of Life, as well as Dayabumi and Masjid Jamek, to the public. On the other hand, Zone B serves customers who can catch sight of the KTM Kuala Lumpur station, which is situated on the other side of the river. This historical landscape will add value to the location by serving as one of the area's landmarks for users and tourists (Harun, Jaafar and Mansor, 2021). This is important for circulation because it ensures that people will use the spaces effectively and with the appropriate activities. Regarding the crossing road in Zone B, efficient traffic flow will also provide good safety for those using the road, notably children or young people travelling from point A to point B. This temporary multi-use space component must also be used in Zone C, as this area will change the themes or functions according to the seasons.

Circulation among the users of the place who are actively moving about, the vendors, and the entertainers. The market element is observed to be more concentrated in Zone C, a transient multi-use space. The locations for this market or placemaking will be determined by the events that occur simultaneously. On the other hand, a rest plaza is offered, likewise centred on Zone C; this enables tourists to take a break or unwind while occupying the area. The same is true for performance components. Because Zone C is a high-magnet environment with plenty of activity, these items will be able to better excite the space. Last but not least, all zones have flora, which will improve the rooms and give the public a sense of healthy living by adding more natural components. Since the River of Life was also implementing the same element to improve the environment, these greenery components will work well together to create a better natural environment that not only supports healthy living but also raises public awareness, as evident from the Sustainable Development Goals strategy.

CONCLUSION

This study was initiated based on the issues of lost spaces in urban areas. Elevated highways and rail lines create a vertical split, obstacles and divisions at ground level. The residual space or leftover spaces under elevated highways and rail lines are often seen as the negative aspect of urban spaces. The space above is used exclusively for transit, while the space below is frequently a void. The area below the elevated highways and rail lines, which has gone largely unnoticed by law enforcement, has become a hot spot for criminal activities and as a result, a location that many people want to avoid due to safety reasons. The space beneath the LRT lines at Pasar Seni was investigated to prove that the public prefers such areas to be safe and attractive places, whether for activities or the image. The study discovered that the lost space beneath the rail line can be revitalised with a repurposing design strategy. Findings suggested that spaces below elevated rail lines can be useful for activities or programmes. The outcome of this study can be used as a reference to urban planners and designers, whereby the findings have most importantly considered the safety of users of such spaces.

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ENHANCING CULTURAL AND RELIGIOUS TOURISM THROUGH INTERPRETIVE SIGNAGE: A CASE STUDY OF MASJID JAMEK SULTAN ABDUL SAMAD KUALA LUMPUR

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Abstract

Cultural and religious tourism significantly contributes to global tourism, fostering economic growth, cultural understanding, and heritage preservation. Religious sites, such as Masjid Jamek Sultan Abdul Samad in Kuala Lumpur, attract Muslim pilgrims and culturally curious visitors. This study examines how interpretive signage can enhance the visitor experience at the mosque, with a focus on cultural and religious aspects. The research assesses how interpretive tools influence visitors' knowledge and engagement through quantitative methods, including surveys and on-site observations. The findings reveal that the mosque still predominantly uses physical exhibition panels, with limited adoption of digital media. Many visitors, particularly non-Muslims, lack awareness of Islamic culture, mosque architecture, and the historical significance of the area. Challenges such as time constraints, language barriers, and inadequate signage placement contribute to underutilising existing interpretive tools. Moreover, the content lacks emphasis on the mosque's construction history and architectural significance. Clear, multilingual, and contextually rich signage enhances visitors' understanding and appreciation. Digital and interactive tools further engage younger audiences, offering a more immersive experience that aligns with the increasing role of technology in tourism. By integrating religious, cultural, and historical information into a cohesive narrative, interpretive signage educates and fosters emotional connections to the site. The study concludes with recommendations to expand digital platforms, increase multilingual inclusivity, and enhance visitor interaction through technological solutions to improve the tourist experience and align with smart tourism needs.

Keywords: Cultural and Religious Tourism, Interpretation tools, Digital interpretation, Cross-cultural.

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INTRODUCTION

Cultural and religious tourism plays a vital role in fostering intercultural dialogue and understanding (Cohen, 2011). In Malaysia, Masjid Jamek Sultan Abdul Samad Kuala Lumpur (MJSASKL), one of the country's oldest mosques, stands as a significant symbol of Islamic architecture and cultural heritage. This historic landmark attracts visitors interested in its aesthetic and spiritual dimensions. However, to fully appreciate the mosque's cultural and religious significance, effective interpretive signage is essential for communicating its rich history and context to a diverse audience.

This study investigates how interpretive signage can enhance the visitor experience at MJSASKL, with a particular focus on cultural and religious interpretation. Using a quantitative approach, it comprises visitor surveys and on-site observations. The research assesses the impact of signage on visitor knowledge, engagement, and satisfaction. Key concerns include the mosque's current signage, which provides limited content focused mainly on rules and instructions, lacking the depth needed to convey its historical and religious relevance (Timothy, 2011).

Language barriers further reduce the signage's effectiveness (McKercher & Lau, 2008). In the study area, Malay and English texts are used; however, they do not serve the growing number of international tourists adequately. The absence of modern features, such as QR codes, AR applications, and audio guides, also limits engagement, as today's tourists expect more interactive and immersive experiences (Montagano, 2023). These tools can bridge the gap between traditional methods and contemporary visitor expectations, creating more meaningful interactions. Key concepts in this study include "interpretive signage" (tools that enhance understanding at cultural and religious sites), "cultural tourism" (travel focused on experiencing heritage and traditions), and "visitor engagement" (the ways tourists interact with and learn at a destination).

Masjid Jamek is chosen as the case study due to its historical value and clear need for improved interpretive strategies. As an iconic cultural landmark, enhancing its signage could deepen tourist appreciation and promote respect for cultural and religious diversity. This study uniquely contributes to interpretive signage literature by situating its analysis within the context of Islamic religious tourism in Malaysia. A domain where cultural sensitivity, spiritual meaning, and heritage education converge. It extends existing scholars by integrating cultural and religious narratives into interpretive design, offering empirical insights into how interpretive signage can mediate cross-cultural understanding and inclusive visitor experiences.

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In conclusion, this study explores how improving interpretive signage at MJSASKL can enhance visitor experience and cultural understanding. By addressing existing limitations and embracing innovative approaches, the research contributes to advancing cultural tourism and ensuring heritage sites effectively share their stories with global audiences.

LITERATURE REVIEW

This literature review examines contemporary research on cultural and religious tourism, focusing on the role of interpretive signage in enhancing visitor understanding and engagement. It critically analyses current debates surrounding digital and interpretive technologies and situates this study within the broader international discourse on heritage interpretation and religious tourism.

Cultural and Religious Tourism

Cultural and religious tourism are increasingly recognised as interconnected sectors that shape how societies experience heritage and spirituality. Cultural tourism involves travel driven by an interest in art, architecture, festivals, and history (McKercher & Du Cros, 2002; Richards, 2018). Religious tourism, on the other hand, centres on visits to sacred spaces motivated by faith, devotion, or cultural curiosity (Timothy & Olsen, 2006). Both promote intercultural dialogue and heritage appreciation, forming a key part of global tourism. According to UNWTO (2022), nearly 40% of international travel is culturally motivated, highlighting the economic and educational potential of these forms of tourism.

Globally, sites such as Mecca, Vatican City, and Jerusalem attract millions of pilgrims annually, not only as centres of worship but also as heritage destinations contributing to education and mutual understanding (Timothy & Olsen, 2006). In Malaysia, religious tourism is integral to the national tourism framework, particularly through Islamic architectural landmarks such as Masjid Jamek Sultan Abdul Samad Kuala Lumpur (MJSASKL). Yet, most Malaysian studies remain descriptive, focusing on infrastructure and visitor management rather than interpretive communication. This gap underscores the need to explore how interpretive tools can mediate learning and respect in religious contexts.

Interpretive Signage and Visitor Engagement

Interpretive signage is a key element of heritage communication, linking tangible heritage with intangible meanings. Tilden's (1977) foundational principles define interpretation as a means of revealing deeper significance rather than merely providing information. A view extended by Moscardo (2022), who emphasises interpretation as an experience that fosters emotional connection and stewardship.

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Recent studies suggest that interpretation effectiveness depends not only on content but also on design, inclusivity, and technological integration. Traditional static signage, though accessible, often lacks interactivity and depth. In contrast, interactive and digital signage incorporating QR codes, touchscreens, and AR applications to enhance immersion, accessibility, and learning (Liu, 2023). Case studies such as the Alhambra in Spain (Electra, 2016) and the Vatican Museums (Buggeln & France, 2018) demonstrate how digital interpretation can improve understanding of historical and religious contexts.

However, most international research prioritises technological innovation rather than contextual sensitivity. In religious settings, interpretation must navigate ethical, cultural, and spiritual dimensions. For instance, an approach that succeeds in European museums may not be appropriate in Islamic sacred spaces, where visual and behavioural norms shape visitor experiences. This highlights the need for culturally adaptive interpretive strategies that combine educational and spiritual awareness for an area still underexplored in Southeast Asia.

Interpretation, Learning, and Experience

Interpretive signage plays a critical role in shaping visitor learning and satisfaction by turning passive observation into active engagement (Falk & Dierking, 2000; Nowacki, 2021). Theories of experiential and constructivist learning (Kolb, 1984; Piaget, 1970) support this view, asserting that understanding deepens when visitors interact, reflect, and connect new knowledge to prior experiences.

Empirical findings show that visitors who engage with interpretive tools report stronger attachment to sites and higher satisfaction levels (Bai Fan et al., 2024). Yet, many heritage destinations still rely on monolingual, static, or poorly contextualised signage, leading to limited comprehension, particularly among international visitors (Timothy & Olsen, 2006). In religious environments, this lack of contextual interpretation can also lead to cultural misunderstanding or disengagement. Addressing these issues requires a more inclusive interpretive framework that integrates with linguistic accessibility, visual clarity, and spiritual respect.

Digital and Technological Innovations

Technological innovations are transforming heritage interpretation globally. The adoption of mobile apps, QR codes, and augmented reality (AR) enhances interactivity, allowing visitors to access layered narratives through visual and auditory media (Liu, 2023). AR and virtual reality applications have proven particularly effective in engaging younger audiences and diversifying learning

modes (Ying, 2020). These tools also address accessibility challenges by offering multilingual options and features for users with disabilities.

Smart tourism literature increasingly emphasises the convergence of interpretation, technology, and visitor experience (Asmadi et al., 2023). Yet, most of these studies are concentrated in Western or East Asian contexts, focusing on secular heritage sites rather than religious settings. The lack of empirical research addressing digital interpretation in Islamic tourism environments, where spiritual sensitivity and cultural ethics must guide technological adoption, constitutes a major research gap

Positioning the Current Study

The reviewed literature demonstrates that while interpretive and digital technologies enhance engagement, their application in religious heritage contexts remains under-theorised and under-tested. Current international research rarely examines how interpretive signage can balance educational goals with spiritual respect. Furthermore, studies in Malaysia and the wider Southeast Asian region have yet to examine how interpretive tools can serve as mediators of intercultural understanding in Islamic tourism.

By addressing these gaps, this study extends international scholarship on digital and interpretive technologies by contextualising their application within Malaysia's religious tourism environment. It contributes new empirical insights into how interpretive signage (traditional and technology-assisted) can support inclusive, meaningful, and culturally sensitive visitor experiences. In doing so, it bridges the existing divide between global digital interpretation practices and the specific interpretive needs of Islamic cultural heritage sites.

RESEARCH METHOD

This study employs a quantitative approach to evaluate the effectiveness of interpretive signage at Masjid Jamek Sultan Abdul Samad in Kuala Lumpur, focusing on its influence on visitor engagement, satisfaction, and educational outcomes. The research also identifies areas for improvement to better communicate the mosque's cultural and religious significance.

A total of 380 visitor responses were collected, based on a calculated minimum sample size using a 95% confidence level from the 2023 visitor population of 75,456. Of these, 360 valid responses were analysed, while 20 were excluded due to incomplete data. The sample comprised both local and international tourists, selected through purposive sampling to ensure diversity in age, nationality, and familiarity with Islamic culture. Field observations were also conducted to assess the existing signage and identify issues related to engagement and clarity.

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Statistical analyses were performed using SPSS software, to examine visitor trends and perceptions.

Although this research was conducted as part of a practice-based research initiative rather than under a formal institutional ethics review, all ethical procedures were observed. Participants were verbally informed of the study's objectives, and consent was obtained prior to participation. The personal identifiers collected were used solely for research purposes and were kept strictly confidential. Respondents were assured anonymity in reporting and informed that participation was entirely voluntary.

While purposive sampling ensured diversity, it may introduce bias since participation depended on visitor availability and willingness. Possible nonresponse or demographic imbalance, particularly among international and older visitors, may also affect representativeness. These limitations were considered during analysis to minimise bias and enhance the reliability of findings.

FINDINGS AND DISCUSSION

Masjid Jamek Sultan Abdul Samad Interpretive Signage

Masjid Jamek Sultan Abdul Samad (MJSASKL), established in 1909, is one of Kuala Lumpur's oldest and most significant mosques, blending Moorish, Islamic, and local architectural styles. Situated in the city centre, it attracts a diverse range of visitors, including local worshippers, Muslim pilgrims, and international tourists, each with varying interests. Some seek spiritual connection, others admire its architectural beauty and cultural significance. As a major religious and cultural site, MJSASKL draws a growing number of annual visitors.

Currently, the mosque's interpretive signage offers limited historical context and explanations, suggesting the need for more engaging and informative materials. The existing signage includes permanent outdoor panels, temporary indoor exhibits, multimedia displays, and guided tours. The outdoor panels, part of the River of Life (ROL) project by Kuala Lumpur City Hall, highlight key historical and architectural themes and provide accessible content. Temporary indoor exhibits, found in areas like the management office and ablution spaces, offer insights into the mosque's history and construction. However, some are harder to access.

Multimedia displays provide immersive content, including videos and interactive elements, explaining Islam and the mosque's history. Guided tours are also available, offering in-depth information. Yet they may not always be accessible due to limited availability. Despite these efforts, the language used in signage could be improved for wider accessibility. Enhancing interpretive signage by integrating richer religious and cultural narratives, improving

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language clarity, and increasing interactivity could greatly enhance the visitor experience. Such improvements would align with the mosque's goal of providing comprehensive and engaging educational experiences for a diverse audience.

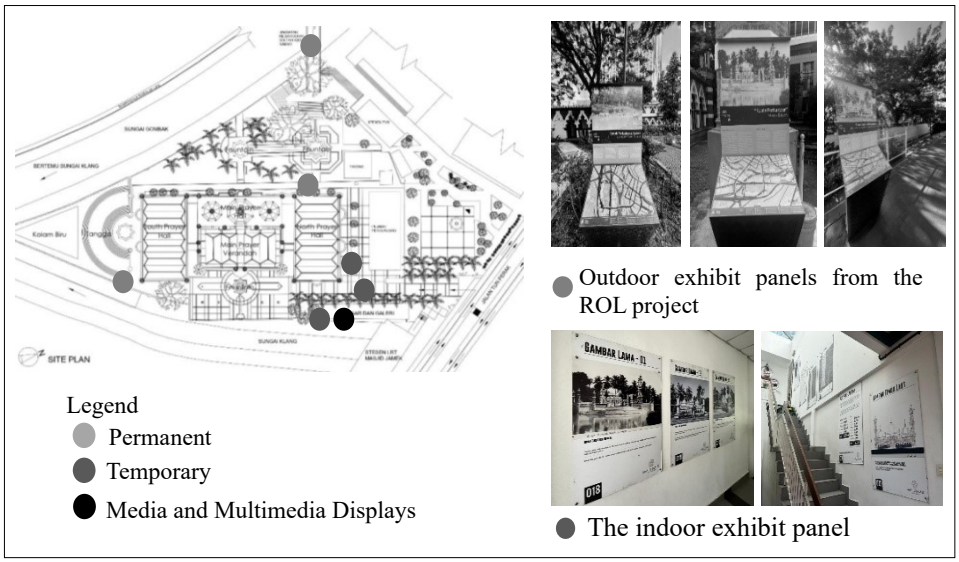


Figure 1: Existing Interpretive Signage Provided in Masjid Jamek Sultan Abdul Samad, Kuala Lumpur.

Interpretive Signage Tourist Experience

The study found that 59% of respondents did not engage with interpretive signage at Masjid Jamek Sultan Abdul Samad, while only 42% did, it indicating the need for improvements. Respondents preferred exhibition formats, with physical indoor panels being the most popular (42%). These static displays provide detailed and accessible information, supporting self-paced learning. Physical outdoor panels were preferred by 31%, offering essential information in entry points or open-air areas, ideal for tourists seeking a brief introduction. Only 27% engaged with video indoor exhibition panels, which provide immersive experiences but are limited by language barriers and equipment needs.

The findings suggest that physical signage remains the most effective, and a balanced approach combining traditional panels with multimedia content could enhance visitor engagement, accessibility, and the overall experience at cultural and religious heritage sites.

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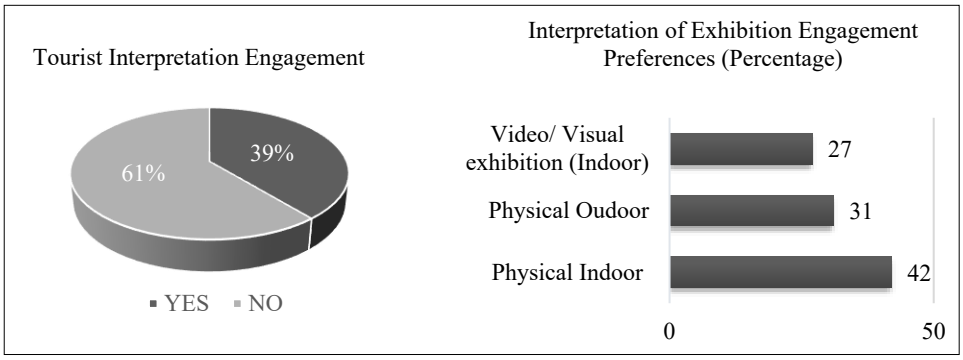


Figure 2: Percentage of Tourist Engagement and Preference of Interpretive Signage.



Figure 3: Interpretive Signage, Tourist Engagement and Indoor Exhibit Panels

Table 1: Crosstabulation Numbers of Respondent Signage Engagement Vs Knowledge Gain

		Knowledge Gain					Total
		No Knowledge	Much Less	Less	Much	Much More	
Engagement with signage	Yes	4	8	92	32	12	148
	No	156	52	0	4	0	212
Total		160	60	92	36	12	360

The analysis shows a clear link between visitor engagement with interpretive signage and knowledge gain. Most respondents who interacted with signage reported moderate knowledge improvement, while many who did not engage (160 visitors) gained no knowledge. This highlights the importance of effective signage in enhancing visitor understanding. The findings suggest that improving content, format, and accessibility could boost knowledge outcomes.

Chi-Square test results in Table 2 confirm a strong, statistically significant relationship between signage engagement and knowledge gain ($p < 0.001$), indicating a linear pattern (more engagement results in more learning). Although a warning about small expected counts was noted, it does not affect the overall validity of the results, reinforcing the crucial role of interpretive tools in cultural and religious tourism experiences.

Table 2: Chi-Square Tests - the relationship between respondent engagement and knowledge gain.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	300.566[a]	4	.000
Likelihood Ratio	377.980	4	.000
Linear-by-Linear Association	242.675	1	.000
N of Valid Cases	360		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 4.93.

Figure 4 above shows that the tourists gained the most knowledge from religious information (48%), reflecting the significance of religious practices, rituals, and beliefs at cultural and religious sites. This content enhances visitors' understanding of the site's deeper meaning, offering insights into spiritual practices and the site's role within the broader religious context. The second most common area of knowledge gained was building architecture (37%). Tourists engaged with the site's architectural features, appreciating its aesthetic value, cultural context, and symbolic design elements. This reflects the visitors' interest in the physical structure and its cultural and historical relevance. Site history had the least engagement (15%), possibly due to tourists focused more on the site's current religious significance and practices than on its past. Additionally, the availability of historical information in other sources may reduce interest in on-site historical content.

In conclusion, visitors prioritise religious and architectural knowledge when engaging with interpretive signage, while the historical context of the site is less emphasised. Future interpretive strategies could integrate historical content alongside religious and architectural information to enhance visitor experience and cater to diverse interests.

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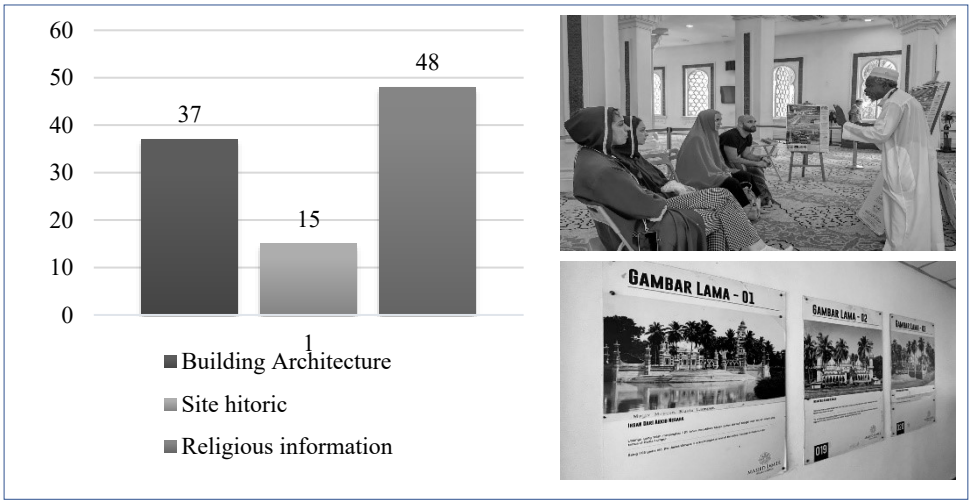


Figure 4: Percentage Distribution of Knowledge Gain from Tourist Engagement with Interpretive Signage

Figure 5 highlights several key challenges with the current interpretive signage at Masjid Jamek Sultan Abdul Samad. The most significant issue, cited by 27% of respondents, is the lack of interactive media, indicating a need for more engaging digital or tactile elements to enhance visitor interaction and understanding.

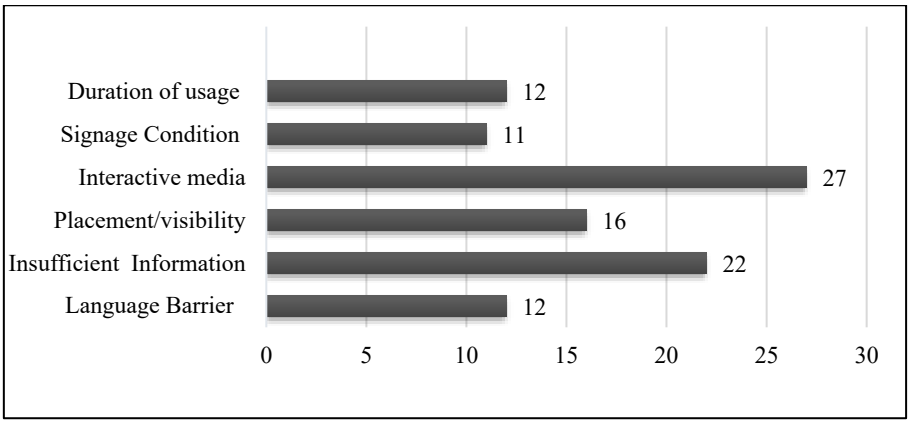


Figure 5: Challenges and Problems Among Visitors (in percentage)

Insufficient information (22%) also emerged as a major concern, suggesting the signage lacks adequate detail or context to support a deeper appreciation of the mosque's cultural and architectural significance. Poor

placement and visibility (16%) reduce the effectiveness of the signage, while the language barrier (12%) limits accessibility for non-Malay-speaking tourists due to a lack of multilingual options.

Additionally, 11% of respondents noted that the signage is in poor condition, which may affect readability and overall engagement. Another 12% pointed out limited usage time, indicating that visitors may not spend enough time interacting with the signage for meaningful learning. These findings emphasise the need to improve the signage's content, design, placement, language accessibility, and interactivity to better serve diverse visitors and enhance the educational value of the site.

Table 3: Crosstabulation of Respondent age Vs Future Preference

		Types of Panels			Total
		Physical Panel	**Digital**	**Guided Tour**	
Age	**18-34**	46	94	48	188
	35-54	36	70	50	156
	55-74	8	0	8	16
Total		90	164	106	360

The analysis of visitor preferences for future interpretive signage at Masjid Jamek Sultan Abdul Samad reveals diverse expectations across age groups. Younger visitors (18–34) favour digital and interactive signage, while middle-aged individuals (35–54) prefer a blend of digital tools and guided tours. Elderly visitors (55–74) prefer traditional physical signage and guided experiences, indicating a need for clear, accessible interpretation methods. These findings suggest that a multi-format strategy—incorporating digital displays, physical signage, and guided tours—is essential to cater to all age groups.

However, the statistical analysis shows a weak, non-significant correlation between age and signage preference ($r(360) = 0.037$, $p = 0.244$). It indicates that age is not a strong predictor of preference. Similarly, demographic factors like education also show little influence on visitor preferences. This suggests that psychological or experiential factors, such as cultural exposure or personal values, may play a more significant role in shaping how visitors engage with interpretive signage. Therefore, interpretive strategies should emphasise inclusivity, diversity of format, and deeper visitor engagement. Future research should explore these non-demographic factors to better understand how interpretive tools can enhance the cultural experience.

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Table 4: Correlation between respondent age and Visitor future signage preference.

		Age	Signage Future Preference
Age	Pearson Correlation	1	.037
	Sig. (1-tailed)		.244
	Sum of Squares and Cross-products	121.822	5.644
	Covariance	.339	.016
	N	360	360
Signage Future Preference	Pearson Correlation	.037	1
	Sig. (1-tailed)	.244	
	Sum of Squares and Cross-products	5.644	195.289
	Covariance	.016	.544
	N	360	360

Additionally, the study assessed visitor experiences with the current signage system. As shown in Table 5, satisfaction levels were mixed: only 7% of visitors reported being "Very Satisfied" and 28% "Satisfied," indicating that while the signage provides basic information, it lacks depth and emotional engagement. A further 21% expressed neutrality, highlighting the signage's limited impact in delivering an immersive or memorable experience. These findings point to the need for more engaging, informative, and context-rich signage to better connect visitors with the mosque's cultural and religious significance.

Table 5: Tourist Satisfaction Level in Interpretive Signage Experience

Satisfaction Level		Percentage
Very Unsatisfied	5	44
Unsatisfied	39	
Natural	21	21
Satisfied	28	35
Very Satisfied	7	

This neutrality signals an urgent need to reassess content relevance, design, and presentation to capture visitors' interest better and enhance their learning journey. The combined 44% dissatisfaction rate is more concerning, with 39% "Unsatisfied" and 5% "Very Unsatisfied," highlighting substantial shortcomings in the current system. Key issues include insufficiently detailed or poorly organised content, which fails to communicate the site's significance effectively. The lack of visually appealing, multilingual, and accessible formats alienates a diverse audience. Additionally, poorly positioned signage and limited integration of digital or interactive tools hinder visitors' ability to engage with the

material meaningfully. Addressing these deficiencies through modern, innovative solutions is crucial to improving visitor satisfaction and ensuring the interpretive signage fulfils its role in enhancing cultural and religious tourism at this iconic site.

DISCUSSION

This study highlights the significant role of interpretive signage at Masjid Jamek Sultan Abdul Samad in enhancing visitor engagement, learning, and satisfaction. Despite the mosque's rich religious and architectural heritage, current interpretive tools such as outdoor exhibits, indoor panels, and multimedia displays are limited in scope, accessibility, and technological integration. As a result, 44% of visitors reported dissatisfaction, citing insufficient content, poor signage placement, and a lack of multilingual and interactive features.

Visitor preferences further emphasise the growing demand for digital experiences, with 51% favouring tools such as QR codes and mobile apps. This trend points to the need for more dynamic and user-friendly interpretive platforms. Meanwhile, traditional methods like guided tours and static panels, preferred by 21% and 28% respectively, still hold value and could be enhanced through digital integration. The study also notes a content imbalance, with current interpretation prioritising religious and architectural aspects over historical context. A more balanced narrative could better cater to diverse visitor interests. To improve overall satisfaction and engagement, the mosque should invest in multilingual support, interactive digital media, and comprehensive, inclusive content, positioning itself as a premier cultural and religious tourism site in Kuala Lumpur.

RECOMMENDATIONS

Revamping the interpretive signage at Masjid Jamek Sultan Abdul Samad is crucial to improving visitor engagement, satisfaction, and learning. Enhancements should include multilingual content, improved placement, and the integration of digital tools such as interactive displays and mobile apps. The current signage lacks depth, accessibility, and technological features, limiting its effectiveness. Incorporating technologies such as augmented reality and virtual tours can offer more inclusive and meaningful experiences. Regular maintenance is also essential.

Future research should assess the long-term impact of digital tools and compare strategies across religious sites to develop best practices for interpreting cultural and religious tourism.

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CONCLUSION

This study evaluates the interpretive signage at Masjid Jamek Sultan Abdul Samad and reveals significant gaps in meeting visitor expectations. Despite the mosque's historical and religious importance, the current signage lacks depth, multilingual inclusivity, and digital interactivity, limiting visitors' engagement, learning, and satisfaction. To address these challenges, a comprehensive enhancement strategy is required, focusing on clearer, more context-rich content, improved placement, and the integration of digital technologies such as mobile applications, QR codes, and interactive displays to create a more inclusive, accessible, and educational experience for diverse audiences.

Although purposive sampling was employed, ethical procedures were followed, and participants' confidentiality was maintained throughout the study to ensure data integrity and reliability. The findings demonstrate how interpretive signage can effectively bridge cultural understanding and spiritual respect, providing a meaningful communication platform for heritage education. By situating its analysis within Malaysia's Islamic tourism framework, this research contributes to global discourse on digital and interpretive technologies in heritage tourism. Its insights extend to other religious heritage sites worldwide, such as the Blue Mosque in Istanbul and the Vatican Museums, where faith, culture, and visitor experience intersect. The study also offers policy guidance, emphasising the need for culturally sensitive, multilingual, and technology-integrated interpretation strategies aligned with sustainable and inclusive tourism goals.

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ADAPTING MALAY TRADITIONAL HOUSE THROUGH GREEN BUILDING INDEX (GBI) FRAMEWORK: A CASE STUDY OF RUMAH DATO' RAJA DIWANGSA

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Abstract

Despite a growing emphasis on sustainability in construction, few studies have explored how traditional Malay houses align with contemporary green building standards, creating a significant research gap. Consequently, this study examines the adaptation of traditional Malay houses to modern green building standards, utilising the Green Building Index (GBI) as a benchmark. Here, Rumah Dato' Raja Diwangsa, a traditional house from Negeri Sembilan, was chosen as a case study to assess how well it satisfies GBI standards for indoor Environmental Quality (EQ), Water Efficiency (WE) and Energy Efficiency (EE), sustainable site planning, materials, and innovation. Using a qualitative case study approach, the research combines site observations and literature reviews to identify alignments and gaps between traditional design and contemporary sustainability standards. The findings reveal that traditional Malay houses incorporate sustainable features like passive cooling, natural ventilation, and locally sourced materials, aligning with several GBI criteria, particularly indoor EQ and innovation. However, the reliance on newer design requirements limits its performance in areas like advanced energy systems and recycled materials. This study highlights the potential for adapting traditional architectural elements to improve modern green building practices and suggests revising GBI guidelines to accommodate traditional houses. By bridging the gap between heritage preservation and sustainable construction, this research contributes insights for future developments in tropical climates. Future studies should expand this analysis to other traditional houses and incorporate quantitative performance metrics for a more comprehensive evaluation.

Keywords: Green Building Index (GBI); Malay Traditional House; Rumah Dato' Raja Diwangsa, Sustainable Architecture, Vernacular Design

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INTRODUCTION

Malaysia has various ethnicities and traditions, including traditional dwellings and architectural works. These diverse architectural styles reflect each community's values, beliefs, and environmental adaptations. Drawing from centuries-old wisdom, traditional Malay architecture reflects a profound understanding of sustainable living within its natural surroundings. Malay architectural traditions developed centuries before modern construction techniques, deeply rooted in local climate, culture, and environment. Their design principles provided a sustainable and comfortable living environment suited to Malaysia's hot and humid conditions. (Mohd Nawayai et al., 2020).

The design of Malay traditional houses varies according to society's beliefs, ideologies, and morality, which form its unique architectural work. Previous studies found that almost all Malay traditional houses shared common criteria, reflecting their design's consistent principles (Husen et al., 2020). These principles include structural features suited to the tropical climate, such as elevated floors for ventilation and flood prevention, open layouts to encourage natural airflow and using locally sourced materials like wood and bamboo, which are sustainable and readily available (Bahardin et al., 2022). The architectural styles also incorporate cultural motifs and craftsmanship, preserving symbolic elements significant to Malay heritage (Johari & Said, 2021). Authorities have undertaken several efforts to preserve Malaysia's traditional houses, including relocation to museums, restoration of existing structures, and reconstruction for educational or tourism purposes. Mini Malaysia and ASEAN Cultural Park (MMAC) in Melaka and Malay Heritage Museum of Universiti Putra Malaysia (UPM) are some of the efforts made to protect and preserve the architectural work of Malaysian traditional houses.

Many researchers have established that the architecture of Malay traditional houses contains many aspects of green architecture that can be emulated by its modern equivalent, especially criteria related to the Green Building Index (GBI) (Cheong et al., 2020). However, no previous studies have evaluated traditional Malaysian houses based on the GBI framework in detail. Therefore, there is a need to demonstrate and compare that traditional Malay architectural designs embody several principles of green architecture. In this case, it is crucial to assess its green architecture using the criteria listed in the GBI, which can determine the level of greenness of the traditional Malay house. Here, further improvement in incorporating green building features could help the traditional Malay house in future applications. Therefore, this study evaluates traditional Malay house features according to green building principles based on GBI characteristics.

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LITERATURE REVIEW

Malay Traditional House

The characteristics of the Malay landscape are influenced by the orientation of the external environment of a Malay house in the traditional view, as indicated in an ancient manuscript of Adat Resam Melayu (Hussain et al., 2020). Based on the ancient manuscript, it is explained that in ancient times, the traditional Malay house had an architectural vision closely linked to the life of the Malays. At that time, the house's entrance was placed in a position facing the rising sun. Abdul Rahman Al-Ahmadi explains the reason for these ingrained practices in *Petua Membina Rumah Melayu: Dari Sudut Etnis Antropologi*, which the reason is to avoid harm to the homeowner because the afternoon sun is much warmer than the sunrise from the East. The afternoon sun can likely harm the homeowner in terms of health or loss of wealth. Such superstitions hold some truth, such as the location of the house protecting the house from being completely exposed to sunlight during the day (Hussain et al., 2020).

Currently, such practices are not widely known and are not practised by Malaysians, which may be due to modernisation and different views taking place in society. Nevertheless, current studies show that the Malaysian cultural landscape and sustainability are closely related, such as the orientation of the house in relation to the position of the sun, ventilation of the air inside the house and surrounding area, the arrangement of planting trees and hedges, planting of edible plants, planting of flowers and open spaces of barns (Essig & Davis, 2021). The elements, designs, and arrangements of traditional Malay architecture depict and indicate the Malays' sustainable lifestyle and culture incorporated into their traditional house design, which is not only a traditional system of belief but also involves practical and sustainable design.

Green Building Index (GBI)

By 2050, the human population is expected to increase from 7 to 9 billion. This population growth raises questions about low water, energy, and natural resource supply due to high demand, and our ecosystems will be overwhelmed. This problem can be faced with the concept of sustainable development introduced by the United Nations to achieve several strategic goals related to long-term environmental issues (Hsu & Ou, 2022). The concept of sustainability adopted by the construction industry has given rise to a green construction movement, which shows that green construction outperforms conventional construction in several areas of activity, thereby meeting the strategic goals set by the United Nations (Prameswari, Rachamawati, Wiguna, & Rohman, 2021; Makmor, Ismail & Hashim, 2015).

According to Marchi et al. (2021), GBI offers four (4) ratings: Certified, Silver, Gold and the highest rating, Platinum. Here, six factors must be assessed

and scored to determine a building's GBI rating, ranging from 50 to 100 points for a building to be certified as green. The Malaysian construction industry, as highlighted by Raouf & Al-Ghamdi (2021), anticipates that GBI will be able to create a common language and measurement standard, encourage integrated and inclusive building design, identify and celebrate environmental leadership, reduce the environmental impact of the built environment and ensure that new and old buildings are fit for today and in the future.

A building's GBI certification is determined by considering several factors. The six criteria are Water Efficiency (WE), sustainable Site planning and Management (SM), Materials and Resources (MR), indoor Environmental Quality (EQ), Energy Efficiency (EE), and Innovation (IN). In addition, achieving and implementing environmentally friendly aspects beyond typical industry practices will earn points under the GBI rating system. The point ranges for GBI ratings (Platinum, Gold, Silver, or certified) are shown in the table below.

Table 1: Point System of GBI Ratings.

Points	**GBI Ratings**
86 to 100 points	Platinum
76 to 85 points	Gold
50 to 65 points	Certified

Source: *Green Building Index (GBI). (n.d.). GBI Rating System. Retrieved from https://www.greenbuildingindex.org/how-gbi-works/gbi-rating-system/.*

In Malaysia, green architecture may still be relatively new and not widespread, especially since many recent studies have focused on assessing the green characteristics of new or existing buildings rather than traditional ones (Cheong et al., 2020). This is not aligned with the policy to preserve traditional house designs that can be used for future generations. In this case, researchers may have overlooked the socio-environmental value of traditional buildings, which creates a significant research knowledge gap. Cheong et al. (2020) also suggested that vernacular architecture can have a higher content of sustainable architectural designs because it draws from time-tested principles of resource efficiency, environmental harmony, and cultural relevance. In this case, vernacular architecture often utilises locally available materials and techniques, aligns with the local climate, and reflects the socio-cultural practices of the community. This makes vernacular architecture naturally sustainable and adaptable. Consequently, it can serve as a valuable reference for modern architectural practices that aim to minimise environmental impact and promote

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sustainability. Therefore, valuing the past can be a great opportunity to understand the lasting characteristics of vernacular architecture associated with traditional Malay houses.

Significance of Green Building

The GBI is increasingly relevant to modern housing design due to growing environmental awareness among homeowners and developers. Nevertheless, its adoption remains limited, as many still prioritise cost-effective conventional practices over sustainable certification. Muchlis et al. (2021) also stated that adopting the GBI has been slow, with many homeowners and developers still prioritising cost-effective and conventional building practices over the more stringent requirements of green building certification. Nevertheless, the GBI can provide valuable guidance for the design and construction of modern houses, as it encourages using energy-efficient technologies, water-saving features, and environmentally-friendly materials. Modern houses designed and constructed per the GBI principles can significantly reduce energy usage, water usage, and waste generation, thereby contributing to a more sustainable built environment.

The GBI can be applied to both modern and traditional houses. However, the specific strategies and approaches may vary in their use. Yu et al. (2020) mentioned that modern green homes often incorporate advanced technologies to achieve EE and reduce environmental impact. These may include solar photovoltaic systems to generate renewable electricity, high-efficiency Heating, Ventilation, and Air Conditioning (HVAC) systems that minimise energy consumption, and smart home automation systems that optimise the home's energy usage. By integrating these cutting-edge sustainable technologies, modern green homes can significantly reduce their environmental footprint and operational costs while providing occupants with a comfortable and healthy living environment (Yu et al., 2020).

On the other hand, traditional green homes often emphasise passive design strategies, using locally sourced and renewable materials and integrating natural ventilation and daylighting to achieve sustainability (Abood et al., 2020). These approaches leverage the inherent qualities of traditional building techniques and local resources to create energy-efficient and environmentally friendly homes well adapted to their regional contexts. By incorporating these traditional green building practices, homeowners and builders can preserve cultural heritage while improving the residential sector's overall sustainability (Sokienah, 2020). Furthermore, integrating passive cooling and heating strategies into contemporary adaptations of traditional houses can enhance EE.

This study extends the existing body of knowledge by drawing parallels between Malay vernacular architecture and similar sustainable

adaptations found globally. For example, the integration of passive cooling and natural materials in traditional architecture parallels practices in Indonesian, Thai, and Japanese vernacular systems that have been adapted into green rating frameworks. This comparative lens positions the Malay traditional house within a broader discourse of culturally rooted sustainable architecture.

RESEARCH METHODOLOGY

This study applied a qualitative interpretive approach using site observation and document analysis to evaluate the alignment of traditional architectural elements with GBI criteria. This may be the opposite of the typical GBI-based research where quantitative scoring systems are used. This approach is appropriate to this study as Rumah Dato' Raja Diwangsa was not originally designed for green certification but incorporates many potential sustainability features, which align with GBI criteria. Sampling from research conducted by Martinovic et al. (2023), this method is suitable for analysing specific aspects of traditional Malaysian architecture from the standpoint of the current sustainability standards, such as the GBI framework. This study does not aim to calculate the GBI scores or percentages but rather to explore the compatibility and adaptability of traditional design principles with modern green standards. However, this qualitative approach does not incorporate numerical GBI scoring or comparative benchmarking with other buildings, which may limit the generalisability of the findings. Future studies integrating quantitative performance metrics would strengthen the comparative rigor of such assessments.

SELECTION OF CASE STUDY

Rumah Dato' Raja Diwangsa was chosen as the case study due to its historical significance and representation of Malay architectural principles, especially Negeri Sembilan Malay Traditional House (NSTMH). The case study was selected due to its easy access for site observation as the house has been relocated and preserved at the Malay Heritage Museum in Universiti Putra Malaysia. As a well-preserved traditional house, it offers a unique opportunity to explore the intersection of NSTMH and the modern sustainability framework. Rumah Dato' Raja Diwangsa has authentic architectural elements such as timber stilt construction, serambi layout and passive ventilation design, making it an ideal case study for analysing how vernacular features align with the GBI framework. This house represents various traditional houses across Malaysia, reflecting cultural and sustainable design principles relevant to this study. This case study will focus on key aspects of the GBI framework, such as EE, WE, indoor EQ, sustainable SM, MR, and IN.

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Data Collection Method

Data collection for this study will have two sources of evidence to ensure a comprehensive understanding of the case study. This includes a literature review and site or field observation. Literature studies, such as historical records, architectural plans, conservation reports, and previous studies on Rumah Dato' Raja Diwangsa, were analysed. This provides contextual information and helps identify building features that correspond to GBI standards.

Site observation

Direct observation of Rumah Dato' Raja Diwangsa was conducted to document its architectural features, material usage, and environmental performance. The observations were guided by the GBI framework, focusing on relevant criteria. This included photographing the house and taking notes on elements relevant to GBI criteria, such as EE, natural ventilation, and material sustainability.

Framework for Analysis

The GBI framework evaluated the house's sustainable features. The six categories of GBI—EE, indoor EQ, sustainable SM, MR, WE, and IN—were used as benchmarks for assessment. Each category was systematically compared with the architectural features of Rumah Dato' Raja Diwangsa to identify alignments, gaps, and potential adaptations. The analysis emphasised the house's vernacular features, including its stilt construction, open layout, use of natural materials, and passive cooling strategies. These elements were critically examined to assess their contributions to GBI criteria, especially in indoor EQ and IN. Areas where traditional practices could be adapted to meet modern sustainability standards were highlighted.

ANALYSIS AND DISCUSSION

Negeri Sembilan Malay Traditional House (NSMTH)

The traditional matrilineal system of Adat Perpatih is often associated with the NSTMH. The matrilineal women are the heads of the household, and the owner's position in the neighbourhood affects the size of the house (Azman et al., 2022). The development of two cultures, the Biduanda village (Jakun) and the Minangkabau people, has significantly impacted the NSTMH's architecture. A unique design was created when the Minangkabau matrilineal system and the local Negeri Sembilan matrilineal system could coexist. The local community's culture greatly influences the architectural and design values of the NSMTH.

The architectural design of NSMTH is a mixture of two evolving cultures: the Minangkabau and Biduanda (Jakun) communities. These two communities influenced the architectural design of NSMTH. NSMTH can be identified easily based on its unique features in its physical form. The house's

features can be categorised into two classes: physical attributes and external influences (Azman et al., 2022).

Physical attributes:

1. Layout typologies such as *serambi* (verandah), which consists of *serambi pangkal, serambi tengah, serambi hujung,* mother house with *loteng* (attic) and kitchen house.
2. The curved roof at both ends is Negeri Sembilan's regional identity.
3. Traditional *tanggam* application as a construction method.
4. Specific shapes of the column, such as *tiang pecah lapan* (octagon shape column) or *tiang pecah empat* (square shape column), in which the specific shape represents the status of the owner.

External influences:

1. High-quality chengal wood and other materials, such as palm leaves.
2. The traditional expertise of *tukang* (master builder).
3. The social system (*Adat Perpatih*), religious system and specific environmental constraints.
4. The time capsule (coin) is concealed under the tiang seri as evidence of the birth date of the house.

Rumah Dato' Raja Diwangsa is located at Malay Heritage Museum of UPM. The house's owner is Datuk Raja Diwangsa Muhammad Yunus bin Jabar, one of the Orang Empat Istana Seri Menanti. Originally, the 82-year-old house was located in Kampung Merual, Seri Menanti, and the house was preserved and relocated to the museum for the museum's exhibition.

A traditional house has its own uniqueness, especially in terms of design and functionality. The base structure was implemented using the timber base column as its stilts to elevate the house and protect the owner from any harm or natural disaster below. The house's elevation on the stilts demonstrates an adaptation to the tropical climate and the local topography, particularly in areas prone to flooding. This design ensures that the house remains cool and dry and guarantees safety from floods. The disturbance of poisonous insects or creeping animals can allow sunlight to shine on the lower part of the house, which is kolong to reduce humidity, with air circulation underneath helping regulate temperature.

In this traditional house of Datuk Raja Diwangsa Muhammad Yunus bin Jabar, the serambi area is situated at the front of the house (Figure 1) and was shaped in the shape of three corners, which are serambi tengah, serambi pangkal and serambi hujung. This space serves as a transitional area between the outside and inside. It is often used to welcome guests and for socialising. The openness of the serambi allows for ventilation and cooling, making it an ideal space for

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relaxation with the addition of many windows and openings. The stairs are needed to access this area from the outside due to the stilt's elevation by the timber base column. Next, rumah Ibu is the largest section of the house in the centre, used for family gatherings, sleeping, and daily activities. It is the most spacious part of the house, often in the shape of a square or big rectangular, reflecting its role as the central living area. It is separated from serambi using an internal wall partition. In this rumah ibu area, there is a space for giving birth that is called kolek anak, whereas the flooring space has gaps that allow for cleaning, giving birth, draining, and more. Due to its spacious area, the attic can be constructed and located under the steeply pitched roof. The attic can be accessed using a small staircase from the rumah ibu, with small windows and vents to allow light and air circulation.

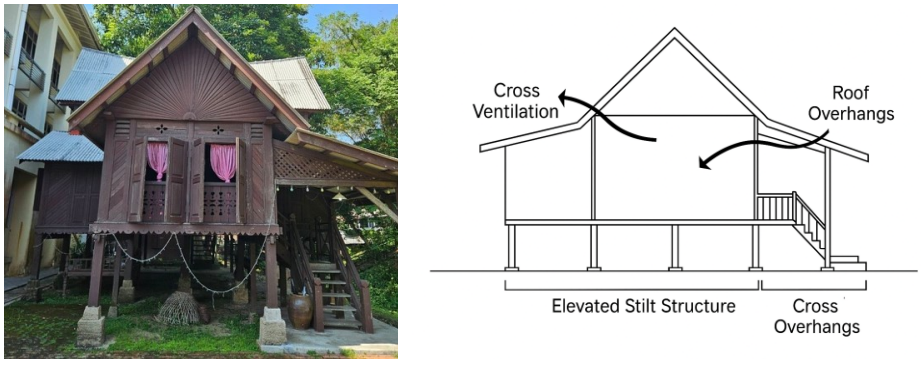


Figure 1. Rumah Dato' Raja Diwangsa, verandah front view – *serambi* (left), and the house's passive design features, including cross ventilation, an elevated stilt structure, and roof overhangs (right)
Source: Authors

Looking at the curved roof of the house, often likened to the shape of buffalo horns, is symbolic of the Minangkabau heritage. Beyond its symbolic meaning, the curved roof serves practical purposes. The design helps to shed rainwater efficiently, which is particularly important in the tropical climate of Malaysia, which has heavy rainfall. The roof's curvature also assists in ventilation, allowing hot air to rise and exit the building, keeping the interior cooler. Besides the roof design, the structural concept is built using pasak dan tanggam using high-quality wood such as chengal and teak, thus allowing the house to be opened and reassembled without damaging the structure and architecture.

Previous research highlights the universal application of traditional architectural practices in promoting sustainability. For example, Flores et al. (2022) examined colonial houses in Santiago, Chile, identifying passive climate

conditioning strategies inherent in these structures. Their study revealed that features such as thick adobe walls and internal courtyards effectively regulate indoor temperatures, minimising reliance on artificial cooling and heating systems. These findings parallel the sustainable design elements observed in Rumah Dato' Raja Diwangsa, such as natural ventilation and the use of local materials. Similarly, a study by Sari et al. (2024) investigated traditional mosques in the Gayo Highland of Indonesia, uncovering sustainable approaches like elevated structures for air circulation and expansive roof overhangs for shading. These architectural strategies, tailored to the local climate, resonate with the design principles of traditional Malay houses. By integrating insights from these international studies, it becomes evident that vernacular architecture worldwide embodies sustainable solutions adaptable to contemporary green building frameworks, reinforcing the relevance of traditional designs in modern architectural discourse.

Table 2 summarises the GBI-required criteria, and the house's architectural criteria are evaluated based on the detailed guidelines listed in the GBI Assessment Criteria for Residential New Construction Version 3.0.

Utilizing the GBI Assessment Criteria for Residential New Construction Version 3.0, Rumah Dato' Raja Diwangsa demonstrates potential alignment with 10 key sub-criteria, which are indoor EQ, IN, sustainable SM, MR and WE. The house incorporates multiple passive design elements that support sustainability and do not involve applying advanced modern energy systems. The evaluation of the house may suggest that the house could score within the 50-65 point range, which qualifies the house for a 'Certified' rating under GBI. Nonetheless, the technological expectation of a few criteria from GBI may not be attainable. Criteria such as EE2, EE3 and MR2 are geared towards contemporary construction methods, which are not present in a traditional house. Thus, this study supports the need for a revised GBI guideline that accommodates the heritage and passive sustainability of traditional architecture. This is essential to ensure the construction of traditional houses can be encouraged and widely enforced to prevent the extinction of traditional houses in Malaysia. This step may help preserve the architecture of traditional Malay houses across the nation for future generations.

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Table 2: Adaptation of Green Characteristics of Rumah Dato' Raja Diwangsa with GBI Requirement.

PART	CRITERIA	ASSESSMENT	DESCRIPTION
2	EQ1	Minimum Indoor Air Quality Performance	Large window opening (half/full opening), it has the ability to encourage natural ventilation.
			Opening the roof attic helps allow ventilation to happen naturally.
			High indoor spaces help ventilation happen naturally and efficiently.
	EQ4	Daylighting	Large window opening (half/full opening) allows daylight to enter the house.
			An area with open space allows good natural ventilation.
			Opening on the wall (i.e., wooden raft/timber louvre) allows natural ventilation.
			An open floor plan helps encourage cross-ventilation.
	EQ5	External Views	House plan with a small width allows good natural ventilation.
3	SM1	Site Selection & Planning	Modular house plan allows easy construction and able to be extended in the future.
3	SM1	Site Selection & Planning	House oriented towards Qiblat, facing the west sunlight, scientifically helps in lowering the heat in the house in the late evening.
	SM13	Heat Island Effect - Roof	Wide roof overhang helps protect the house from direct sunlight. A roof made of leaves or clay (senggora) acts as a heat insulator, hence reducing heat transfer into the house and reducing heat absorption.
4	MR4	Sustainable Timber	Natural construction materials (i.e., timber/bamboo).
5	WE1	Rainwater Harvesting	Rain harvesting and use of water well are for domestic purposes such as shower, irrigation and cleaning.
5	WE2	Waste Water Recycling	Flooring with gaps allows for draining.
5	WE3	Water Efficient Irrigation and Landscaping	Rain harvesting and use of water well are for domestic purposes such as shower, irrigation and cleaning.
6	IN1	Innovation in Design and Environmental Design Initiatives	Built on stilt with concrete or stone base helps overcome flood, is easy to maintain, and gives more privacy to the occupants.
			Opening the roof attic helps allow ventilation to happen naturally and daylight to enter the house.
			An open floor plan allows natural cross ventilation and natural lighting.
			Construction using wood joints will allow for stronger construction and an easy assembly and disassembling process.

PART	CRITERIA	ASSESSMENT	DESCRIPTION
			The attic space below the roof provides additional floor area that can serve as a multipurpose room and storage.

Note: Only sustainable design elements observed in Rumah Dato' Raja Diwangsa are mentioned in Table 2.

CONCLUSION

This study evaluated the traditional Malay house, Rumah Dato' Raja Diwangsa, against the GBI framework to assess its sustainability features and compatibility with modern green building standards. The findings revealed that, while the house demonstrates strong compliance in specific GBI criteria, particularly in indoor EQ and IN, it falls short in areas that heavily rely on modern construction technologies, such as advanced EE systems and recycled material use. The analysis highlights the inherent sustainability of traditional Malay architectural practices, including passive cooling, natural ventilation, and the use of locally sourced materials. These findings bridge the gap between traditional design principles and contemporary sustainability demands.

This study contributes to the growing body of knowledge on sustainable architecture by reinforcing the relevance of vernacular architecture within modern sustainability frameworks. The research demonstrates that traditional designs can offer innovative, culturally significant approaches to green architecture in future applications by applying the GBI framework to a traditional house.

This research makes a novel contribution to the body of literature on sustainability and vernacular architecture in Malaysia by offering the first systematic alignment of a Malay traditional house with the GBI framework. By contextualising vernacular design principles within a formal green rating system, this study demonstrates how cultural heritage can actively inform and enhance sustainable building standards in tropical regions.

The findings emphasise the need to revise sustainability standards to better reflect traditional building practices. Traditional design strategies—such as elevation for flood mitigation, natural material use, and passive cooling—can inform modern tropical housing. Adapting the GBI framework to recognise these vernacular features would both preserve cultural heritage and promote sustainable construction. The study provides valuable insights, but several constraints must be acknowledged. The evaluation was limited to a single case study, potentially restricting the generalizability of the findings to other traditional houses. Furthermore, the study relied heavily on qualitative data, including observations and literature, which may lack the precision of quantitative performance metrics (e.g., energy consumption or material efficiency). However, Rumah Dato' Raja Diwangsa was selected due to its cultural architectural significance as a representative example of Negeri Sembilan

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traditional houses. Future research should extend this analysis to other traditional houses from various regions and typologies. Future studies could also incorporate mixed methods, including qualitative assessment and quantitative GBI scoring. In conclusion, traditional Malay houses such as *Rumah Dato' Raja Diwangsa* exemplify sustainability principles that complement modern green building goals. Developing a tailored assessment framework for heritage structures would help integrate vernacular wisdom with contemporary environmental objectives, ensuring their continued relevance in the built environment.

ETHICAL STATEMENT

Site observations and photographic documentation were conducted in accordance with Universiti Putra Malaysia (UPM)'s research ethics guidelines. Permission for access and documentation of *Rumah Dato' Raja Diwangsa* was obtained from the Malay Heritage Museum, UPM.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests with the funders and concur that this study was carried out free from financial, commercial, or self-benefitting conflicts.

AUTHORS' CONTRIBUTIONS

Aqilah Adib carried out the research and wrote the article. Nasyairi Mat Nasir conceptualised the research framework and supervised the research progress. Mohd Azrai Azman, Maisarah Makmor, and Abdul Hadi Ahamad have provided critical reviews, edited, and approved the article for submission.

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STRATA LIVING IN TRANSITION: UNDERSTANDING PUBLIC COMPATIBILITY AND HOUSING PREFERENCES IN BRUNEI DARUSSALAM

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Abstract

Strata living is an emerging residential concept in Brunei Darussalam, offering a shift from traditional housing models. Despite its potential benefits, public acceptance of strata housing remains limited. This study explores the transitional phase of strata living in Brunei Darussalam by examining public compatibility and housing preferences among potential homebuyers. Seven key factors were identified from existing literature and assessed through a structured questionnaire administered to 201 Bruneian respondents. Using inferential statistical analysis via Statistical Package for Social Sciences (SPSS), the study revealed that six of the seven factors significantly influenced respondents' compatibility with strata living. These findings suggest that public preferences are shaped by a combination of design, affordability, facilities, governance, and policy-related influences. As strata living continues to evolve in Brunei Darussalam, the identified factors provide valuable insights for policymakers and developers to enhance its appeal and promote wider acceptance.

Keywords: Evaluation, Strata Residential, housing, settlement, compatibility, Bruneian

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INTRODUCTION

This study contributes uniquely by contextualizing strata housing acceptance within Brunei's distinct socio-cultural and policy environment. Unlike previous studies in Malaysia or regional contexts, this research highlights how Brunei's small-scale housing market, strong state-led welfare model, and cultural preferences for landed homes shape the public's acceptance of strata living. Emphasizing these unique national conditions strengthens the paper's originality. Today, strata housing has emerged as a preferred choice for many homebuyers. The development of strata residences, whether high-rise or landed, offers several advantages. One notable benefit is the shared facilities within these residential areas, which help reduce management and maintenance costs. Additionally, the concept of gated and guarded communities commonly applied to strata housing has contributed to the increasing homeownership rate (Kathitasapathy et al., 2023). However, despite these benefits, strata housing remains relatively new in Brunei Darussalam, and its acceptance among residents is still moderate (Omar et al., 2024; Brudirect, 2016). Resident compatibility generally refers to the overall satisfaction and willingness of individuals to accept something positively (Bailey & Mullins, 2022). It can also be associated with the extent to which an innovation meets personal needs and aligns with cultural norms (Rogers et al., 2014; Omar & Ali, 2023). Therefore, examining the compatibility of Bruneian residents with the concept of strata housing must emphasize the key factors that influence their decision-making process (Omar & Ali, 2023). Thus, this study aims to identify the main factors that could attract potential homebuyers to purchase strata residential units in Brunei Darussalam. Ultimately, homebuyers' choices are influenced by a combination of factors, including the features of the housing itself and external influences that drive their purchasing decisions.

LITERATURE REVIEW

In analyzing the factors that influence the acceptance of strata housing among the Bruneian population, seven key aspects have been identified as crucial. These include the availability of various facilities within the strata housing, cost savings for residents, housing design, legal regulations, government support, political stability, and the overall living environment. Furthermore, strata housing involves the provision of various facilities that contribute to residents' well-being (Abdullah et al., 2024). These facilities include gym services, swimming pools, attractive landscaped areas, open spaces, and parking facilities (Kleeman et al., 2022; Omar et al., 2023). The availability of such amenities allows for shared use among residents of strata units at a lower cost. This is attributable to the fact that the service and maintenance expenses are collectively borne by all occupants of the same building. Additionally, the strata management appointed by the

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designated management body has the capacity to continuously improve the quality of life for the residents over time.

Strata housing also contributes to cost savings for its residents, as the management and maintenance costs of the housing and facilities are shared among the residents (Adzham, 2023; Shuhaimi et al., 2023; Susilawati & Yakobus, 2010: Abdullah et al., 2024), through a uniform service charge. This makes strata housing more affordable compared to other types of residences. In essence, this aligns with the current mission to enable every citizen to own a home according to their financial capability (Subramaniam & Kumar, 2023; Easthope & Randolph, 2018; Nethercote, 2020).

Strata developments offer a diverse range of housing designs. It includes high-rise apartments, townhouses and detached homes within gated communities, catering to various lifestyle preferences. Many contemporary strata projects integrate eco-friendly features such as rainwater harvesting systems, solar panels, and green spaces, contributing to a more sustainable built environment (Chuweni et al., 2024; Mahmoudi et al., 2021). In addition, building design and technology innovations have enabled the development of taller and more compact infill redevelopment projects. In particular, it incorporates smart and sustainable materials to address contemporary urban challenges, particularly climate change and population growth (Higgins, 2015; Leshinsky et al., 2018; Loonen et al., 2024). Moreover, these design elements have become key factors in attracting prospective homebuyers to invest in such residential units (Bramley & Power, 2009; Burton, 2000; Yang et al., 2022; Subramaniam & Kumar, 2023).

The strata community living system operates within a specific legal framework that clearly defines the rights and responsibilities of both residents and management bodies (Crommelin et al., 2020; Easthope et al., 2019; Hassan et al., 2021; Kitsakis, 2020; Treffers & Lippert, 2020; Zainal et al., 2024). This legal structure plays a vital role in ensuring the smooth governance of strata communities by safeguarding residents' rights (Troy et al., 2017). A positive perception of legally owning strata property is, therefore, a significant factor influencing the acceptance of this housing model (Zainal et al., 2024). Building on this, residents' trust and confidence in the legal framework that governs strata property management is crucial for fostering broader acceptance of strata living (Mohit & Raja, 2014; Radha et al., 2023).

In addition, the overall environment of strata housing developments plays an essential role in shaping the quality of life for residents. Elements such as cleanliness, landscaping, noise levels, safety, and the general neighborhood atmosphere significantly impact residents' satisfaction with their living conditions (Dredge & Coiacetto, 2011). Hence, developers and strata managers carry a corporate social responsibility to proactively address these factors, ensuring that well-maintained and harmonious communities are created to

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enhance residents' well-being (Leshinsky et al., 2018). Thus, the residential environment within strata developments has become one of the key factors in attracting potential homebuyers.

A stable political environment generally plays a crucial role in the successful development of strata residential properties (McCabe, 2016; Waldron, 2021). Such effective enforcement of citizen welfare protections within strata housing can enhance residents' confidence in choosing this type of home. Additionally, political stability supports both the financial capacity of individuals in acquiring such properties and the implementation of sustainable urban planning (Radha & Razali, 2023).

Government support is a crucial aspect in enhancing the status of strata housing. This support includes the provision of incentives to developers (Ebekozien et al., 2019; Shuid, 2016; Yap & Ng, 2018), subsidies for affordable housing units, tax reductions (Dredge & Coiacetto, 2011), and the improvement of services for strata housing. Considering this perspective, government support for strata housing development is believed to increase demand for this type of housing. This, ultimately, encourages property developers to invest in strata developments (McClure, 2019; Nethercote, 2020; Saiz, 2023; Yap & Ng, 2018; Ramli et al., 2024).

The seven factors mentioned above are considered key components in evaluating strata housing settlements in Brunei Darussalam. Therefore, these aspects are extensively studied to assess the extent of Bruneian citizens' acceptance of this type of housing.

METHODOLOGY

This study utilizes survey data collected through a structured questionnaire designed around seven key factors of strata housing, as explored in the literature review. The questionnaire was developed based on prior validated studies but adjusted to local context through expert consultation and pilot testing.

The questionnaire assesses respondents' perceptions and compatibility with this housing type. Accordingly, a total of 241 respondents, out of 1,000 registered prospective homebuyers in Brunei Darussalam, participated in the study. However, upon data screening and validation, only 201 responses met the criteria for inclusion in the statistical analysis conducted using SPSS software. The data was first analyzed using descriptive cross-tabulation (crosstab) to illustrate the distribution of respondent profiles alongside their compatibility scores for strata housing. This was followed by a correlation analysis to determine the significance of each factor in influencing respondents' compatibility with strata housing. Correspondingly, factors reported to be significant were further analyzed using regression analysis to assess their contribution to the acceptance

and compatibility of Bruneian residents with strata housing, as examined through the model summary and regression coefficients.

RESULT

Table 1: Reliability Test

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.595	.594	7

Table 1 presents the results of the reliability test conducted on the variables used in this study. All seven key factors examined recorded a Cronbach's Alpha of 0.595, which is close to 0.6. According to Nunnally (1967), a value of 0.6 contributes to the reliability of variables, particularly when dealing with a small number of items. This aligns with the recommendations of George and Mallery (2003), who considered Cronbach's Alpha of 0.6 as the minimum threshold for reliability.

The study acknowledges several limitations, particularly the sampling method which relied on voluntary participation from registered homebuyers. The Cronbach's Alpha value of 0.595 indicates moderate internal consistency, which may affect reliability. Furthermore, as the sample size was limited to 201 respondents, the generalizability of findings should be interpreted with caution.

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Figure 1. Respondents' compatibility scores regarding the strata housing

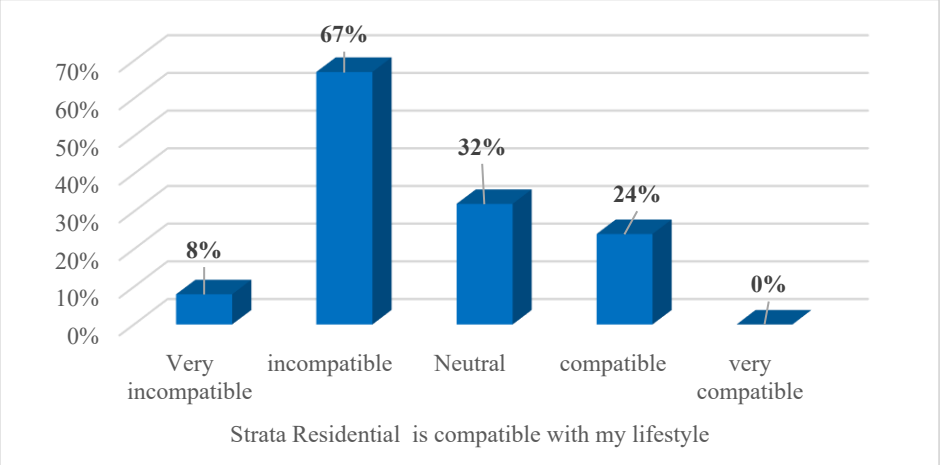


Figure 1 illustrates the respondents' compatibility scores regarding the strata housing with their current lifestyle. Notably, 67% of respondents were incompatible with strata housing, while only 32% were still uncertain about the feasibility of strata housing in their current lives. Meanwhile, only 24% of respondents were positively inclined towards accepting strata housing in Brunei Darussalam.

Table 2: Respondents' compatibility scores in different profiles

%		B8. Strata Title Living is compatible with my lifestyle					Total
		Very incompatible	incompatible	Neutral	compatible	very compatible	
Nationality	Non-Bruneian	0	1	1	3	0	6
	Bruneian	8	66	31	21	0	94
Age	50 and above	2	31	14	8	0	40
	Between 18-29	1	8	3	1	0	10
	Between 30-39	3	11	7	7	0	23
	Between 40-49	2	19	8	7	0	27
Marital Status	Single	2	10	8	5	0	21
	Divorced	0	2	0	1	0	3
	Married	6	57	23	17	0	75
	Others	0	0	0	0	0	0

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%		B8. Strata Title Living is compatible with my lifestyle					Total
		Very incompatible	incompatible	Neutral	compatible	very compatible	
Occupation	Academic staff	0	1	0	0	0	0
	Others	1	7	7	3	0	15
	Student	0	0	1	0	0	1
	Government sector	6	36	14	13	0	51
	Private sector	1	25	10	7	0	31

The respondents' compatibility scores with strata housing were further analyzed using crosstab analysis to examine the distribution of compatibility scores according to their profiles. Among the four profile categories, 66% of Bruneians felt incompatible with strata housing, compared to only 21% who felt compatible. The incompatibility score was particularly high among respondents aged 40 and above (50%). Of these, 57% were married, and 36% were employed in the government sector. On the other hand, 43% of respondents who felt compatible with strata housing came from various age groups, with 20% of the total respondents who felt compatible working in both the government and private sectors. The results of this analysis indicate that while Bruneians have some knowledge of strata housing, their understanding is still relatively low across all age groups and both public and private sector employees. The compatibility score was then analyzed using Pearson correlation with the seven factors potentially influencing Bruneians' compatibility scores with strata housing (Table 2).

Table 3: Pearson Correlation's Result

		B8.	B4.	B13.	B18.	B19.	B20.	B21.	B23.
Pearson Correlation	**B8. Compatibility**	1.000	.279	.236	.220	.108	.285	.369	.059
	B4. Cost Saving	**.279**	1.000	.146	.092	.055	.265	.156	.133
	B13. Facilities Provided	**.236**	.146	1.000	.218	.046	.144	.179	.104
	B18. House Design	**.220**	.092	.218	1.000	.259	.341	.206	.125
	B19. Law & Regulation	**.108**	.055	.046	.259	1.000	.193	.122	.321
	B20. Housing Environment	**.285**	.265	.144	.341	.193	1.000	.457	.111
	B21. Political Will	**.369**	.156	.179	.206	.122	.457	1.000	.024
	B23. Government Support	.059	.133	.104	.125	.321	.111	.024	1.000
Sig. (1-tailed)	**B8. Compatibility**	.	<.001	<.001	<.001	.049	<.001	<.001	.181
	B4. Cost Saving	**.000**	.	.012	.078	.198	.000	.008	.020

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	B8.	B4.	B13.	B18.	B19.	B20.	B21.	B23.
B13. Facilities Provided	**.000**	.012	.	.000	.241	.013	.003	.056
B18. House Design	**.000**	.078	.000	.	.000	.000	.001	.027
B19. Law & Regulation	**.049**	.198	.241	.000	.	.001	.030	.000
B20. Housing Environment	**.000**	.000	.013	.000	.001	.	.000	.044
B21. Political Will	**.000**	.008	.003	.001	.030	.000	.	.356
B23. Government Support	.181	.020	.056	.027	.000	.044	.356	.

Table 3 presents the results of the Pearson correlation analysis. The normal distribution of the data set led to the use of Pearson correlation analysis to assess the significance of each factor studied. The analysis results reveal that six factors studied recorded values < 0.05 at a 1-tailed significance level. In particular, factors B4 (Cost Saving), B13 (Facilities Provided), B18 (House Design), B20 (Housing Environment), and B21 (Political Will) recorded a value of 0.000, which is highly significant and contributes to the compatibility scores being studied. Although only B19 (Law & Regulation) recorded a value of 0.049, it is still considered significant. Meanwhile, B23, referring to Government Support, was discovered to be completely insignificant and does not contribute to the respondents' compatibility scores. Meanwhile, the Pearson correlation coefficient values for these six factors ranged from 0.108 to 0.369, indicating that the influence of these factors is between 11% and 37%. The results indicate that cost-saving benefits, design quality, and housing environment were the strongest positive correlates with compatibility. These findings suggest that economic and lifestyle dimensions have greater influence than policy or legal factors.

Next, these six significant factors were further analyzed using regression to assess how much these factors contribute to the adoption of strata housing in Brunei Darussalam. According to Table 4: model summary, the analysis results indicate an adjusted R-squared value of 0.203, suggesting that these factors influence only 20% of the variation in the compatibility scores studied.

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Table 4: The compatibility assessment model for strata housing with Bruneian residents.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.473[a]	.223	**.203**	1.516	.223	11.174	6	233	<.001	1.693

a. Predictors: (Constant)
B4. Strata Title Living facilities are cheaper compared to conventional living
B13. Strata Title Living facilities are safe to live in
B18. Strata Title Living designs, facilities and costs motivate me to experience it
B19. The laws, circulars and policies governing the Strata Title Living facilitate its effective usage
B20. My surrounding environment motivates me to use Strata Title Living
B21. The political conditions in Brunei Darussalam motivate me to use Strata Title Living

b. Dependent Variable:
B8 Strata Title Living is compatible with my lifestyle

Nonetheless, the results still demonstrate that these six factors have their own influence. The low R-squared value may be attributed to the relatively low level of knowledge and awareness about strata housing, as reflected in the compatibility scores in relation to the respondents' profiles. This can be observed in the regression coefficients results in Table 5, where each of the six factors records its own standardized coefficient value, with Beta values ranging from 0.05 to 0.278. This indicates that these factors uniquely create compatibility between Bruneian residents' acceptance and strata housing. The regression analysis confirms that political will and cost-saving aspects exert the highest standardized effects on compatibility. This suggests that residents' acceptance is shaped by both perceived economic efficiency and trust in governance stability.

Table 5: Evaluation of Strata Residential Settlement Compatibility Among Bruneian Residents

Regression Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.041	.321		3.240	.001					
	B4.	.198	.060	**.198**	3.286	.001	.282	.210	.190	.918	1.089
	B13.	.132	.065	**.121**	2.022	.044	.224	.131	.117	.926	1.080
	B20.	.051	.070	**.050**	.722	.471	.283	.047	.042	.687	1.456
	B21.	.274	.064	**.278**	4.249	<.001	.374	.268	.245	.779	1.284
	B18.	.097	.068	**.092**	1.441	.151	.217	.094	.083	.811	1.232

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Regression Coefficients [a]										
	Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
B19.	.022	.066	**.021**	.342	.733	.105	.022	.020	.915	1.092
a. Dependent Variable: B8 Strata Title Living is compatible with my lifestyle										

CONCLUSION

This study highlights Strata Title (ST) living as a promising housing model to support sustainable urban development in Brunei Darussalam. However, public acceptance remains limited despite its potential, primarily due to gaps in awareness and institutional readiness. Through our analysis, we have identified several key determinants, namely, legal and regulatory support, perceived benefits, and the quality of communal living, which play a central role in shaping public acceptance.

To address these challenges, the findings suggest that targeted policy interventions are essential. Furthermore, legal reforms, improved governance frameworks, and strategic public engagement are critical to facilitating wider acceptance of strata living. Although the overall compatibility scores were modest, segments with more positive responses offer valuable insights that can inform future policy and planning efforts. Accordingly, these insights lay the groundwork for aligning housing strategies with national development goals. This, in turn, will help meet public expectations and promote a transition towards more diversified and sustainable housing options in Brunei Darussalam.

The study also demonstrates that various factors significantly impact the compatibility scores of Bruneian residents with strata housing. These factors are crucial in shaping residents' views and acceptance of this housing model. While the descriptive results demonstrate relatively low scores across various profile categories, the profile cells that exhibit positive compatibility scores should receive further attention. Thus, these segments offer critical insights into the attributes that align with residents' needs. This underscores the significance of prioritizing these factors in future strata housing developments to better address the actual needs of Bruneian residents.

This study revisits ST living as a promising housing model that can offer residents a more comfortable lifestyle through the sustainable urban development framework proposed in Brunei Darussalam. Although public acceptance of this housing model remains relatively limited due to a lack of awareness and institutional support, identifying key factors influencing acceptance scores is vital in enhancing public receptivity.

To encourage greater public acceptance, the study's findings suggest that government intervention through targeted policy initiatives could

significantly increase residents' readiness to embrace strata housing. That is, legal reforms, improved governance frameworks, and strategic public engagement are essential in promoting this housing option. While the overall compatibility scores were moderate, the positive responses from residents regarding future policies and planning offer a strong foundation for aligning national housing strategies. This alignment could help promote strata living as a viable and sustainable residential choice for the public.

The study also reveals that various factors significantly impact Bruneian residents' compatibility scores with strata housing. These factors are instrumental in shaping public perceptions and acceptance of this housing model. Specifically, the findings confirm that aspects such as shared facilities (Kleeman et al., 2022), cost savings (Adzham, 2023; Shuhaimi et al., 2023), housing design (Yang et al., 2022), and political will (Waldron, 2021) all strongly influence acceptance levels. Moreover, accessibility and political support also contribute meaningfully to enhancing the appeal of strata living. These findings, in line with global research, affirm that universal factors continue to exert influence, even within emerging markets like Brunei Darussalam.

However, the study also highlights some notable differences, particularly in terms of government support. While government intervention is often perceived as a key enabler of housing development in other contexts, it was not reported to be a significant factor in Brunei Darussalam. This discrepancy could stem from low public awareness or a lack of transparency surrounding government initiatives. Similarly, although legal frameworks were highlighted to hold some statistical relevance, their overall influence was minimal compared to other factors. This may be due to the relative immaturity of strata developments in Brunei Darussalam and the general public's unfamiliarity with the legal and institutional structures that govern this model.

Moreover, the relatively low descriptive scores across resident profile categories warrant further investigation, with particular attention paid to attributes that align with residents' needs. Thus, emphasizing these key factors in future strata housing development will help address the actual housing needs of the Bruneian population.

In conclusion, this study contributes to the growing body of knowledge on strata housing by offering empirical evidence from Brunei Darussalam. Hence, by providing a more profound understanding of the factors influencing compatibility among Bruneian residents, the study offers a dynamic and localized framework that could support the broader adoption of strata housing in Brunei Darussalam.

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ETHICAL CONSIDERATIONS

Ethical approval was not required for this study as it involved voluntary and anonymous survey participation without any sensitive or personal data collection. Informed consent was obtained from all participants, and data confidentiality was strictly maintained.

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CASE STUDIES OF THE DECISION TO STAY AT A HOMESTAY IN A MOUNTAIN NATURE TOURISM AREAS AT DIENG PLATEAU AND HARAU VALLEY, INDONESIA

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Abstract

This study examines the influence of comfort and facilities on tourists' decisions to stay at homestays in two tourism areas. It aims to encourage the development of homestay management by proposing a research model that focuses on increasing homestay visits and strengthening the tourism sector. Using a quantitative research method, 460 responses were collected from domestic tourists in Dieng Plateau (Central Java) and Harau Valley (West Sumatra) through questionnaires. Purposive sampling was the sampling technique utilized or this purpose. Data were analyzed using SEM-AMOS software. The findings revealed contrasting results between the two regions. The completeness of facilities and their comfort level factors did not significantly influence tourist's decision making to stay in Dieng Plateau homestay. However, comfort level played a vital role in influencing tourists' decisions to stay in Harau Valley. Future research should include data from other regions in Indonesia to enhance generalizability of the results. Adopting a multidisciplinary approach, this research emphasizes the importance of considering cultural context and local wisdom in rural land management as a strategy for sustainable tourism development.

Keywords: Homestay; environmental comfort; facilities; local wisdom; rural land management.

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INTRODUCTION

Tourism contributes to the welfare of local communities (Hidayani & Guspul, 2021; Diekmann & Haukeland, 2024). Highland or mountain tourism is particularly important for recreation. Mountain communities, particularly in developing countries such as Indonesia, are often dependent on grazing and agriculture, making them more vulnerable to climate change and natural disasters (Vedwan, 2006). To diversify their income to non-agricultural sources, highland communities in developing countries should diversify their income by focusing to non-agricultural livelihoods, such as tourism (Asia et al., 2014) or produce derivative products from agricultural and livestock products. Derivative products from agriculture and livestock can be a source of additional income for farmers in rural (Zaim, Z. 2020; Nurul Suliana Yusoff, Mohamad Fadhli Rashid, 2024).

Service-oriented enterprises, such as tourist homestays. naturally emerge in the highlands and can bring profit to their owners and locals. Homestays offer tourists the opportunity to learn about and experience the culture and lifestyle of the local communities (Adli & Chin, 2021). Homestay tourism refers to a type of tourism with an emphasis on ecotourism and community-based tourism, where visitors stay with host families in rural areas and host families are required to treat tourists as their own family and involve them in their daily activities to share experiences, learn about the way of life of local people, and learn about the local culture and environment. (Ahmad et al., 2014; Hermawan et al., 2022; Mohamad Pirdaus Yusoh, Ang Kean Hua, Normah Abdul Latip, Zulayti Zakaria, Dg Junaidah Awang Jambol, Mohammad Al Amir As Khairullah, 2023).

However, homestay development must align with local conditions to avoid undermining community welfare. Poorly managed homestay expansion can disrupt spatial layout, structure, and land use of a rural settlement, and it can have an impact on reducing the standard of living and space for indigenous farmers, causing a transformation of farmers' livelihoods and changes in their daily lives (Bi & Yang, 2023).

This study compares two locations in relation to each other, namely, a community on Java Island and a community on Sumatra Island—both having different characteristics and cultures. This approach, examining the spatial management and level of comfort of highland homestays in a comparison of two areas with distinct cultural special characteristics is novel in the literature. In general, research on homestay tourism is lacking in the hospitality and tourism literature, despite its importance for the development of the quality of life of local communities, protecting the natural environment, and contributing to sustainable tourism practices (Janjua et al., 2021). This research is important to review the conditions of spatial management and the comfort of highland homestays.

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Efforts to protect the environment and its sustainability in West Sumatra existed even before Indonesia's independence. Traditional figures, such as the *datuk* (head of the ethnic group) and the *ninik mamak* created local wisdom in the form of a *rimbo larangan* (forest rules) for the maintaining forest sustainability (Afrianti, S, 2020). When the customary rules have been violated—especially causing damage to the *rimbo larangan*, such as by stealing wood—then the perpetrator receives customary sanctions, namely a fine payable in livestock or money, in proportion to the level of loss caused. The punishment is decided by the *ninik mamak* and the *datuk penghulu adat* through consensus. The government, through Law Number 18 of 2013, which concerns the prevention and eradication of forest destruction, is expected to strengthen customary provisions to maintain forest sustainability. These forests contribute to environmental comfort of homestays by offering cool and clean air around the homestay could attract tourists (Błazejczyk et al., 2010).

According to the Homestay Management Regulations, homestays are typically run as a secondary activity to provide accommodation for tourists in rural areas. Homestay buildings are generally located near tourist areas, functioning as rentals to tourists, in which the tourists can directly observe the community's daily life, enjoy the scenery, and even temporarily live like local residents. A homestay is an accommodation facility that provides leisure, recreation, and a sample of various local culture for tourists while transforming hosts with unused housing resources in rural areas. The facilities that are usually provided by homestay managers tend to be various, including room decoration, design, and layout; hygiene facilities; internet facilities; and smoking areas and ecological areas (Lin et al., 2019). In a study of tourists' behavioral intentions, Tavitiyaman et al. suggested that destination facilities can influence tourists' behavioral intentions in choosing a destination (Tavitiyaman et al., 2021). Where tourists can obtain more information from the internet regarding their destinations and have stronger perceptions of destination images, they will tend to have greater behavioral intentions to choose a destination.

Human beings have a natural tendency to adapt to the changing conditions of their environment, and this natural tendency is seen in the adaptive approach to thermal comfort. Nicol and Humphreys have proposed a model of adaptive thermal comfort as a suitable tool for use in the design of naturally ventilated spaces and for quantification of their thermal comfort performance (Nicol & Humphreys, 2002; Sun et al., 2024). Previous studies have found that the assessment of the sound environment of a room is highly dependent on the room's specific characteristics, as well as the various conditions of the physical environment influencing individual behavior (Yu & Kang, 2009; Meng et al., 2013). The development of a homestay requires a strategy to ensure that

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homestays are not displaced by hotels. This can be achieved through fulfilling the wishes of tourists who have already stayed at the homestay.

This study is notable for its multidisciplinary approach including management, architecture, and rural spatial development. This summarizes the significance of a line of research that is now being explored. This research is novel in its design of the variable indicators that are used particularly to examine decisions to stay based on aspects of environmental comfort and facilities. These would include the architectural elements and the rural development surrounding the homestay. Architectural comfort here is related to thermal comfort, sound, wind, and odor. The facilities relate to the cultural activities that are offered by homestays, parking spaces, and places of worship.

LITERATURE REVIEW

Stimulus-Organism-Response Theory

The Stimulus-Organism-Response model has been adopted by many researchers as a basic theory to study consumer behaviour (Chae et al., 2020). Similarly, this article proposes the S-O-R paradigm as a conceptual framework (Mehrabian, A., & Russell, 1974) states that the stimulus from the environment (S) affects the user's behavioural response (R) through eliciting organisms (O). Stimulus can be formed as a factor that affects the internal conditions of individuals, wherein organisms refer to internal processes that are the result of a stimulus, usually playing a mediating function between stimulus and response. The response is the end result of the stimulus and the organism, which includes factors such as individual intentions and actual behaviour. The stimulus model from Mehrabian-Russell describes that the formation of a person's response to a stimulus because of environmental factors. Stimulus-Organism-Response explains that the environment is a stimulus (S), a set of symptoms that triggers an internal evaluation (O) and creates a response (R) (Mehrabian, A., & Russell, 1974). The SOR model indicates that responding to environmental stimuli requires consumer emotions. This model also shows that conscious and unconscious responses, as well as what a person feels are influenced by the interpretation of the environment (Donovan, R.J; Rossiter, 1982).

Homestay Tourism

Homestay is a new addition to the accommodation industry that has recently emerged in the tourism industry. Although there is no universal definition for Homestay, it is usually defined as a type of accommodation where visitors stay in the homes of local people. Homestays are initially defined as "the accommodation product for experience in a tourist environment". Homestay is an accommodation product that has been transformed by a homestay host from an unused housing resource in a rural area to provide leisure, recreation and a wide range of local culture to tourists (Lin et al., 2019). Homestay refers to booking

accommodation in someone's home away from home, allowing the traveller to experience a new lifestyle, unique customs or even language. In this case, the local community provides tourists with furnished accommodation and homelike treatment that is respectful of the local environment and sustainable in nature (Chakraborty, B. & Islamia, 2020). However, the concept of homestay varies according to the circumstances of the countries involved, for example, the concept of homestay in Western countries is to provide an ideal setting for overseas students to become familiar with the target culture, language and safety of a family (Richardson, 2003). Homestays in Eastern countries are generally associated with leisure, adventure, & exploring local customs (Basak et al., 2021).

Homestay Facilities

Homestay is an accommodation where visitors can experience local life by living in a local home (Mura, 2015). As an alternative to traditional accommodation, rural homestays have multiplied in recent years (Sood, J., Lynch, P. & Anastasiadou, 2017). However, rural Homestays are more than just an accommodation option in a scenic location; they are also an important means of promoting economic growth and sustainable development in local communities and rural tourism destinations (Long et al., 2018). Homestay facilities are operated as a secondary household activity to accommodate tourists in rural areas. Homestay establishments typically have five or fewer guest rooms with a total guest room area of less than 150 m^2. Their home facilities, including the amenities and living space, are shared with the tourists, who can thereby experience a home-like welcome. To make this more of an experience, services are typically packed with the local cuisine, utilities, and even the opportunity to participate in local traditions. This forms an alternative form of accommodation, allowing visitors to stay with a vetted household, communicate with them and experience daily life in the host family's culture (Jamal, S.A., Othman, N. and Muhammad, 2011).

Comfort Homestay & Rural Land Management

Comfort experienced during activities is subjective. Some studies have suggested that comfort is a psychological sensation in a particular environment (Richards, L.G., Jacobson, I.D. and Kuhlthau, 1978). Well-designed outdoor spaces provide a pleasant environment for visitors and encourage outdoor use, which has a positive impact on visitors' health and well-being. It is therefore necessary to take a comprehensive view of the aspects of neighbourhood and architectural design that affect people's comfort and the quality of the environment in which they live. Environmental comfort can be measured in at least three dimensions, including thermal comfort, visual and acoustic comfort. Thermal performance and the lack of design guidelines in the early stages of building design. Appropriate spatial scale and configuration of terraces help to improve their effectiveness in achieving indoor and outdoor thermal comfort. Nicol & Humphreys (2002) have

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proposed adaptive thermal comfort models as appropriate tools for designing naturally ventilated spaces and quantifying their thermal comfort performance. Outdoor thermal comfort is related to outdoor microclimates such as air temperature, humidity, wind velocity, and mean radiant temperature (Błazejczyk et al., 2010). Homestay visual comfort refers to the level of psychological satisfaction derived from observing elements outside the homestay, including the street scene, terrain conditions, road types, and information provided by the homestay (Yunwei et al., 2023). In addition, sound pressure levels can only explain a limited part of an individual's acoustic perception: at the same sound level, very different perceptual outcomes can occur due to various variables related to acoustic and non-acoustic factors, e.g. individual, environmental, & contextual (Marquis-Favre, C., Premat, E. and Aubrédue, 2005).

Rural land management can influence the comfort of a rural atmosphere, including in the consistency of regulations that relate to the integrity of protective trees, animals, and customary forests. This will help conserve the natural habitat and its water resources, and maintain comfortable air temperatures. Customary regulations, such as the prohibition of forests on some village lands in Indonesia, are part of local wisdom applied to maintain the sustainability of nature and the coolness of the village (Afrianti, S, 2020; Government Law Number 18 of 2013). Local wisdom consists of local ideas that are thoughtful, value driven, and culturally embedded in and followed by the members of society in a region. The supervision or involvement of the indigenous community can manage forest resources, applying severe penalties for those who violate their rules (Wicaksono et al., 2022; Apriwan & Afriani, 2015).

Decision to Stay

Altunel and Koçak (2017) define behavioral intention as the consumer's tendency to behave in a certain way with respect to products or services. A tourist stay decision refers to a tourist's behavioral intentions, as expressed in the form of purchasing behavior by tourists based on their subjective evaluation of the services and experiences at the destination. Tourist behavioral intention encompasses more than a simple purchase decision; it includes a variety of factors that range from repeat purchases to word-of-mouth recommendations (Chen et al., 2024). The decision to stay overnight at a place can be driven by various aspects, including the level of service and facility design that will improve tourists' comfort. Tourists who feel the maximum service from destination managers exhibit loyalty, and often recommend destinations to other tourists (Souza et al., 2020). Pre-purchase decisions have been the focus of several studies, such as brand perception (Chen et al., 2024), quality of experience (Altunel & Koçak, 2017) and facilities (Tsai et al., 2014) predicting purchase intentions, which are considered fairly accurate.

The Effect of Homestay Facilities on The Decision to Stay

Homestay facilities tend to include only what the owner provides in the home. Generally, homestays have certain facilities, such as bathrooms, bedrooms, kitchens, living rooms, as typically found in homes. Some homestays even provide additional services, such as an internet connection and other amenities. Tourist satisfaction with a destination, one of which is seen from the fulfillment of its facilities, is important to create visits. The concept of facility design has been recognized as one of the important indicators of company success in the tourism marketing literature (Oliver, 2010; Bi & Yang, 2023). Visiting behavior is considered a manifestation of consumer satisfaction after utilizing the facilities provided (Oliver, 2010). The findings produced from many studies suggest that all relevant aspects of consumer behavior must be considered; some may be less salient while remaining important indicators for facility design that should be examined to produce a reliable assessment of customer behavior. Lin et al. concluded that the external environment of homestays produces little effect on the intention to visit homestays (Lin et al., 2019). Another study (Nguyen, 2023) finds that customer knowledge regarding a product or service can influence purchase intention, such as in the case of electric vehicle products.

Hypothesis H1ab: Homestay facilities positively affect visitor stay decisions.

The Effect of Homestay Comfort on The Decision to Stay

The presence of a transition space connecting the inside and outside of the building can play an important role in improving the conditions of comfort around the building and will impact visitor behavior when visitors decide to stay overnight (Sun et al., 2024). It is also clear that environmental conditions and users' thermal experience also influence the use of outdoor. This means that the design of accommodation geometry plays a key role in improving thermal comfort, therefore, could encourage the use of accommodation (Yang, 2017). Other recent studies have investigated the acoustics of homestay particularly focusing on how acoustics affect comfort and behavior (Torresin et al., 2024).

Hypothesis H2ab: Homestay comfort positively affects visitor stay decisions.

RESEARCH METHODOLOGY

Research design with a quantitative approach based on SEM-AMOS modelling, explaining the relationships between variables and indicators, and also explains how they relate to each other (Hair Jr, 2021). A survey based on questionnaires was chosen as the data collection tool. This study is based on three variables, namely homestay facilities, environmental comfort and the decision to stay at a homestay. The questionnaire was developed based on the adoption of previous relevant research. The adopted questionnaire has been adapted in wording to the context of this study. The sample criteria set as a purposive sampling option include tourists who have reached adulthood to assess the comfort of the

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homestay (Hair Jr, 2021). Data were collected at one time (cross-section) from visitors staying in the Dieng Plateau and Harau Valley region. The questionnaire was distributed to 230 respondents in each region. The total number of valid and processable questionnaires was 460, or a response rate of 100%.

Convergent validity of constructs is measured and assessed in the SEM measurement modelling technique with a minimum threshold value of 0.50 or more. The square root of the AVE (average variance extracted) must be greater than the correlation of the latent variables for discriminant validity. The reliability of individual items is evaluated from the construct reliability (CR) score and the AVE. All CR achieved values above the required threshold of 0.7, and AVE exceeds the 0.5 threshold for all constructs (Farrell, A.M; Rudd, 2014).

RESULTS

Demographic Characteristics of Respondents in Dieng Plateau and Harau Valley.
The study obtained 230 valid responses from respondents in the Dieng Plateau region of Central Java,. The final sample consisted of 54.8% males (n=126) and 45.2% females (n=104). Most were employees (laborers), at 34.3% (n = 79). The largest group of visitors were from Central Java, at 37% (n=85). This is likely because the Dieng Plateau is located in the Central Java's Wonosobo Regency. In addition, 230 valid responses were obtained from respondents in the Lemah Harau region of West Sumatra. The final sample was 67.8% male (n=156) and 32.2% female respondents (n=74). The most of the respondents were entrepreneurs, at 37% (n=85). Many of respondents (63.1%) were from Riau (n=145). Harau Valley lies between the cities of Padang and Riau, the latter being a major tourist source.

Measurement Model Test – Validity & Reliability Dieng Plateau & Harau Valley.
AMOS software was used to conduct confirmatory factor analysis (CFA). The results of data processing in the Dieng Plateau region of Central Java shows that the measurement model has met the statistical criteria for goodness of fit, where the CMIN/DF score is 2.00 (less than or equal to 2.00), Goodness of Fit Index (GFI) scores are 0,928 and Adjusted Goodness of Fit Index (AGFI) scores are 0,883 respectively, RMSEA score is 0.074 (less than 0.08), and TLI and CFI scores are 0,911 and 0,933 respectively (greater than 0.90). Therefore, according to the rule of thumb (Hooper, Daire; Coughlan, Joseph; Mullen, 2008), a satisfactory rating for this model. Testing also shows that all items are reliable (Homestay Facilities: 0.78; Homestay Comfort: 0.74; Stay of Decision: 0.71), as all variables have a Construct Reliability (CR) value of more than 0.70 (Farrell, A.M; Rudd, 2014). The threshold of 0.50 has also been met for the average variance extract (AVE) values of all variables (Homestay Facilities: 0.59; Homestay Comfort: 0.56; Stay of Decision: 0.53) (Hair Jr, 2021). Thus, the model study has no convergent validity problems. Likewise, the square root of the

AVE/DV is greater than the correlation value for the latent variable, indicating that there are no discriminant validity problems (as shown in Fig.1).

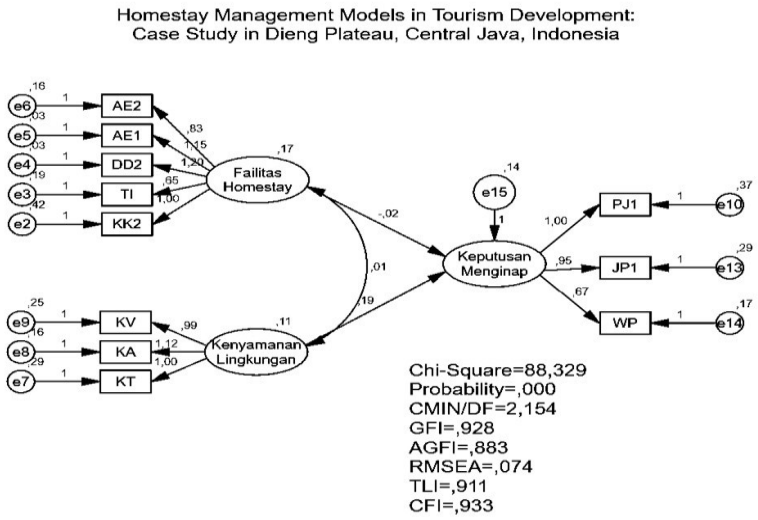


Figure 1: Full Structural Model Test.

CFA was performed using the AMOS software for the results in the Harau Valley, and the measurement model met the statistical criteria for goodness of fit. The GFI value is 0.945 and the AGFI value is 0.901 (greater than 0.90), the RMSEA value is 0.084 (above the 0.08 threshold), and the CFI value is 0.837. Therefore, according to the rule of thumb (Hooper, Daire; Coughlan, Joseph; Mullen, 2008), this model is satisfactory. This test also shows that all items are reliable (homestay facilities: 0.76; homestay comfort: 0.71; decision of stay: 0.72) because all variables have Construct Reliability (CR) values greater than 0.70 (Farrell, A.M; Rudd, 2014). The threshold of 0.50 was also met for the Average Variance Extract (AVE) values of all homestay facilities variables: 0.58; homestay comfort: 0.53; decision of stay: 0.54 (Hair Jr, 2021). Thus, the model used in this study had no convergent validity problems. Similarly, the square root of the AVE/DV is greater than the correlation value of the latent variable, indicating that the model is free from discriminant validity problems (Figure 2).

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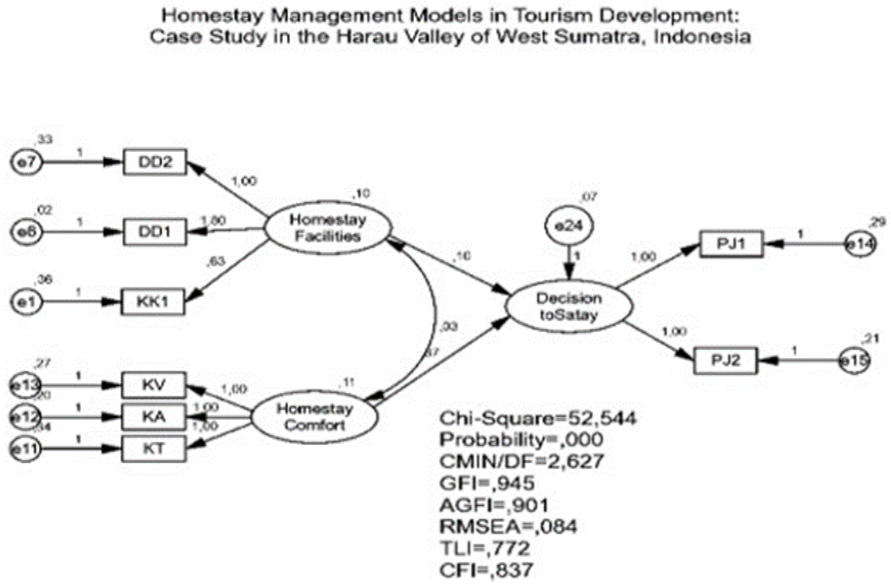


Figure 2: Full Structural Model Test

Structural Model Test – Hypothesis Testing Dieng Plateau & Harau Valley.
Estimating the causal relationships between the exogenous and endogenous latent variables forms the next step in the analysis. The SEM-AMOS approach was used to further analyze the data from the Dieng Plateau to validate the research hypotheses. The SEM-AMOS results are shown in Table 8; homestay facilities did not significantly affect visitor stay decisions (β=−0.015, p-value 0.805< 0.05). Likewise, homestay environmental comfort does not affect visitor stay decisions (β=0.126, p-value 0.185 > 0.05). Thus, H1a and H2a were rejected. (see Table 1).

Table 1: Path Estimates and Hypothesis Results in Dieng Plateau, Central Java

Hypothesis	Regression	β	S.E.	p-value	Result
H1a	HF → DS	-0,015	0,059	0,805	Rejected
H2a	HC → DS	0,185	0,095	0,126	Rejected

Source: Primary data processed (2024).
H1a: Homestay facilities positively influence the decisions to stay in the Dieng Plateau area.
H2a: Environmental comfort positively influences the decision to stay in the Dieng Plateau area.

The next step in the analysis was to estimate the causal relationships between the exogenous and endogenous latent variables. The SEM-AMOS approach was used to analyze the data from the Harau Valley to validate the research hypotheses. The explainable results for the SEM-AMOS analysis are shown in Table 9; homestay facilities have no significant effect on visitors' decision to stay (β=−0.077, p-value 0.554>0.05) or on the comfort of the

homestay environment, which had no effect on visitors' decision to stay (β=0.746, p-value 0.002<0.05). Therefore, H1b is rejected, and H2b is accepted (see Table 2).

Table 2: Path Estimates and Hypothesis Results in Harau Valley, West Sumatra

Hypothesis	Regression	β	S.E.	p-value	Result
H1b	HF → DS	-0,077	0,130	0,544	Rejected
H2b	HC → DS	0,746	0,242	0,002	Accepted

Source: Primary data processed (2024)
H1b: Homestay facilities positively influence the decision to stay in the Harau Valley area.
H2b: Environmental comfort positively influences the decision to stay in the Harau Valley area.

DISCUSSION

Highland tourist destinations are becoming more popular, both for solitary refreshment and for spending time with family. Homestay is the most common alternative for staying overnight. This study examined the factors that contribute to tourist behavior in making overnight decisions in the highlands of Dieng Plateau and Harau Valley. Findings from visitors staying at homestays in the Dieng Plateau and Harau Valley (n=460) show that the proposed model cannot all explain the predicted level of visitor behavior.

The results of the analysis in the Dieng Plateau showed that variable homestay facilities did not affect visitors' decision to stay at the homestay. This result can be explained by the fact that whether the homestay facilities are adequate or not, it does not affect the decision to stay overnight. This finding is not in line with research conducted by Tsai and Sun (Tsai et al., 2014; Sun et al., 2024), which explains that the facilities that are provided by tourist destinations will have an impact on the decision to visit.

This confirms that visitors who decide to stay at the Dieng Plateau homestay do not consider whether the facilities are complete or high-quality. They tend to decide to stay overnight because the average homestay has been booked by other visitors, so when a homestay is empty, visitors tend to make an immediate decision to stay. The Dieng Plateau tends to be busy toward the weekend, this is what causes homestays in the Dieng Plateau area to be booked toward the weekend. Zeithaml explains that behavioral intentions correspond to customer purchases of the product and that intention is a key concept in the theory of planned behavior, identified as an individual customer's motivation based on his decisions (Zeithaml et al., 1996) .

This study also found that the comfort of the homestay environment had no effect on the decision to stay at a Dieng Plateau. This can be explained by the observation that visitors who decide to stay at a homestay do not focus on whether the homestay is comfortable. These results are not in line with research conducted by (Meng et al., 2013; Lau, K.K.L. & Choi, 2021; Chen et al., 2024; Sun et al.,

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2024), which explains that visitors decide to make purchases at tourist destinations with good environmental comforts. With respect to homestay facilities, it is observed that visitors who decide to stay overnight tend not to focus on the level of comfort of the homestay environment. Instead, they tend to choose to stay overnight somewhere because the other homestays are booked or filled by other visitors; if a given homestay is available, visitors choose to stay overnight.

The results for the Harau Valley showed that homestay facility variables did not affect visitors' decision to stay with a homestay. This can be interpreted to mean that homestay visitors in the Harau Valley do not see the facilities provided, whether the provided homestay influence visitors' decisions to stay. However, these results are not in line with research conducted by (Tsai et al., 2014; Sun et al., 2024), explaining that the destination facilities have an impact on purchasing decisions at that destination. In addition, some tourists are parents of boarding school students who are visiting their children, with a short ability to visit; the main motive to visit Harau is not recreation, which means that they do not prioritise the completeness of homestay facilities.

Consumer purchasing behavior of goods or services tends to be the same, such that in cases where the good or service needed is relatively scarce, consumers tend to make purchases without focusing on the details of the good or service being bought (Kotler, 2005). In addition, consumer purchasing behavior for Harau Valley homestays appears to be high on weekends, leading homestays to be booked by many visitors. Another finding from this study is that the level of environmental comfort produces a positive effect on the decision to stay at Harau. This can be interpreted to mean that the more comfortable the homestay environment is, the greater the tendency for the visitors to stay. The results of these findings are in line with research conducted by (Meng et al., 2013; Lau, K.K.L. & Choi, 2021; Chen et al., 2024; Sun et al., 2024) which has found that the comfort of a hotel environment or similar accommodation environments can influence the decision of visitors in purchasing. The environmental comfort in the Harau Valley is high, as it features a fairly cool climate, between 20°-28° Celcius, 86.6% humidity, low-noise, dust-and pollution-free. The environmental comfort in Dieng Plateau is very high with 12^0-20^0 Celcius.

Efforts to protect the natural view and environment have been existed since Indonesia's independence. In West Sumatera, Datuk (head of ethnic) and "Ninik mamak" created a local wisdom in the form of "Rimbo larangan" (forbidden forest) to maintain forest sustainability (Afrianti, 2020). Suppose there is a violation of customary rules, especially damage to the Rimbo larangan, such as stealing wood. In that case, the perpetrator will receive customary sanctions, namely a fine in the form of livestock, cows, goats, or money, according to the level of loss caused. Through Law Number 18 of 2013 concerning the prevention & eradication of forest destruction, the government is expected to strengthen

customary provisions to maintain forest sustainability. The existence of forests can certainly create a comfortable rural environment (Błazejczyk et al., 2010).

CONCLUSION

Homestay tourism refers to a type of tourism focusing on ecotourism and community-based tourism. The Stimulus-Organism-Response theory is confirmed and validated by these findings. There are differences between the two research areas, where the results show that homestay facilities and homestay environmental comfort do not influence the decision to stay overnight for visitors in the Dieng Plateau. Most visitors to Dieng Plateau come for vacation purposes to enjoy the natural atmosphere with host families; these are potential latent variables. Meanwhile, research results in the Harau Valley show that environmental comfort affects visitors' decisions to stay overnight. These two results show that community culture or everything attached to the community will trigger individual behaviour. The policies applied in the management and design of homestays are adjusted to geographical conditions, community characteristics, and local wisdom on rural spatial development.

This study uses data from only two highland regions for comparison. So, there are still some limitations caused two culturally distinct regions. Future research requires data from other regions in Indonesia, as well as from comparable homestay regions, so that the research results can be generalised.

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ADDRESSING BARRIERS TO AFFORDABLE AND SUSTAINABLE HOUSING FOR MALAYSIAN YOUTH

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Abstract

This study explores the critical challenges and opportunities of affordable, sustainable housing for youth in Malaysia. Drawing upon the Theory of Planned Behaviour (TPB), the research identifies key factors influencing youth homeownership, including attitudes toward affordability and sustainability, social expectations, and perceived financial control. The findings highlight significant barriers, including high property prices, limited housing options in prime locations, and inadequate awareness of financial aid schemes. Moreover, the study underscores the significance of financial literacy programmes, innovative policy interventions, and sustainable urban planning to address these issues. Notably, fostering collaboration among policymakers, developers, and financial institutions can create a more inclusive and accessible housing landscape, empowering youth to secure long-term homeownership and contribute to national socio-economic stability.

Keywords: Affordable Housing, Sustainable Housing, Youth Homeownership, Theory of Planned Behaviour (TPB)

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INTRODUCTION

Access to affordable and sustainable housing remains a critical concern for Malaysian youth, particularly as they transition towards financial independence amid rising living costs and economic uncertainties. Housing affordability is generally defined as when housing costs do not exceed 30% of an individual's or household's monthly income (Abu Bakar & Jusoh, 2017). However, this benchmark is increasingly unattainable for young adults due to stagnating income growth and escalating property prices, especially in urban centres (Shu, 2024).

The youth demographic, covering individuals aged 15 to 40 under the Youth Societies and Youth Development Act 2007, forms a substantial portion of Malaysia's population (Berita Awani, 2023). This group is vital to national development but faces mounting socio-economic challenges, including student loan debts, unstable employment, and limited financial literacy (Hamzah & Zyed, 2021; Cai et al., 2021). The government's decision to adjust the youth age bracket to 18 to 30 years, effective January 2026, aims to refine youth-targeted policies (Berita Awani, 2023).

Affordable housing initiatives, notably Rumah Mampu Milik (RMM) programmes, have been central to national strategies to bridge the supply-demand gap (Liu & Ong, 2021). However, criticisms persist regarding their effectiveness in addressing affordability barriers such as strategic location and infrastructure (Ramli et al., 2024). Properties located far from economic hubs often lead to substantial commuting costs, discouraging potential buyers (Hu & Wang, 2019) and contributing to urban sprawl and additional economic strain (Olanrewaju & Wong, 2020).

Sustainability has also emerged as an essential dimension in housing development. Sustainable housing incorporates economic, social, and environmental considerations to promote long-term viability and minimise environmental impacts (Mohamad et al., 2020). Features such as energy-efficient designs and green spaces improve residents' quality of life and align with Malaysia's global sustainability commitments (Rahman & Wahid, 2021). However, the high initial costs of sustainable construction remain challenging for RMM developers (Chuweni et al., 2024).

Another significant barrier is financial literacy. Many young people lack the financial knowledge to navigate home financing effectively (Sapiri et al., 2023), compounded by low awareness of schemes like Skim Rumah Pertamaku and PR1MA (Shu, 2024). Public education and financial counselling initiatives have proven crucial in equipping young adults to make informed decisions and improve homeownership rates (Abiddin et al., 2022).

This paper uniquely applies the Theory of Planned Behaviour (TPB) to the issue of youth homeownership in Malaysia, offering a behavioural perspective that extends beyond prior conceptual and policy-focused studies. This

article critically examines the intersection between affordability, sustainability, and youth-specific barriers, offering insights to inform more inclusive, responsive housing policies that better address the evolving needs of Malaysia's young generation.

LITERATURE REVIEW

A. Key Concepts and Definitions

Youth in Malaysia

In Malaysia, youth are officially defined as individuals aged 15 to 40 under the Youth Societies and Youth Development Act 2007, although amendments effective from January 2026 will narrow this range to 18 to 30 years (Berita Awani, 2023). This revision aims to better tailor policies to young adults' realities, including job insecurity, student loan burdens, and rising living costs (Krauss et al., 2020). These socio-economic pressures particularly affect their ability to achieve homeownership in high-cost urban areas (Hamzah & Zyed, 2021; Shu, 2024). While some studies (Judge et al., 2019; Masukujjaman et al., 2023) have examined behavioural intentions toward sustainable housing, limited research has focused on Malaysian youth's decision-making regarding RMM. This gap underscores the need to examine how psychological factors, such as perceived control and attitudes, shape young buyers' housing preferences.

Affordable Housing

Affordable housing (RMM) refers to housing that costs no more than 30% of a household's monthly income (Abu Bakar & Jusoh, 2017), highlighting its importance for economic stability. Despite initiatives such as PR1MA and Skim Rumah Pertamaku, many young adults continue to face barriers to homeownership due to high property costs and stringent eligibility criteria (Liu & Ong, 2021; Francis et al., 2024). Market speculation, rising land prices, and building materials further widen the affordability gap (Wong et al., 2020). Although several studies (Baig & Sarwar, 2024; Aziz et al., 2022) focus on policy and economic factors, few examine how young people perceive and respond to these challenges behaviourally. This underscores a gap in understanding of youth housing decisions, particularly in underutilising frameworks such as the Theory of Planned Behaviour (TPB).

Sustainability in Housing

Sustainability encompasses the environmental, social, and economic dimensions of housing. Research has underscored the significance of green spaces, energy-efficient systems, and water-saving technologies in enhancing livability (Gardezi et al., 2022; Rahman & Wahid, 2021; Gill et al., 2018). Despite that, sustainable features are often underrepresented in RMM due to their high upfront costs

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(Chuweni et al., 2024). While Mohamad et al. (2020) and Kampilong et al. (2024) examined the adoption of sustainable design in Malaysian housing, there is a notable lack of studies linking these features to young buyers' behavioural intentions or attitudes. This represents a significant research gap in understanding youth perceptions of sustainability trade-offs.

B. Issues and Barriers in Homeownership for Youth

Financial Constraints

Financial constraints remain a significant barrier to homeownership among young adults. The widening gap between income growth and property prices has made housing increasingly inaccessible for this group (Shu, 2024). Student debt and unstable employment prospects further limit their ability to save for down payments or manage mortgage obligations (Cai et al., 2021). Although schemes like Skim Rumah Pertamaku assist, strict eligibility criteria often reduce their effectiveness (Hamzah & Zyed, 2021; Baskaran et al., 2020). With stagnant salaries and rising debt burdens, young adults face growing challenges (Hamzah & Zyed, 2021; Cai et al., 2021). While economic barriers are widely recognised (Francis et al., 2024), further research is required to understand how these pressures influence perceived behavioural control and attitudes within the Theory of Planned Behaviour (TPB).

Location and Infrastructure Challenges

RMM projects are often far from city centres, resulting in higher transportation costs and reduced convenience (Ramli et al., 2024; Olanrewaju & Wong, 2020). Current research adopts economic or spatial perspectives, providing limited behavioural insights into how location impacts youth decision-making. Longer commuting times and rising transport expenses ultimately lower residents' quality of life (Hu & Wang, 2019). Studies emphasise that access to public transport, educational institutions, and healthcare facilities is essential for improving RMM appeal (Olanrewaju & Wong, 2020). Despite government efforts to improve housing availability in strategic locations, urban planning inefficiencies remain a significant obstacle (Francis et al., 2024).

Awareness and Financial Literacy

A lack of financial literacy and awareness about homeownership schemes remains a significant obstacle for young adults (Sapiri et al., 2023). Many are unaware of available government programmes or lack the financial skills to navigate home-buying (Abiddin et al., 2022). Therefore, financial counselling and educational initiatives are crucial in equipping youth with the knowledge to make informed decisions (Ng & Masud, 2018; Shu, 2024). Beyond financial barriers, the psychological impact of financial literacy is often overlooked.

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Improving financial knowledge can significantly enhance young people's confidence and perceived control, opening new pathways to address challenges in housing accessibility.

C. Sustainability in Affordable Housing

Sustainable housing also encompasses social dimensions, such as parks and communal areas, that enhance well-being and foster social cohesion (Zhao et al., 2021; Pfeiffer et al., 2020). Although these elements align with long-term liveability objectives, they are frequently overlooked in youth housing discussions. Hence, additional behavioural studies are required to investigate how perceptions of sustainability affect young people's housing intentions.

Environmental and Economic Considerations

Sustainable housing incorporates green technologies to reduce energy consumption and operational costs. Key features include solar panels, rainwater harvesting systems, and sustainable construction materials (Rahman & Wahid, 2021; Kampilong et al., 2024). However, the high initial costs associated with these features often deter developers and buyers (Chuweni et al., 2024). Accordingly, government incentives, such as tax exemptions and subsidies for sustainable housing projects, can mitigate these costs and promote eco-friendly development (Mohamad et al., 2020).

Social and Community Aspects

Sustainable housing also prioritises community well-being by incorporating shared public spaces, recreational areas, and green zones (Zhao et al., 2021). These elements foster social interaction, active lifestyles, and improved mental and physical health (Pfeiffer et al., 2020). Alternatively, inclusive housing policies that address the needs of low-income groups can reduce urban inequality and enhance social cohesion (Che Maznah et al., 2021).

D. Theoretical Framework: Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) offers a valuable framework for understanding young people's intentions regarding homeownership. TPB identifies three key factors influencing behaviour: attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991). While TPB has been widely applied across various fields, including housing (Judge et al., 2019; Masukujjaman et al., 2023), few studies focus on young adults' housing needs. This paper addresses that gap by applying TPB to examine the connections between affordability, sustainability, and housing intentions among Malaysian youth. Attitudes toward homeownership are influenced by affordability, sustainability considerations, and perceived ownership benefits (Ramli et al.,

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2024). Family expectations and peer influences shape decisions (Zulkifli & Ismail, 2023). Moreover, financial confidence and awareness of available assistance significantly affect young adults' likelihood of purchasing a home (Shu, 2024). The literature highlights the intricate relationship between affordability, sustainability, and financial literacy in shaping youth homeownership trends. Addressing these challenges requires coordinated actions from policymakers, developers, and financial institutions to establish inclusive and supportive housing policies. Figure 1 presents a conceptual overview of the reviewed literature, showing how demographic factors, affordability, sustainability, and barriers align with TPB components, attitudes, subjective norms, and perceived behavioural control to influence youth housing behaviour in Malaysia.

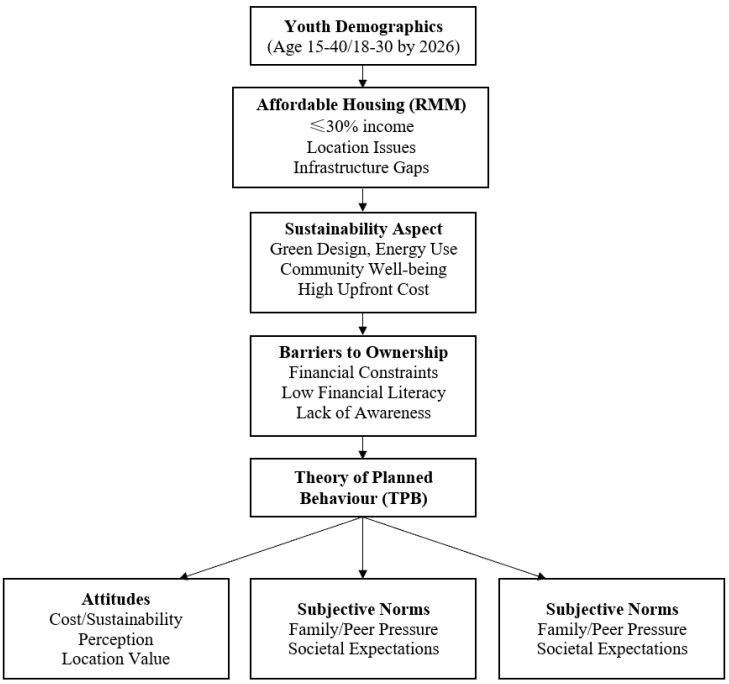


Figure 1: Conceptual Overview of Youth Homeownership Factors

THEORETICAL FRAMEWORK

Introduced by Ajzen (1991), the TPB provides a vital lens for understanding youth homeownership intentions. The TPB posits that behaviour is influenced by three key components: attitudes, subjective norms, and perceived behavioural

control. In the context of RMM, these components reflect the underlying factors that influence young people's decision-making processes.

Attitudes towards Affordable Housing
Attitudes reflect an individual's evaluation of the benefits or drawbacks of a particular action. In this case, young adults' attitudes toward RMM are influenced by location, price, sustainability features, and amenity availability (Ramli et al., 2024). Studies have demonstrated that positive attitudes toward energy-efficient homes and cost-saving features increase the willingness to purchase sustainable homes (Chuweni et al., 2024).

Subjective Norms
Subjective norms refer to the perceived social pressures from family, friends, or society to engage in or refrain from a particular behaviour (Zulkifli & Ismail, 2023). In Malaysia, cultural expectations often place significant importance on homeownership as a milestone of adulthood and financial stability. Thus, family influence and societal norms can powerfully shape home-buying decisions.

Perceived Behavioural Control
Considering external and internal constraints, perceived behavioural control reflects an individual's belief in their ability to perform a behaviour. RMM encompasses financial confidence, awareness of government assistance schemes, and the ability to obtain mortgage financing (Shu, 2024). Higher perceived control, such as understanding loan options and subsidies, boosts homeownership intentions. To enhance the TPB's relevance, this study aligns attitudes, subjective norms, and perceived behavioural control with Malaysian youth's housing challenges (see Table 1).

Table 1: Application of The Theory of Planned Behaviour in The Youth Homeownership Context

TPB Component	Youth Housing Barrier	Description & Behavioural Implications
Attitudes	• High property prices • Long-term value of sustainability	Young individuals are motivated to invest in homes for potential long-term savings from energy-efficient features, but concerns about location and accessibility may affect their purchasing decisions.
Subjective Norms	• Family expectations • Peer pressure to live in urban areas	In Malaysia, cultural and familial expectations emphasise property ownership, especially before marriage. Social comparisons also influence preferences for urban areas, despite affordability challenges.

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TPB Component	Youth Housing Barrier	Description & Behavioural Implications
Perceived Behavioural Control	• Low financial literacy • Lack of awareness of government schemes • Difficulty accessing financing	Limited confidence in financial planning and awareness of assistance schemes, such as PR1MA and Skim Rumah Pertamaku, reduces individuals' belief in their ability to purchase a home, even in RMM options.

This analysis demonstrates that the TPB provides a robust framework for understanding the processes by which young Malaysians develop housing intentions. Specifically, this framework establishes a foundation for policy recommendations informed by behavioural insights by integrating psychological factors with structural barriers.

RESEARCH METHODOLOGY

This study adopts a qualitative content analysis approach to review and synthesise findings on youth homeownership. Secondary data from journal articles, government reports, and policy documents were analysed to identify recurring themes, focusing on RMM, sustainability, and youth-specific barriers in Malaysia and internationally. Literature was sourced from databases such as Scopus, Web of Science, Google Scholar, and MyCite using keywords like "affordable housing in Malaysia," "youth homeownership," and "Theory of Planned Behaviour (TPB)." Studies published between 2017 and 2024 were included based on relevance to the Malaysian or Southeast Asian context.

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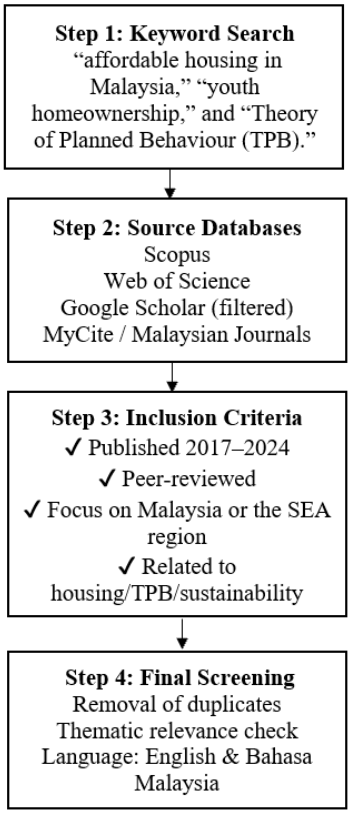


Figure 2: Flow of Content Analysis and Article Selection Criteria

Key themes include financial constraints, location and infrastructure challenges, financial literacy, and sustainability considerations. The review's limitations include potential biases from secondary sources and the possibility of overlooking recent policy shifts. Nevertheless, ethical standards were maintained through proper citation, and ethical approval was not required as no human participants were involved. Future research should incorporate primary data collection, such as surveys or interviews, to validate and expand these findings. Figure 2 summarises the analytical process. However, the study's reliance on secondary data limits its empirical depth and prevents direct validation of the proposed behavioural relationships. The absence of primary data, such as surveys or interviews, may affect the generalisability of findings, underscoring the need for future empirical validation.

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Ethical Compliance Statement
This study did not involve human participants or primary data collection. All secondary sources were cited appropriately, and the research adhered to academic ethical standards and publication integrity guidelines.

ANALYSIS AND DISCUSSION

The analysis categorised the findings into the following core themes: financial constraints, location and infrastructure challenges, financial literacy, and sustainability considerations.

A. Price and Affordability Issues

One of the most significant challenges facing Malaysian youth is the affordability of housing. The widening gap between household income growth and property prices, especially in metropolitan areas like the Klang Valley, has made homeownership increasingly difficult (Shu, 2024; Hamzah & Zyed, 2021). Rising land and building materials costs exacerbate this issue (Wong et al., 2020). Although initiatives like Skim Rumah Pertamaku aim to assist first-time buyers, stringent eligibility conditions restrict access for many young adults (Shu, 2024; Baskaran et al., 2020). Thus, affordability requires innovative financial models, such as flexible mortgage schemes, and stronger collaboration between financial institutions and policymakers (Francis et al., 2024). Furthermore, Durdyev et al. (2022) emphasised the importance of pricing strategies and perceived long-term value in shaping purchase intentions. Said et al. (2024) noted that affordability models often overlook future value considerations for youth buyers.

B. Importance of Location

The location of affordable housing (RMM) developments greatly influences their appeal and functionality. Many RMM projects are built on the outskirts of cities, where land is cheaper (Ramli et al., 2024), often leading to longer commutes and higher transport costs that negatively affect residents' quality of life (Hu & Wang, 2019). Access to public transportation, schools, and healthcare facilities is also a key factor in housing desirability (Olanrewaju & Wong, 2020). Moreover, integrated infrastructure and public perception are critical in shaping young Malaysians' preferences for housing locations (Gardezi et al., 2022; Che Maznah et al., 2021). Although government programmes like PR1MA aim to improve affordable housing availability in strategic areas, urban planning inefficiencies and market pressures remain obstacles (Francis et al., 2024). Incorporating transport hubs and public amenities into urban plans could boost RMM attractiveness (Solaymani, 2022).

C. Job Opportunities and Proximity

Proximity to employment hubs is another critical factor influencing young buyers' housing preferences. Youth are more likely to choose homes near economic centres to reduce commuting time and costs (Thanaraju et al., 2019), as the availability of job opportunities within a reasonable distance from residential areas supports financial stability and work-life balance (Zulkifli & Ismail, 2023). Nonetheless, homes in prime locations often command higher prices, creating a dilemma for young homebuyers with limited financial resources (Ramli et al., 2024).

D. Awareness of Government Housing Schemes

Financial literacy and awareness of housing schemes are crucial in shaping homeownership rates among young adults (Sapiri et al., 2023). However, many remain unaware of their eligibility for government programmes like PR1MA and Skim Rumah Pertamaku (Abiddin et al., 2022), resulting in missed opportunities. A lack of knowledge about financing options and the home-buying process continues to pose barriers. Educational initiatives and financial counselling are essential to enhance financial literacy (Ng & Masud, 2018), helping youths manage budgets, understand loan terms, and make informed decisions (Shu, 2024). Furthermore, housing schemes often fail to reach the youth effectively (Liu & Ong, 2021), highlighting the need for stronger awareness campaigns to influence ownership behaviour (Masukujjaman et al., 2023).

E. Community and Environmental Sustainability

Sustainability features, such as energy-efficient designs and renewable energy sources, are essential in housing developments (Rahman & Wahid, 2021). These elements reduce environmental impact and lower long-term costs (Gill et al., 2018), although high initial expenses may discourage developers and buyers (Chuweni et al., 2024). Community amenities like parks and shared spaces foster social cohesion and improve residents' well-being (Zhao et al., 2021; Pfeiffer et al., 2020). Balancing cost-efficiency and quality is crucial to make sustainable homes accessible to young buyers (Mohamad et al., 2020). Incorporating innovative technologies and community happiness indicators can further boost sustainability (Mohamad et al., 2020). Additionally, young adults are more likely to adopt eco-friendly homes when they perceive greater lifestyle value (Masukujjaman et al., 2023).

F. Addressing Barriers through Policy Interventions

Policies are crucial in supporting young people aspiring to own homes. Government assistance, tax incentives, and public-private sector collaboration can help lower homeownership costs (Francis et al., 2024; Baig & Sarwar, 2024).

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Agencies, banks, and developers must work together to deliver affordable, sustainable, high-quality homes (Aziz et al., 2022). Policies should consider behavioural influences on decision-making (Judge et al., 2019), while incentives for green-certified homes could address affordability and sustainability challenges (Chuweni et al., 2024). Integrated urban planning linking transport, jobs, and services fosters vibrant communities (Syed Jamaludin et al., 2018). Public awareness and financial education are also vital (Sapiri et al., 2023).

G. Findings Table: Relationship between TPB Components and Housing Factors

Table 2: Mapping TPB to Youth Housing Challenges

TPB Component	Related Findings	Supporting Literature and Behavioural Insights
Attitudes	• Positive perception of sustainable features (e.g., energy efficiency, green spaces). Negative attitudes towards distant homes due to commuting costs.	Research indicates that younger buyers prefer homes with sustainable features due to long-term benefits (Rahman & Wahid, 2021). Additionally, long commutes can negatively impact job access and work-life balance, discouraging housing choices (Hu & Wang, 2019).
Subjective Norms	• Family expectations influence homeownership decisions. • •Peers shape urban living preferences.	Cultural and familial norms pressure youth to buy property (Zulkifli & Ismail, 2023), while peer comparisons drive urban housing preferences (Hamzah & Zyed, 2021).
Perceived Behavioural Control	• Financial literacy and confidence in managing housing loans. • Awareness of government schemes (e.g., PR1MA, Skim Rumah Pertamaku).	Enhanced financial knowledge strengthens perceived behavioural control (Sapiri et al., 2023), while low awareness of assistance reduces access opportunities (Abiddin et al., 2022).

Note: 20 of the 37 reviewed articles were reported to be directly relevant to the TPB framework. These were thematically synthesised to align specific youth housing barriers with the behavioural constructs of attitudes, subjective norms, and perceived behavioural control.

Table 2 maps findings from reviewed studies, showing how Malaysian youth housing challenges align with TPB constructs. This framework offers a behaviourally informed view of homeownership intentions. Relevant articles were synthesised to examine how attitudes, subjective norms, and perceived behavioural control relate to key challenges to youth homeownership.

H. Summary of Findings

The findings reveal ongoing challenges in enhancing youth access to RMM, including financial constraints, limited housing supply in well-connected urban

areas, and a lack of awareness about government housing schemes. Previous studies have often isolated these factors without using a comprehensive framework like the TPB. This study aligns these challenges with TPB components—attitudes, subjective norms, and perceived behavioural control—offering a deeper understanding of youth homeownership dynamics. A multifaceted approach is vital for Malaysian youth to access equitable, affordable housing. Key steps include increasing public awareness, integrating sustainability, and expanding financial support to create an inclusive housing landscape for long-term socio-economic stability.

I. Future Empirical Validation Using TPB

Future research could empirically test the conceptual framework developed in this paper by employing TPB-based survey instruments or structural equation modelling. Such quantitative validation would strengthen understanding of how attitudes, subjective norms, and perceived behavioural control influence youth housing decisions across different regional and socio-economic contexts.

CONCLUSION

This research integrates the Theory of Planned Behaviour (TPB) to explore youth homeownership in Malaysia, addressing affordability and sustainability challenges. Malaysian youth face significant hurdles, including financial constraints and rising property prices, exacerbated by limited housing options and low financial literacy. While government initiatives like Skim Rumah Pertamaku exist, their effect is hindered by strict eligibility requirements and low awareness. The study analyses young people's homeownership intentions in terms of attitudes toward sustainability, social influences, and perceived financial control, highlighting the need for sustainable housing that improves quality of life. Policy recommendations include enhancing financial literacy, expanding urban housing options, and fostering collaboration among government, financial institutions, and developers. However, reliance on secondary data has limitations, suggesting that future research should collect primary data to capture diverse regional contexts. Addressing youth homeownership challenges requires a comprehensive approach that emphasises affordability, accessibility, and sustainability, while fostering inclusive policies and public awareness to promote socio-economic stability.

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INSTITUTIONAL APPROACH TO ADDRESS DELAY IN WATER ASSET LAND OWNERSHIP WITHIN WATER SERVICES RESTRUCTURING REGIME

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Abstract

This paper highlights the importance of in-depth exploration of the institutional dynamics shaping water asset land ownership within Malaysia's restructured water services industry, focusing particularly on the pivotal role played by PAAB. Despite PAAB's proactive efforts, the industry faces persistent challenges that have resulted in significant delays in the land alienation process for water assets. These challenges have raised concerns among industry stakeholders. Notably, early adopters of industry restructuring have encountered issues during the land alienation process, with Negeri Sembilan and Johor experiencing notable hurdles. Employing institutional theory as a guiding framework, this research seeks to comprehensively examine these challenges and propose effective solutions. Through semi-structured interviews conducted with twelve respondents in Negeri Sembilan and Johor, the study identifies and analyses fifteen internal and external challenges that hinder progress in water asset land ownership. By considering normative, rational choice, historical, and empirical approaches, the study aims to recommended a solution by involving the cooperation of state and federal governments for water asset land ownership, with a focus on implementing proactive measures to enhance industry efficiency and effectiveness.

Keywords: Institutional Approach, Land Title and Water Assets Land Ownership

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INTRODUCTION

The global urban population has surged dramatically, from 1.019 billion in 1960 to 4.117 billion in 2017, with projections indicating further growth to 9.7 billion by 2050, leading to pressing water challenges such as scarcity and degradation of water quality in urban areas (UN DESA, 2019; The World Bank Group, 2018). Factors contributing to these challenges include population expansion, uncontrolled development, and industrial and agricultural growth (Intan & Nor Ashikin, 2012). Despite the historical roots of water management in Malaysia dating back to the 19th century, the sector faces increasing complexity due to urbanization, rising water consumption, pollution, land use conflicts, and climate change, necessitating comprehensive water governance strategies and restructuring efforts to ensure sustainable water resource management (Jiada Li *et al.*, 2020). In Malaysia, the restructuring of the water services industry aims to enhance efficiency, quality, and long-term sustainability, but challenges persist, particularly concerning land ownership processes, highlighting the need for a deep understanding of the dynamics of land ownership within the restructured industry to optimize its benefits and ensure seamless operations (Nariman & Azhar, 2017; Ching, 2012).

Spearheading this transformation is Pengurusan Aset Air Berhad (PAAB), an essential entity entrusted with acquiring water supply assets and the corresponding land from state water operators. The acquired assets are subsequently leased back to the state water operators for a stipulated period, typically 45 years. However, amidst the comprehensive restructuring efforts, particular challenges have arisen in the land ownership process, mainly regarding the alienation of land titles to PAAB. Several land applications have encountered delays or remain unapproved, posing significant concerns and complexities in water asset land ownership. The institutional approach, which integrates rational-choice institutionalism, old institutional economics, and new institutionalism, provides a comprehensive framework for understanding the dynamics and implications of these restructuring efforts across diverse socio-economic contexts (Silva *et al.*, 2023). Within this context, water asset land ownership plays a pivotal role in shaping the operational landscape and strategic direction of restructured entities. This paper seeks to explore the interplay between institutional approach and the challenges in water asset land ownership within the restructured water services industry, focusing on Malaysia's evolving regulatory framework and institutional arrangements.

LITERATURE REVIEW

The review of the existing literature is composed of three themed subsections. First is an overview of the restructuring of the water supply, followed by the

process and challenges of land ownership for water assets, and lastly, the significance of the institutional approach in water asset land ownership.

Overview Of The Water Supply Restructuring

The establishment of the National Water Services Commission (SPAN) in January 2008 marked a significant step in Malaysia's water services restructuring, supported by the Federal Government's development of a holistic model focused on efficiency, competitiveness, and sustainability (Phang Wai Leng *et al.*, 2016). This restructuring aims to regulate, supervise, and monitor the industry, with PAAB providing essential funding for capital expenditures (Nariman & Azhar, 2017). The Federal Government's involvement has established a holistic model for the national water services industry, emphasizing efficiency, effectiveness, competitiveness, and sustainability. In this model, PAAB assumes State Government loans initially held by concession companies, while state governments and operators transfer land ownership and sell water assets to PAAB at book value. PAAB then leases these assets back to state operators for 45 years, also taking responsibility for constructing new infrastructure and managing repairs and upgrades. The restructuring aims to enhance water and sewerage services for both consumers and environmental sustainability (SPAN, 2019).

Process and Challenges of Land Ownership for Water Assets

Land ownership of water assets is essential for effective water resource management and successful execution of Malaysia's Water Supply Service Industry Structuring Agreement. According to PAAB (2022), the State Government must grant ownership to the Federal Government's applicant agency to support seamless restructuring. Under this model, PAAB assumes State Government loans initially transferred to concession companies and enters a 45-year leaseback with state water operators, while managing new infrastructure, repairs, and upgrades. Key restructuring functions are assigned to various entities: government, regulation (SPAN), asset ownership (PAAB), and service provision (state water company). Efficient asset transfer is essential for addressing rising water demands and promoting sustainability, with land ownership for water supply achievable through land alienation, transfer, or acquisition.

Table 1: PAAB Application for Land Ownership Through Water Supply

NO.	STATE / AGREEMENT	APPLICATION DATE		APPROVED	(%)	OWNERSHIP (TITLES)	(%)	NOT YET ISSUED THE TITLE
1	Melaka	17/12/2008	107	100	93.46	99	92.52	8
2	N.Sembilan	31/12/2008	567	488	86.07	435	76.72	132
3	Johor	11/03/2009	547	377	68.92	294	53.75	253
	TOTAL		**1,221**	**965**	**79.03**	**828**	**67.81**	**393**

Source: PAAB (2022a)

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The National Audit Report (2019) highlights that Melaka, Negeri Sembilan, and Johor were among the first states to agree to restructure the water supply service industry in 2008 and 2009. As of September 2022; 1,221 sites were submitted for land alienation, yet only 828 received titles, despite over a decade since the initial agreements as illustrated in Table 1. This delay calls for in-depth analysis to identify contributing factors and explore solutions to expedite the land alienation process, supporting effective implementation of the industry restructuring.

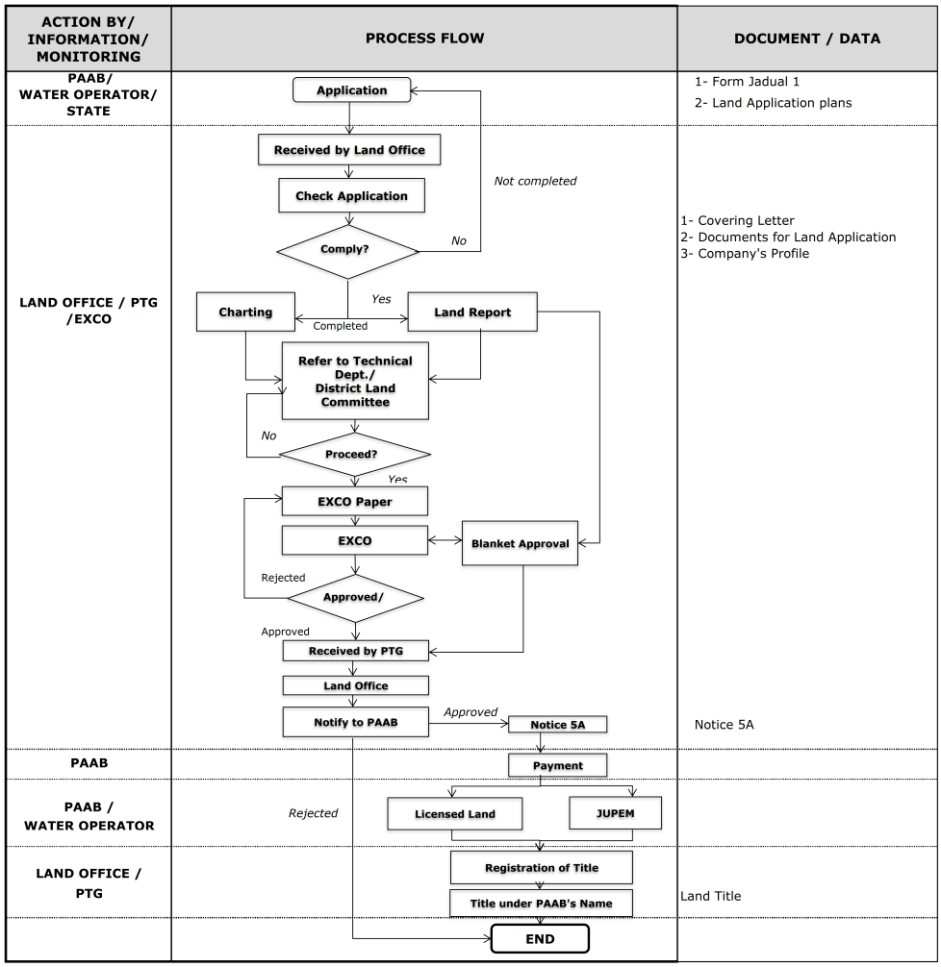


Figure 1: Standard Operating Procedure (SOP) for Land Alienation
Source: PAAB (2022b)

Figure 1 outlines the Standard Operating Procedure (SOP) for Land Alienation from start to finish. Once an application is complete, it is submitted to MMKN for approval or rejection. If approved, the application is returned to the District Land Office, which then issues an approval letter (Notice 5A) to PAAB, specifying the payment due within a set timeframe. PAAB must make the payment promptly to facilitate the issuance of the land title. However, despite payment, PAAB reports delays in title issuance, raising concerns. Figure 2 details the process and timeline for issuing land titles, taking a minimum of seven months or 213 working days. The process may be delayed further if only one officer handles PAAB applications, especially if that officer is unavailable. The officer's responsibilities include preparing a land report, conducting site visits, and obtaining feedback from the technical department, which is required for the application to advance. Delays in receiving these inputs render applications incomplete, impeding progress. The following sections will analyse these challenges and propose strategies to streamline the land alienation process, supporting the restructuring of the water supply service industry.

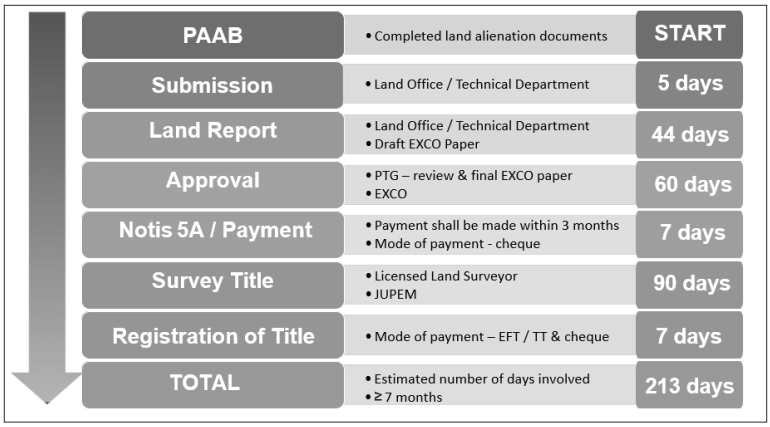


Figure 2: Process Flow and Timeline for Land Alienation Title Issuance
Source: JKPTG (2013)

In conclusion, land ownership for water assets is essential for achieving water restructuring goals and ensuring fair access to water resources. Issuing titles and transferring ownership smoothly are key to providing legal assurance for landowners and supporting sustainable water management. This study is valuable as it explores the restructuring of Malaysia's water supply service industry, examining the motivations, policies, and stakeholder roles involved. It aims to address challenges related to delays in water asset land ownership and offers solutions through an institutional approach, providing insights relevant to Malaysia.

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Significance of the Institutional Approach in Water Asset Land Ownership

Institutionalism, originating from the late 19th century, has deeply impacted social sciences by highlighting the role of institutions in shaping human behavior and societal structures (Tom Kauko, 2019; Maxfield & Peters, 2020). In water resource management, institutional theory provides valuable insights into governance, regulations, and stakeholder roles, influencing policy and practice (Scott, 2008; Bakker *et al.*, 2018). Its applicability also spans international business and organizational studies, underscoring its role in understanding organizational adherence to rules and norms (Sahin & Mert, 2022; Scott & Meyer, 1983). Institutional theory's adaptability remains relevant, supporting various paradigms like policy-making and social analysis by addressing how institutions influence policies, collaboration, and resource sustainability (Richard Hoefer, 2022; Ostrom, 2011).

The theory's interdisciplinary reach helps explain the creation and evolution of institutions through human interactions, which shape organizational behavior and societal norms (John & Mattea, 2017). By linking theoretical concepts with practical applications, institutional theory guides the understanding of complex institutional systems, such as in restructured water services, where it highlights governance, stakeholder interactions, and policy impacts (Bakker, 2010; Struckell *et al.*, 2022). Furthermore, institutional theory delves into how organizations interpret productive activities with humanitarian and aesthetic considerations (Chowdhury, 2015). Despite its breadth, institutional theory is less prominent in fields like social work due to its wide-ranging branches, with foundational approaches including normative, rational choice, historical, and empirical models, as outlined by Peters (2000) and shown in Table 2.

The Normative Institutional Approach highlights how authorities shape policies based on institutional norms, emphasizing the influence of institutional regulations on behavior, contrasting with individualism (Maxfield & Peters, 2020). Chowdhury (2015) discusses how interactions between powerful agencies and organizations can create misalignments, impacting institutional dynamics. Meanwhile, The Rational Choice Approach centers on maximizing benefits within institutional limits, illustrating how individuals can influence institutions through their values (Hoefer, 2022).

Historical Institutionalism integrates past regulations and practices, showing how historical power dynamics affect current policies, with a focus on institutional origins (Maxfield & Peters, 2020; Hoefer, 2022). The Empirical Institutional Approach emphasizes formal structures and their role in government efficiency (Hoefer, 2022; Peters, 2000). Neo-institutionalism examines the real-world impacts of institutional arrangements (Maxfield & Peters, 2020). Collectively, these approaches, as reflected in Table 2, establish a conceptual

foundation for analysing the institutional dynamics underlying water asset land ownership within Malaysia's evolving governance framework.

Table 2: Institutional Approach Mechanism

NO.	APPROACH	CONCENTRATION
1	Normative	The Normative Institutional Approach demonstrates the role of authorities in formulating specific policies based on institutional regulations and processes.
2	Rational Choice	The Rational Choice Approach refers to decisions made to maximize benefits and uphold priorities, even if they are constrained by institutions, despite not aligning with existing regulations and policies.
3	Historical	The Historical and Background Institutional Approach refers to incorporating past ideas, regulations, and processes into an organization's practices, which continue to be implemented to this day.
4	Empirical	The Empirical Institutional Approach is based on old institutions that focus on formal government structures, regulations, and their implementation to ensure smooth workflow and achievement of objectives.

Sources: Peter (2000), Maxfield & Peters (2020) & Hoefer (2022)

In water asset land ownership, the institutional approach clarifies the dynamic between formal structures and individual actions, shaped by historical factors. Normative institutionalism stresses the role of authoritative agencies, while rational choice institutionalism highlights individual influence on institutions. Historical institutionalism points to the lasting impact of past policies on present decisions, providing a comprehensive view of organizational adaptation in water asset management.

RESEARCH METHODOLOGY

This study uses a qualitative approach, conducting semi-structured interviews with 12 key informants involved in various stages of the application process for water asset land ownership. These informants, chosen through purposive sampling, include senior officials from PAAB, District Land Offices, State Economic Planning Units, Land and Mines Offices, regulatory bodies, and ministries, representing both Negeri Sembilan and Johor due to their early adoption of water restructuring agreements. With high application numbers, these states were selected for in-depth analysis alongside federal bodies like the MTN, PETRA, PAAB, and JKPTG Federal.

Using narrative descriptive analysis, this methodology enables a detailed exploration of qualitative data, constructing a narrative to capture themes and nuances within the research. This approach aims to identify challenges and recommend collaborative solutions for water asset land ownership, with insights

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from respondents shaping the findings. Through this analysis, the study seeks to clarify complex institutional interactions and contribute to the broader discourse on water asset land ownership.

This study relied primarily on descriptive analysis to interpret qualitative responses from key informants. While this approach provides rich contextual understanding, it limits the ability to generalize findings statistically across broader rural tourism or land administration settings. Future research may employ inferential techniques to test relationships between variables and strengthen the robustness and external validity of the conclusions drawn.

Ethical Considerations

This study complied with the research ethics requirements of Universiti Teknologi Malaysia. All participants were informed of the study's purpose, and informed consent was obtained before the interviews. Respondent confidentiality was strictly maintained, and no personal or sensitive information was disclosed.

ANALYSIS AND DISCUSSION

The findings in this section present a narrative-descriptive analysis of the challenges contributing to delays in water asset land ownership and the strategies proposed to overcome them through an institutional approach. Insights were derived from in-depth interviews with twelve key informants representing federal and state agencies involved in land administration and the restructuring of Malaysia's water services industry, as summarized in Table 3.

Challenges in Water Asset Land Ownership Delays

Land administration plays a crucial role in facilitating land transactions, development projects, and resource management. However, its effectiveness is often constrained by both internal and external factors. Respondents highlighted a range of operational and procedural issues affecting their ability to process applications efficiently.

Internal Challenges

The study identified several internal challenges that hinder the efficiency of land administration processes. These include excessive workloads among Assistant Land Officers, inadequate logistical resources such as vehicles for site inspections, substantial backlogs of pending applications, and time constraints encountered by duty officers. Additionally, inconsistencies in procedural guidelines, limited staff competency, deferred decision-making, shortages of technical personnel, missing or incomplete documentation, and delays in obtaining inter-departmental feedback were frequently reported. Collectively, these organizational constraints originate within the administrative system itself

and significantly impede the overall effectiveness and timeliness of land ownership processing, as summarized in Table 3.

Table 3: Challenges Contributing to Delays in Registering Ownership

NO	INTERPRETATION OF CHALLENGES	INTERNAL CHALLENGES	EXTERNAL CHALLENGES
1	High duty burden of Assistant Land Officer	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10 & R11	R12
2	Lack of vehicles to go site visits to prepare a land report	R1, R2, R3, R4, R5, R6, R7, R9, R10, R11, & R12	R8
3	A large and growing backlog of applications (Increasing number of applications)	R1, R2, R3, R4, R5, R6, R7, R8, R9, R11, & R12	R10
4	Time constraints of the officer on duty (Ad-hoc duties)	R1, R2, R3, R4, R5, R6, R7, R8, R9, R11, & R12	R10
5	The flowchart procedures include too many levels and stages (Varying instructions and procedures)	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, & R12	-
6	Lack of knowledge among staff	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10 & R12	R11
7	Involvement and postponement of decisions of the District Land Committee & MMKN	R2, R3, & R8	R1, R4, R5, R6, R7, R9, R10, R11, & R12
8	Lack of staff, especially technical staff, in the respective unit	R2, R3, R4, R8, R10, R11, & R12	R1, R5, R6, R7 & R9
9	File Missing and File Not Found	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, & R12	-
10	Incomplete Application	-	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, & R12
11	Delay in receiving feedback from the other parties (applicant, technical department)	-	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, & R12
12	Change of officers / Moving staff to another unit/section	R2, R3, R4, R8, R9, R11, & R12	R1, R5, R6, R7 & R10
13	High task load with others tasks and full of the meeting schedule	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, & R12	-
14	Changing of applicant's address	-	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, & R12
15	The application was rejected due to land status (resubmit)	-	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, & R12

Source: Author's own research (2024), based on interviews with Respondents R1–R12

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Analysis and Insights

The findings reveal that delays in land ownership processes are shaped by an overlap of internal and external challenges, demonstrating the interconnected nature of land administration systems. Common themes include limited resources, procedural complexity, and inconsistent communication among stakeholders.

To improve efficiency, respondents suggested several measures: streamlining procedures, enhancing staff training, strengthening inter-agency collaboration, leveraging digital systems for monitoring, and advocating for supportive regulatory reforms. Addressing these factors collectively is essential to ensure effective land governance and timely issuance of titles for water assets.

Institutional Approach in Addressing Delays

Collaboration between federal and state agencies plays a pivotal role in accelerating the processing of land ownership applications for PAAB. Insights from respondents reveal that various institutional approaches—namely normative, rational choice, historical, and empirical institutionalism—provide complementary perspectives for addressing these administrative challenges. The integration of these approaches underscores the importance of coordinated governance and adaptive policy mechanisms, as illustrated in Table 4.

Normative Institutional Approach

Respondents emphasized the need for clear, consistent, and practical policies across federal and state levels. A strong normative framework, grounded in fairness, transparency, and accountability, is vital to reduce workload imbalances, minimize procedural ambiguity, and improve decision-making efficiency.

Rational Choice Institutional Approach

While some respondents viewed rational choice decision-making as essential for managing backlogs, delays, and incomplete applications, others expressed concern about its inconsistency with established policies. They suggested that rational choices should be guided by institutional principles to ensure equity and alignment with long-term governance objectives.

Historical and Background Institutional Approach

Respondents highlighted the importance of understanding historical practices to inform current policies. Reviewing past processes enables the identification of systemic bottlenecks—such as file management inefficiencies and staff turnover—while supporting continuity and adaptation to modern administrative requirements.

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Table 4: Institutional Approach and Key Recommendation

NO	APPROACH	CHALLENGES	RESPONDENT
1	Normative	(i) High duty burden of Assistant Land Officer (ii) Complex flowchart procedures (iii) Staff shortage (iv) High task load (v) Application rejection due to land status	All respondents agreed that the policy needs to be clear, uniform, practical, and comprehensive as a guideline at the federal and state levels.
2	Rational Choice	(i) Backlog of applications (ii) Involvement and postponement of decisions (iii) Incomplete applications (iv) Changing applicant addresses	R3, R4, R5, R6, R9, R10 & R12: Rational Choice decisions are necessary, but caution must be exercised to ensure that the justifications provided are relevant to the current situation and benefit all parties. R1, R2, R7, R8 & R11: The Rational Choice institution is concerned that every decision made is inconsistent and unfair because it contradicts existing rules and policies.
3	Historical	(i) Time constraints of officers (ii) File management issues (iii) Staff turnover	All respondents agreed that regulations and processes closely related to history and background should be periodically reviewed and improved to keep pace with the times, technology, and national development.
4	Empirical	(i) Lack of vehicles for site visits (ii) Lack of knowledge among staff (iii) Delay in receiving feedback	All respondents agreed that the empirical institution is very helpful, especially regarding the structure, regulations, and practices that have been implemented to make decisions. It needs to be improved according to the times so that the laws are current and relevant

Source: Author's own research (2024), based on interviews with Respondents R1–R12

Empirical Institutional Approach

Empirical evidence was regarded as a key driver for informed decision-making, particularly in addressing gaps in staff capability, logistical constraints, and

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response delays. Respondents recommended that data-driven approaches be regularly updated to ensure their relevance and applicability to evolving administrative contexts.

Integrative Perspective

Table 5 summarizes the implications of these institutional approaches, emphasizing the importance of adaptive policy reform that balances fairness, consistency, and efficiency. Respondents collectively supported interdisciplinary solutions that integrate normative, historical, and empirical insights for more effective land governance. Continuous policy review and technological adaptation were considered essential to maintaining institutional responsiveness and supporting Malaysia's broader development goals.

Table 5: Implications of Institutional Approaches in Land Administration

NO	APPROACH	RESPONDENT PERSPECTIVE	IMPLICATION
1	Normative	Emphasizes the importance of clear, uniform, practical, and comprehensive policies at Federal and state levels to address challenges.	Policy reforms should prioritize clarity, uniformity, and practicality to enhance the effectiveness and fairness of land administration processes. Normative approaches provide essential guidance for stakeholders, ensuring consistency and transparency in decision-making.
2	Rational Choice	Acknowledges the necessity of rational decision-making but expresses concerns about inconsistencies and unfairness in decision-making processes.	Combining insights from various institutional approaches offers a holistic approach to tackling challenges. Rational choice decisions must be relevant to the current situation and benefit all parties involved.
3	Historical	Stresses the importance of periodically reviewing and improving regulations and processes in line with historical background and development.	Regular review and updating of regulations and practices are essential to keep pace with evolving technologies and national development goals. Historical insights inform adaptation to meet contemporary needs.
4	Empirical	Recognizes the usefulness of empirical evidence in decision-making but highlights the need for continuous improvement to ensure relevance and currency.	Leveraging empirical evidence and data-driven approaches optimizes decision-making processes. Continuous improvement ensures regulations and practices remain relevant and aligned with changing circumstances.

Source: Author's own research (2024), based on interviews with Respondents R1–R12

The comparative analysis presented in Table 5 also highlights the interdependence of these institutional dimensions. The normative and rational choice approaches provide the ethical and strategic foundations for administrative decision-making, while the historical and empirical approaches contribute contextual understanding and evidence-based validation. Integrating these perspectives fosters a holistic institutional framework capable of improving the procedural efficiency, accountability, and transparency of land ownership processes.

Building upon these findings, this study underscores the value of strengthening the analytical dimension of institutional research. While the current analysis relied primarily on descriptive and narrative methods to interpret stakeholder perspectives, future research could employ basic inferential techniques—such as chi-square tests or cross-tabulations—to statistically validate the observed institutional patterns and enhance the generalizability of the findings across broader governance contexts.

Implementing Institutional Approaches through Task Force Coordination

The establishment of task force monitoring and coordination meetings exemplifies the practical implementation of institutional principles aimed at enhancing the efficiency and transparency of land ownership processes. These platforms serve as collaborative mechanisms that align federal and state stakeholders toward common objectives, facilitate systematic information sharing, and promote collective accountability, as illustrated in Figure 3.

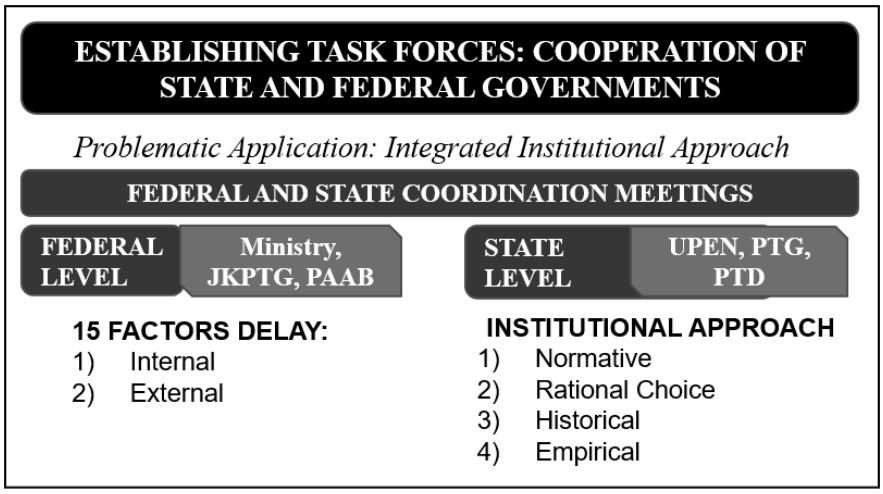


Figure 3: Cooperation Between Federal and State Agencies in Coordination Meetings
Source: Author's own research (2024)

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Such coordination mechanisms promote transparency, flexibility, and proactive problem-solving. They also support capacity building by ensuring that officers receive adequate resources and training to handle complex applications effectively. Ultimately, this institutionalized cooperation enhances accountability, streamlines administrative workflows, and strengthens intergovernmental collaboration toward more efficient and sustainable land ownership management within the water services restructuring framework.

CONCLUSION

This study identified fifteen key challenges contributing to delays in the issuance of water asset land ownership titles in Malaysia. These challenges stem from a combination of bureaucratic inefficiencies, procedural inconsistencies, limited resources, and coordination gaps among federal and state institutions. The application of an institutional approach has proven valuable in addressing these barriers by enhancing process efficiency, governance transparency, and stakeholder collaboration. Institutional frameworks—namely the Normative, Rational Choice, Historical, and Empirical Institutionalism approaches—provide complementary perspectives for navigating regulatory complexities and improving administrative performance. By integrating these institutional dimensions, agencies can develop adaptive mechanisms that balance policy coherence, procedural consistency, and resource efficiency, thereby supporting more sustainable land administration practices. The study also underscores the importance of task force monitoring and coordination meetings as practical institutional mechanisms that promote intergovernmental cooperation. Such collaborative platforms enable proactive problem-solving, accountability, and knowledge sharing, which are crucial for accelerating land title issuance and achieving the broader objectives of the water services restructuring programme. Beyond its direct implications for the water sector, this research contributes distinctively to the institutional and governance literature by demonstrating how intergovernmental coordination mechanisms can effectively mitigate ownership delays in complex, multi-stakeholder systems. Furthermore, the institutional lens adopted in this study offers transferable insights applicable to homestay and community-based tourism initiatives, particularly within Malaysia's coastal and island regions, where land tenure security, institutional alignment, and local participation are equally critical to sustainable development. Overall, this study reinforces that adopting integrated institutional approaches can streamline land registration processes within the restructured water services industry, strengthen collaborative governance, and ensure that sustainable development goals are achieved through timely and transparent land ownership practices.

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ASSET MANAGEMENT USING PESTLE-SWOT ANALYSIS: STRATEGIC ASPECTS FOR INTEGRATED DAM CATCHMENT MANAGEMENT

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Abstract

Dam is generally utilised for flood control, water supply, recreation, and minimising the effects of increasing runoff due to changes in land use brought about by real estate developments. However, it is found that current work practice is only focusing on dam's operations and overlook on the dam catchment activities such as land encroachment, land use activities, and other possibility of being polluted by surrounding land use activities. Due to various activities surround catchment, it is important for management to discover strategic aspects for integrated dam catchment management to ensure any issues pertaining catchment area are integrated into the planning process. Therefore, this study aims to discover strategic aspects for dam catchment management to be more integrated in managing dam assets including its land and buildings using PESTLE-SWOT analysis. A mixed-method approach is adopted, involving focus group discussions with stakeholders and analysed using content analysis and descriptive analysis. The findings highlight technological and legal factors as the most critical dimensions for ensuring long-term dam sustainability and effective governance. This study provides a framework that bridges dam operations, asset management, and environmental planning, contributing to more resilient and sustainable dam catchment management practices aligned with national water resource and sustainability goals.

Keywords: Dam catchment, asset management, PESTLE-SWOT, real estate

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INTRODUCTION

Real estate covers a huge scope of functions, including operational real estate. Within Malaysian context, Machap Dam is owned by the government which has prompted to manage their assets in a more systematic and effective way since their operations plays a significant role in the infrastructure of the Johor state and brought impacts on the state's economy and its inhabitants. Generally, Machap dam is utilised for flood control, water supply, recreation, and minimising the effects of increasing runoff due to real estate developments. In this context, dam can be considered as an entity of physical asset that can create, sustain, or destroy values at any stage in its life cycle.

Apart from the benefits, there is also a possibility where the water can be polluted due to human activities on land which could create dam issues, especially from the land use activities (Ayman, 2021; Yaacob, 2021). The complexity of managing these assets that lies in their engineering operations have overlook on the supervision of the land and ecosystem that surrounds them, which are often subject to competing land uses, encroachment, and environmental degradation. This concludes that dam catchment activities also need to be monitored to avoid any possibility of being polluted by surrounding land use activities, while making its communities a part of the overall effort through a structured SWOT analysis (Ghorbani & Hamidifar, 2021), complemented by a PESTLE framework to assess the external opportunities and threats (Srdjevic et al., 2012; Buye, 2021).

This supports Malaysia's Twelfth Malaysia Plan (2021–2025), the National Water Resources Policy (2012), and the Malaysia Dam Safety Management Guidelines (2017) by employing PESTLE–SWOT framework that allows policymakers to systematically link macro-environmental drivers such as political, legal, economic, social, technological, and environmental factors with operational realities at the site level including its building and land. This integration enhances the government's capacity to align dam management practices with broader national sustainability objectives such as the Sustainable Development Goals (SDG 6: Clean Water and Sanitation) and Malaysia's National Water Sector Transformation 2040 (WST 2040) agenda. In a meantime, Ijlil et. al (2025) highlighted that Integrated Water Resources Management (IWRM) is a crucial process for sustainable and equitable water resource use, by using SWOT analysis to reveal the current water management framework, including local stakeholders' perceptions.

From this, there is a urgent need for the government to implement specific measures to maximise the management effectiveness of its assets by establishing specific department of units to control or supervise management functions relating to real estate assets (Abdullah et al., 2011). Dam asset management involves the systematic evaluation of dams as physical assets,

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considering their lifespan, criticality, operational history, maintenance, and long-term financing (Quader & Kabir, 2025). It concludes that role of dam asset management in supervising an assets and involvement of day-to-day operations at the site surround dam catchment area is significant to identify possibilities of risk or problem that bring negative impacts to all parties concerned related to dam catchment.

As it is advisable to integrate asset management to apply a holistic planning on the preservation of an asset throughout its whole life cycle, it is important for management to discover strategic solutions for integrated dam catchment management as part of a preventive measures and holistic approach in ensuring any issues pertaining to catchment area are integrated into the planning process. Therefore, this study aims to discover dam catchment management to be more integrated in managing dam assets including its land and buildings using PESTLE-SWOT analysis. There are two objectives outlined in this study which are 1) To identify PESTLE factor towards dam catchment management, and 2) To assess PESTLE-SWOT effect for integrated dam catchment management. Overall, this study is significant in bridging the gap between dam operations and dam assets governance including its land and buildings through a multi-dimensional analytical framework.

LITERATURE REVIEW

Dam Management Guidelines

In Malaysia, Department of Irrigation and Drainage (JPS) has established a national guideline on dam safety management for a safe governance of dams and resilient community surrounding the dams in Malaysia, which is Malaysia Dam Safety Management Guidelines (MyDAMS) in 2017. This guideline includes dam safety aspects comprising legal requirements, potential hazards, safety principles, safety management system, investigation, design, construction, commissioning, operation and maintenance, surveillance and safety review, rehabilitation, emergency preparedness, changes and decommissioning of dams.

To add, MyDAMS also noted the encouragement of dam owners to view proper dam safety management as a key element of their overall risk and asset management strategies whilst must be sustained since it is an important long-lasting asset to the society. However, Toh et al. (2020) in their study highlighted that there is still a major gap towards MyDAMS implementation into the dam industry and proposed a way forward framework to be carried out with various stakeholders.

Apart from that, Finland, New Zealand, Auckland also have established dam safety guidelines namely as Dam Safety Guide (2012) produced by the Centres for Economic Development, Transport, and the Environment, Dam Safety Guidelines (2015) published by the International Commission on Large

Dams (ICOLD), as well as Dam Safety Guidelines published by Auckland Regional Council (n.d.), respectively. All guidelines are also highlighted dam safety aspects comprising legal requirements, potential hazards, safety principles, safety management system, investigation, design, construction, commissioning, operation and maintenance, surveillance and safety review, emergency preparedness, and lifecycle management.

However, Okhovat (2021) claimed that there is a gap pertaining to New Zealand Dam Safety Guidelines whereby there is absence of comprehensive legal binding scheme to monitor and maintain the structural integrity of dams. Furthermore, the dam assets in Finland are believed to ageing and more education relating to dam safety is needed to upgrade and improvise the dam development (Isomaki, 2021). From this point of view, these scenarios contribute to the advancement of strategic planning in sustaining the existing dam by appointing an asset manager to handle, control, and conduct dam work practices to achieve dam owner's goal.

PESTLE-SWOT Analysis Relating to Dam Operations

In the process of decision making and the development of strategic plan, it is important to identify key elements that affects the business or situation. As claimed by Gurel (2017), SWOT and PESTLE analysis provide highly effective analysis tools which could assist an organisation during the process of strategic planning development. SWOT analysis could interpret the findings for the business to determine the strengths and weaknesses, as well as opportunities and threats. As for the PESTLE analysis, it considers the broad environmental context that affects the business and the changes occur which aims to guide the planning and strategic decision making, as well as to determine the potential issues or events that could impact the organisations (Buye, 2021).

PESTLE analysis facilitates the inclusion of diverse stakeholder perspectives by highlighting the social and political dimensions of dam management. This engagement is crucial for achieving consensus and ensuring that the decisions made are socially acceptable and politically feasible (Song et al., 2021). Economic and financial factors identified through PESTLE analysis also could assist in assessing the cost-effectiveness of different management strategies. This includes evaluating the long-term financial implications of maintenance, rehabilitation, and potential upgrades or decommissioning of dams (Anggarini et al., 2022; Quader & Kabir, 2025). This could be simplified that SWOT and PESTLE analysis significantly enhances decision-making in dam asset management by providing a structured approach to evaluate a wide range of factors. This comprehensive analysis ensures that decisions are well-informed, balanced, and sustainable, ultimately leading to improved management and operation of dam assets.

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There are several studies focusing on SWOT analysis which has been applied in real estate asset management field, especially relating to dam as report in various case studies. For instance, SWOT is used to examine factors of development strategies of the rubber dams (Ghorbani & Hamidifar, 2021), evaluate the potential for SWOT data to improve reservoir operations in the upper Niger river basin (Munier et al., 2014), as well as determine the management strategy of Rendani River catchment area, Indonesia (Sadsoeitoeboen et al., 2021).

However, there is synergy between SWOT and PESTLE which provides an extensive and more accurate analysis of a complex system and its multidimensional interaction with the environment. For example, Vorthman (2008) argues that SWOT serves to recognise the positive and negative internal and external factors of a system, but that it is necessary to use PESTLE for any further analysis of these factors.

Previous study by Srdjevic et al. (2012) performed an approach for specific class of management of water problems. In their study, SWOT-PESTLE analysis is used and has been evaluated by invited expert to discover the internal and external environment. All aspects of the problems and factors is considered according to the domain factor of the effects including political, economic, social, and so forth that could be applied to real-life problem. The obtained SWOT-PESTLE analysis is then representing the possible criteria for multicriteria analysis which is one of the approaches to favour the factors to maximise the opportunities and minimise the weaknesses in the hydro system. The result revealed the top ranked factors based on SWOT-PESTLE analysis which aimed to select the best practice during the decision-making process.

Within Malaysia context, none of related studies considering SWOT-PESTLE approach in day-to day decision making and operation context with stakeholders. It can be seen that there is still a major gap towards MyDAMS implementation into the dam industry and proposed a way forward framework to be carried out with various stakeholders (Toh et al., 2020).

Since PESTLE analysis provides an effective tool to analyse the catchment and other external environmental factors that will influence the business, the domain factors of Machap Dam must take into considerations to discover a strategic plan by looking into political, economic, social, technological, legal, and environmental aspects.

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METHODOLOGY

Study Area

This study mainly focuses on Machap dam, Kluang, Johor, completed in 1982 and has been gazetted by the government. The water body is about 9.1 km^2 while the basin area is 77 km^2. Machap dam basin lies in three local authorities, namely Majlis Perbandaran Kluang, Majlis Daerah Yong Peng and Majlis Daerah Simpang Renggam. The dam is initially designed for flood mitigation, but latter is used to regulate the flow at downstream for water supply intake.

Data Collection & Data Analysis

Objective 1: To identify PESTLE factor towards dam catchment management

Interview survey in the form of FGD sessions is conducted and analysed using NVIVO tools. FGD provides in-depth discussion which aims to obtain data from a purposely selected group of individuals rather than from a statistically representative sample of a broader population. In this study, it is conducted among panels who have knowledge and experience in dam management and its surroundings, as well as its effect towards dam catchment. Consent has been obtained during FGDs and surveys. A total of 20 sample sizes has been collected, as in **Table 1** below.

Table 4: FGD Panel

No.	Organisation	No. of Panel
1.	Department of Irrigation and Drainage (JPS)	8
2.	Badan Kawalselia Air Johor (BAKAJ)	1
3.	Suruhanjaya Perkhidmatan Air Negara (SPAN)	1
4.	Ranhill SAJ Sdn Bhd	3
5.	National Water Research Institute of Malaysia (NAHRIM)	1
6.	Majlis Perbandaran Kluang (MPK)	1
7.	Majlis Daerah Yong Peng (MDYP)	1
8.	Malaysia Office of the Chief Government Security Officer (CGSO)	2
9.	Village Head Machap	1
10.	Secretariat of Village Head Ayer Hitam	1
	Total sample size for FGD	**20**

To achieve this objective, the list of PESTLE factors for the dam management is derived through FGD. It is then assessed to obtain the effect of each PESTLE factors either provides the positive or negative effect towards the Machap Dam. Since Vorthman (2008) claimed the positive and negative internal and external factors can be recognised by SWOT analysis, hence, the positive and negative effect derived from each of the PESTLE factors become the outcome for this analysis which is the list of SWOT classification from each PESTLE factors for the Machap dam either it provides positive or negative effects. The positive factor is classified under Strength (internal factor) and Opportunity (external

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factor), meanwhile the negative factor is classified under Weakness (internal factor) and Threat (external factor).

The outcome is then used to assess the impact over time for each PESTLE factors whether it provides short, medium, or long-term impact for the Machap Dam. FGD session is concurrently performed together with the previous activity and analysed using content analysis through NVIVO tools.

From this, the list of SWOT impact over time from each PESTLE factors for the Machap dam are derived. As a result, the situation for Machap Dam is obtained by looking into their effect either it provides positive or negative (SWOT), and their impact over time whether provides short-term, medium-term, or long-term effect towards dam catchment management.

Objective 2: To assess PESTLE-SWOT effect for integrated dam catchment management

Primary data is obtained in this stage using questionnaire survey. The purpose of this stage is to examine the obtained PESTLE factors by dynamics whether it provides an important effect to Machap dam or not, and how important it is. PESTLE factors are ranked from 'very not important' [1], 'not important' [2], 'important' [3], and 'very important' [4] using questionnaire survey during FGD session, as in **Table 2** below. It is then analysed using descriptive analysis through SPSS tool to determine importance level and term effect of each PESTLE factor towards dam catchment management.

Table 5: Questionnaire design

No.	PESTLE Factor	1	2	3	4
Political Aspect					
1.	Press freedom for public information and awareness				
2.	Involvement of local community within dam catchment				
Economic Aspect					
1.	Local economic activities opportunity				
2.	Ecotourism/Edutourism opportunity				
3.	Local economic activities within dam catchment cause water pollution				
4.	Ecotourism/Edutourism activities cause pollution and encroachment issue				
Legal Aspect					
1.	Water Act 1920 (Act 418)				
2.	Water Services Industry Act 2006 (Act 655)				
3.	Protected Areas and Protected Places 1959 (Act 298)				
4.	Occupational Safety and Health Act 1994 (Act 514)				
5.	Environmental Quality Act 1974 (Act 127)				
6.	National Land Code 1965 (Section 62); Reservoir area				
Technological Aspect					
1.	Regular dam safety inspection				
2.	Security gate control and CCTV utilisation within dam operation area				
3.	Drone utilisation within catchment and dam operation area				
4.	Study on decision making based on GIS for dam optimisation				

No.	PESTLE Factor	1	2	3	4
5.	Unavailability of CCTV coverage within dam catchment area				
Environmental Aspect					
1.	Land clearing determination for soil erosion control				
2.	Research on integrated catchment management plan				
3.	Integration of water pollution management control with community				
4.	Research on *Neptunia Oleracea* threat towards dam management				
5.	Community involvement in maintaining dam ecosystem cycle				
6.	Study on water inflow forecasting				
7.	Small distance between commercial crops and dam catchment area				
8.	Significant flood occurrences due to dam capacity				
9.	Climate change effect				
10.	Uncontrolled *Neptunia Oleracea* growth				
Social Aspect					
1.	Local people's water lifestyle consumption				
2.	Increment in local population size				

As a result, the level of importance and term effect of each PESTLE factor towards dam catchment management is obtained and will be integrated with SWOT effect to discover an integrated dam catchment management in managing dam assets including its land and buildings using PESTLE-SWOT analysis.

FINDINGS

Table 3 and **Figure 1** below presents the results based on FGD's panel experts for Objective 1 and Objective 2 regarding the dam catchment management effect on Political, Economic, Legal, Technological, Environmental, and Social factor towards dam catchment management that integrates with the importance level and term effect for each factor, as well as the SWOT categorisation. In terms of importance level, this study excludes 'Not Important' aspect as it is not assisting in encouraging the management to be more advanced in delivering current dam work practice.

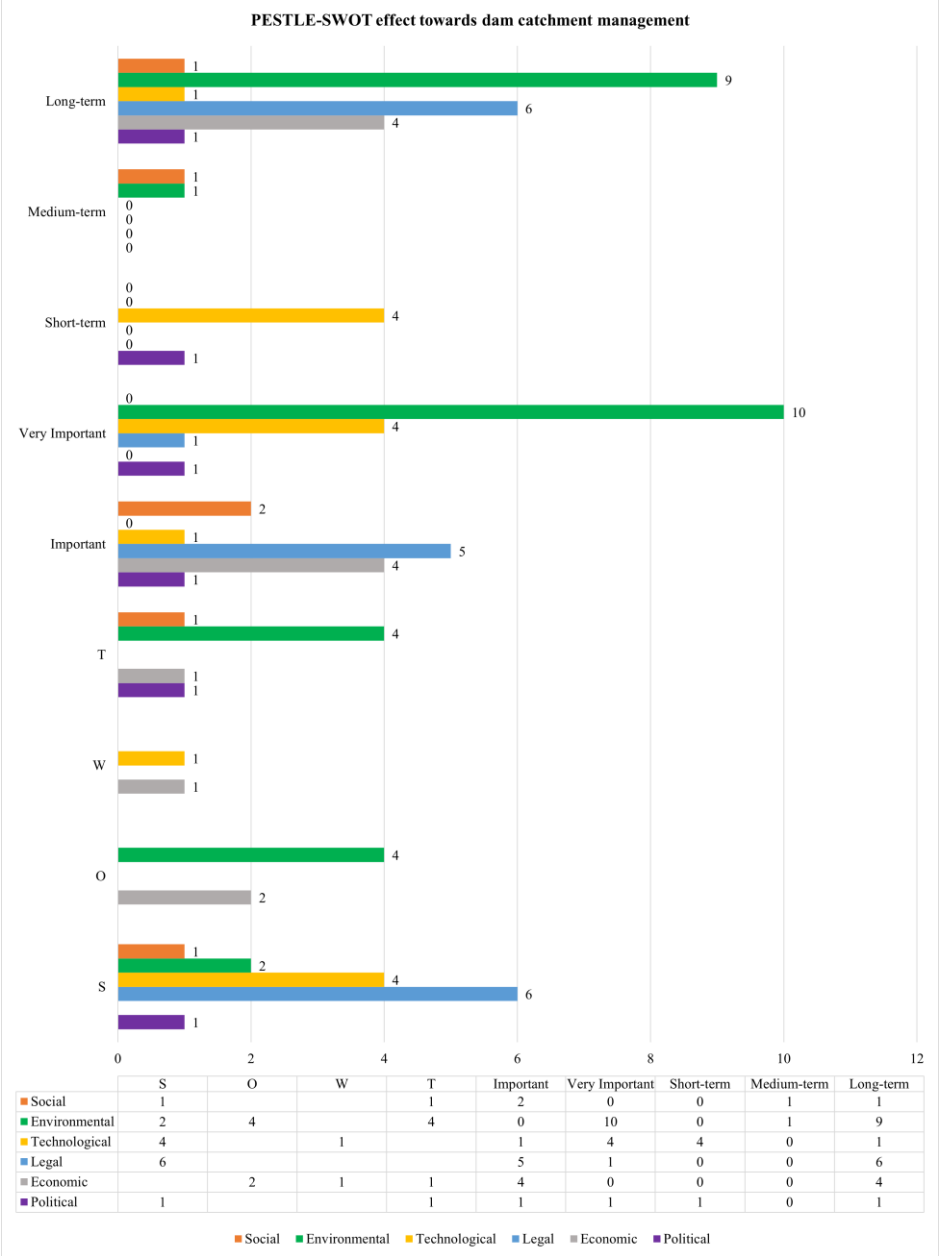
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Table 3: PESTLE-SWOT effect towards dam catchment management

No.	PESTLE Factor	SWOT Effect				Mean Value	Level of Importance		Term Effect		
		Positive		Negative			Important	Very Important	Short-term	Medium-term	Long-term
		Strength (S)	Opportunity (O)	Weakness (W)	Threat (T)						
Political Aspect											
1.	Press freedom for public information and awareness	/				3.14	/		/		
2.	Involvement of local community within dam catchment				/	3.57		/			/
Economic Aspect											
1.	Local economic activities opportunity		/			3.29	/				/
2.	Ecotourism/ Edutourism opportunity		/			2.90	/				/
3.	Local economic activities within dam catchment cause water pollution			/		3.29	/				/
4.	Ecotourism/ Edutourism activities cause pollution and encroachment issue				/	2.90	/				/
Legal Aspect											
1.	Environmental Quality Act 1974 (Act 127)	/				3.81	/				/
2.	Protected Areas and Protected Places 1959 (Act 298)	/				3.67	/				/
3.	Water Act 1920 (Act 418)	/				3.57		/			/
4.	National Land Code 1965 (Section 62); Reservoir area	/				3.57	/				/
5.	Water Services Industry Act 2006 (Act 655)	/				3.48	/				/
6.	Occupational Safety and Health Act 1994 (Act 514)	/				3.38	/				/
Technological Aspect											
1.	Regular dam safety inspection	/				3.36		/	/		
2.	Security gate control and CCTV utilisation within dam operation area	/				3.36		/	/		

No.	PESTLE Factor	SWOT Effect				Mean Value	Level of Importance		Term Effect		
		Positive		Negative			Important	Very Important	Short-term	Medium-term	Long-term
		Strength (S)	Opportunity (O)	Weakness (W)	Threat (T)						
3.	Drone utilisation within catchment and dam operation area	/				3.36		/	/		
4.	Unavailability of CCTV coverage within dam catchment area			/		3.36		/	/		
5.	Study on decision making based on GIS for dam optimisation	/				3.27	/				/
Environmental Aspect											
1.	Land clearing determination for soil erosion control	/				3.91		/			/
2.	Research on integrated catchment management plan	/				3.91		/			/
3.	Integration of water pollution management control with community		/			4.00		/			/
4.	Research on *Neptunia Oleracea* threat towards dam management		/			3.91		/			/
5.	Community involvement in maintaining dam ecosystem cycle		/			3.64		/			/
6.	Study on water inflow forecasting		/			3.55		/			/
7.	Small distance between commercial crops and dam catchment area				/	3.91		/			/
8.	Significant flood occurrences due to dam capacity				/	3.73		/			/
9.	Climate change effect				/	3.55		/			/
10.	Uncontrolled *Neptunia Oleracea* growth				/	3.45		/		/	
Social Aspect											
1.	Local people's water lifestyle consumption	/				3.23	/			/	
2.	Increment in local population size				/	3.46	/				/

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	S	O	W	T	Important	Very Important	Short-term	Medium-term	Long-term
Social	1			1	2	0	0	1	1
Environmental	2	4		4	0	10	0	1	9
Technological	4		1		1	4	4	0	1
Legal	6				5	1	0	0	6
Economic		2	1	1	4	0	0	0	4
Political	1			1	1	1	1	0	1

Figure 1: PESTLE-SWOT effect towards dam catchment management

Press freedom for public information and awareness contributes a short-term positive effect on dam catchment management. It strengthens transparency, promotes public oversight, and allows early detection of illegal or unusual activities around the catchment (Gurel, 2017). However, uncontrolled community involvement within the dam catchment area can create long-term negative effects, as it increases the risk of encroachment, land-use conflicts, and mismanagement (Yaacob, 2021). Effective governance and structured participation frameworks are therefore essential to ensure community engagement supports, rather than threatens, catchment protection.

Local economic development and ecotourism or edutourism initiatives provide long-term positive impacts by generating sustainable livelihoods and promoting environmental awareness (Gavrikova et al., 2020). Yet, economic activities within the catchment that resulted in encroachment may produce long-term negative effects (Ayman, 2021). These findings reveal the dual nature of economic growth is beneficial when it is properly managed, but potentially harmful without strong legal enforcement and environmental regulation.

Malaysia's comprehensive legal framework including the Environmental Quality Act 1974, Protected Areas and Protected Places Act 1959, National Land Code 1965, Water Services Industry Act 2006, Occupational Safety and Health Act 1994, and Water Act 1920 provides strong, long-term positive effects for dam catchment management. These laws serve as the foundation for preventing illegal land use, pollution, and encroachment. However, fragmented enforcement among agencies reduces their overall effectiveness, indicating the need for integrated legal coordination and stronger institutional collaboration (Toh et al., 2020).

Technological aspects including GIS-based decision-making, regular safety inspections, CCTV and gate control systems, and drone monitoring, have significant positive effects on dam operations (Quadier & Kabir, 2025; Selangor Journal, 2023; Srdjevic et al., 2012). These technologies improved early detection of erosion, encroachment, and illegal land use (Quaber & Kabir, 2025), as seen in Selangor and Melaka's implementation of drones and fencing (The Sun, 2021). Nonetheless, the lack of comprehensive CCTV coverage remains a short-term weakness that limits continuous monitoring. Investment in digital infrastructure and operator training is therefore vital for effective catchment management.

Environmental findings highlight both opportunities and threats. Positive factors include land-clearing control for erosion prevention, research on integrated catchment management, community-based pollution management, studies on *Neptunia oleracea*, and water inflow forecasting. These initiatives strengthen long-term ecosystem resilience. However, close proximity of agricultural areas to dams, recurring floods, climate change, and uncontrolled *Neptunia oleracea* growth pose significant long and medium term threats to

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catchment sustainability (Munier et al., 2014). Adaptive environmental management and continuous monitoring are therefore essential.

Local water-use behaviour provides a medium-term positive effect by promoting responsible consumption and supporting sustainable dam operations. In contrast, population growth presents a long-term negative effect in which increase the water demand and pressure on dam infrastructure. Integrating social awareness campaigns and water-use education into management strategies can may reduce long-term strain on the catchment system.

Overall, this study concludes that technological and legal aspects serve as the strongest pillars of sustainable dam governance. However, their success depends on cross-sector collaboration, community participation, and evidence-based decision-making. Moving forward, Malaysia's dam management strategies should prioritise policy integration, technological modernisation, and adaptive management within its catchment including land and building to maintain ecological resilience while supporting socio-economic growth.

From this, SWOT output can be addressed in the form of PESTLE-SWOT analysis for integrated dam catchment management as an assessment and advancement for current work practices to sustain the existing assets from land encroachment issues and decision making process, as in **Figure 4** below.

	STRENGTH (S)	WEAKNESS (W)	OPPORTUNITY (O)	THREAT (T)
Long-term	**Very Important:** o Water Act 1920 (Act 418) **Important:** o Water Services Industry Act 2006 (Act 655) o Prohibited Areas and Prohibited Places Act (Act 298) o Occupational Safety and Health Act 1994 (Act 514) o Environmental Quality Act 1974 (Act 127) o National Land Code 1965 (Section 62): Reservoir area o Study on decision making based on GIS for dam optimisation o Land clearing determination for soil erosion control o Research on integrated catchment management plan		**Very Important:** o Integration of water pollution management control with community o Research on *Neptunia Oleracea* threat towards dam management o Community involvement in maintaining dam ecosystem cycle o Study on water inflow forecasting **Important:** o Local economic activities opportunity o Ecotourism/ Edu tourism opportunity	**Very Important:** o Involvement of local community within dam catchment o Significant flood occurrences due to dam capacity o Effect of climate change o Small distance between commercial crops and dam catchment area o Local community activities within dam catchment area cause water pollution **Important:** o Ecotourism/ Edu tourism activities cause pollution and encroachment issue o Increment in local population size
Medium-term	**Important:** o Local people's water lifestyle consumption			**Very Important:** o Uncontrolled *Neptunia Oleracea* growth
Short-term	**Very Important:** o Regular dam safety inspection o Security gate control and CCTV utilisation within dam operation area o Drone utilisation within catchment and dam operation area **Important:** o Press freedom for public information and awareness	**Very Important:** o Unavailability of CCTV coverage within dam catchment area		

Figure 5: SWOT analysis for integrated dam catchment management

CONCLUSIONS

This study discovered that Technologies and Legal factor are the important strategic aspects for dam catchment management to be more integrated in managing dam assets including its land and buildings using PESTLE-SWOT analysis. Those nine factors are necessary to be focused to achieve long-term dam sustainability, particularly related to law and regulations, as well as the enhancement of technological directions.

PESTLE–SWOT framework may enable related agencies to systematically monitor external pressures, assess internal management capacities, and prioritise interventions across short-, medium-, and long-term planning horizons. It also provides a structured means of coordinating multi-agency responsibilities, particularly in contexts where jurisdictional overlaps exist between water authorities, local governments, and environmental regulators.

Situational analysis within dam catchment area is recommended to be carried out to review any possibilities of dam failure and illegal activities by third parties, as well as enable decision makers to secure sustainable dam management and water resources. From this, dam asset manager may integrate asset management planning processes into current work practices to enhance the deliverables of dam functions and its catchment area, especially land use and encroachment matters.

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SMART FEATURE INDEX RATING TOOL FOR SMART LIVING HOUSING VALUATION

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Abstract

Conventional housing valuation uses the comparison approach due to homogeneous housing features, despite its limitations in capturing intangible hedonic qualities. Smart Living (SL) housing, with distinctive features prioritising resident well-being, requires a specialised valuation approach. Despite challenges in quantifying Smart Living housing's gross development value, the cost approach is deemed appropriate. This research introduces the Smart Feature Index Rating (SFIR) tool, a novel method for designing and validating valuation via a cost approach. A 5-point Likert scale survey of 45 experts was conducted to rank 43 Smart Living elements based on practicality and adoption likelihood using the Relative Importance Index (RII). Findings reveal five levels of Smart Features Implementation ranging from Certified to Diamond, forming an index rating framework for Smart Living housing valuation. This study contributes a systematic evaluation framework that integrates hedonic components to represent Smart Living housing value accurately.

Keywords: Housing Valuation, Hedonic, Literature Reviews, Smart Living Features, Survey, Smart Feature Index Rating Tool

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INTRODUCTION

The evolution of Smart Living housing in Malaysia, driven by Smart City initiatives, signals a major shift in conventional housing practices by emphasising resident well-being and sustainability across economic, social, and environmental dimensions. Beyond technological advances such as smart thermostats and universal design, Smart Living integration extends to resource-efficient systems like motion sensors and water-saving fittings. However, the absence of standardised regulations challenges developers in integrating Smart Living features into projects. Conventional valuation methods struggle to capture these innovations' intangible benefits, comfort, security, and energy efficiency

International frameworks such as BREEAM, WELL, and LEED provide sustainability and health-based assessments but primarily focus on environmental and design performance rather than valuation. The SFIR tool distinguishes itself by applying a cost-based valuation approach integrated with hedonic variables assessment, allowing monetary quantification of Smart Living components within the Malaysian context. This positions SFIR as a context-specific decision-support tool bridging valuation practice and sustainable housing innovation.

To address the gap between traditional valuation and Smart Living concepts, this study presents the Smart Feature Index Rating (SFIR) tool. The SFIR quantitatively assesses Smart Living housing features, energy efficiency, safety, and quality of life improvements, through a hedonic and cost-based framework, aligning valuation practices with Smart Living's multifaceted nature.

LITERATURE REVIEW – OVERVIEW ON SMART LIVING CONCEPT, SMART FEATURE INDEX RATING TOOL, AND COST APPROACH VALUATION

Numerous recent studies conducted in developed nations have elucidated the efficacy of Smart Living approaches due to rapid growth in their aging population. With Malaysia's ageing population as reported by Khazanah Research Institute, (2021) and the Department of Statistics Malaysia (2020), the policymakers have taken proactive steps to embrace Smart Living development, aligning with the ongoing revolution in the global housing market. (Creaney et al., 2021). Hence, this study utilized the PRISMA 2020 framework for a thorough literature review, focusing on extracting Smart Living features from published articles (Page et al., 2021) as the foundational list of features for SFIR tool.

Globally, rating systems like LEED, BREEAM, and WELL assess sustainability performance based on design criteria and occupant health. However, they do not integrate cost-based valuation metrics. The SFIR tool fills this gap by merging sustainability indicators with economic value analysis through the RII method, contextualised for Malaysian Smart Living housing.

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PRISMA search keywords were categorised into Process, Body of Knowledge, Field Area, and Context, covering aspects like adoption, development, implementation, Smart Living concept, additional development cost components, market perception, Smart Living housing development, Green building development, and stakeholders such as developers and policymakers in the construction industry, particularly in housing projects.

Table 1: Categories of Search with Keywords for Relevant Articles Identification on Salient Smart Living Features

Process	Body of Knowledge	Field Area	Context
• Adoption • Development • Implementation	• Smart Living Concept • Smart Living Features • Additional Development Cost Components • Market Perception	• Sustainable Construction • Smart Living Development • Green Building Development	• Developers/ Policy Makers • Construction Industry • Housing Project

Table 1 categorizes keyword searches into four categories: Process (3 keywords), Body of Knowledge (4 keywords), Field Area (3 keywords), and Context (3 keywords). The initial search yielded 161 articles under 'Process', focusing on adoption, development, and implementation. The 'Body of Knowledge' category, including keywords like Smart Living concept and market perception, narrowed the pool to 43 articles. The 'Field Area' category, with keywords on Smart Living and Green building development, further reduced it to 35 articles. The 'Context' category, focusing on developers, policymakers, and the construction industry, left 32 articles for review. Additionally, the researcher reviewed two grey literature sources: the Ministry of Housing and Local Government Malaysia (2019). This structured approach ensured a thorough review of relevant literature and resources.

From the gathered literature, 49 Smart Living features were identified and sorted into three sustainability pillars: social, economic, and environmental. Social features promote well-being and convenience, such as pedestrian-friendly streets. Economic features offer value and efficiency, like solar panels. Environmental features aim to reduce human impact, including disaster risk management. This ensures alignment with sustainability principles. Tables 2, 3, and 4 summarise all identified Smart Living features, organized by the three pillars, and categorized into building and townscape elements.

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Table 2: 23 Smart Living Features on the Social Aspect of Sustainable

Smart Living Features	Elements (Building/Townscape)
Recreational Facilities	Townscape
Entrance Landscape	Townscape
Security Provision - Gated Guarded Community	Townscape
Public Transport Facilities	Townscape
School & Education Centre	Townscape
Health & Medical Centre	Townscape
Sport Facilities	Townscape
Retail Facilities	Townscape
Pedestrian Friendly Street	Townscape
Cycling Friendly Street	Townscape
Universal Design: Ramp with truncated dome tactile strip	Townscape
Drone/Unmanned Aerial Vehicle	Townscape
Internet Connectivity	Building
Video Monitoring System	Building
Smart Security Lock System	Building
Security-to-Household Intercom System	Building
Universal Design: Ramp & Assisted Washroom	Building
Wheelchair Lift at Staircase	Building
Occupancy, Motion Sensor System	Building
Smart Sensor Cloth Dryer	Building
Portable Parcel Box	Building
Smoke and Fire Detector	Building
Safety Panic Button	Building

Table 2 lists 23 features for the social aspect of Smart Living houses, designed to enhance convenience, independence, and well-being. These features foster community engagement, personal autonomy, and a sense of belonging, reflecting societal and cultural dynamics. Next, Table 3 presents features aligned with the environmental aspect of Smart Living houses.

Table 6: 15 Smart Living Features on the Environmental Aspect of Sustainable

Smart Living Features	Elements (Building/Townscape)
E-Governance System	Townscape
Smart Tourism Area	Townscape
Cashless Payment Equipment & System	Townscape
Solar Panel on Pedestrian Walkway Roof	Townscape
Smart Meter at Parking Area	Townscape
District Cooling System	Townscape
Light-emitting Diode (LED) type Lighting System	Building
Water Closet Item - Dual Flush Toilet	Building
Water Closet Item - Faucet Aerator	Building
Solar Panel on Building Roof/Balcony	Building
Rainwater Harvesting System	Building
Grey Water System	Building
Smart Thermostat	Building
Smart Siren	Building
Energy Management Sensor & Meter for Electrical Appliances	Building

Table 3 outlines 15 features categorized under the environmental aspect of Smart Living houses, focusing on interactions with the natural world and the ecological impact of human activities. These features include waste management, disaster risk management, and sustainable practices like urban plantations or green spaces. Table 4 presents 10 features aligned with the economic aspects of Smart Living houses, emphasizing societal and value-for-money considerations.

Table 4: 10 Smart Living Features on the Economical Aspect of Sustainable

Smart Living Features	Elements (Building/Townscape)
Tree Cover/Tree Inventory	Townscape
Disaster Risk Management (Consultation)	Townscape
Hill Slope Structure	Townscape
Flood Mitigation Structure/Facilities	Townscape
Acoustical Environmental Structure (Consultation)	Building
Daylight-oriented Structure (Consultation)	Building
Refuse Disposal - Garbage & Recycling Bin/Chute	Building
Remote Control Blinding/Shades	Building
Garden Works & Landscaping	Building
Private Farming Proximity	Building

The comprehensive review identified 48 Smart Living features detailed in Tables 2, 3, and 4, sourced from scholarly articles and grey literature. These features range from individual building elements to broader townscape elements. Examples include solar panels, LED lighting, and pedestrian-friendly streets. At the building scale, features like motion sensor thermal comfort systems and integrated landscape designs were noted, while at the townscape scale, communal spaces, and amenities such as shopping facilities and medical centres were highlighted.

In Malaysian Smart Living housing valuation, integrating these Smart Living features is crucial for enhancing overall quality of life and property desirability (Kaczmarek et al., 2022). These features offer intangible benefits like convenience, safety, and connectivity, beyond mere functionality. Recognizing these benefits influences property attractiveness and commands premium pricing in the real estate market. The Smart Features Index Rating (SFIR) tool addresses gaps in existing frameworks by providing a structured basis for evaluating Smart Living features comprehensively. It quantifies their holistic value, aligning with market trends and promoting transparency in rating systems.

RESEARCH METHODOLOGY

This research combines literature reviews and quantitative approaches to investigate the impact of Smart Living features on housing valuation in Malaysia. The literature review systematically explores existing knowledge, identifying gaps and trends related to Smart Living features. Through reviews of scholarly

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articles and industry reports, disparities between Smart Living feature implementation and conventional housing valuation methods are uncovered. Additionally, a theoretical list of 48 Smart Living features is established.

The study employs structured surveys among stakeholders to prioritize these features based on perceived value and impact on housing valuation metrics. The 45 experts were selected through purposive sampling, including registered valuers, quantity surveyors, developers, and local authority officers with a minimum of 10 years of professional experience in housing or smart city projects. The questionnaire was pre-tested with five senior academics and industry professionals to ensure content clarity and construct validity before full deployment.

Next, this research utilised statistical analysis and the Relative Importance Index (RII), the research quantitatively evaluates feature viability, as shown in Equation 1.

$$RII = \sum W / (A*N) \quad \text{(Equation 1)}$$

The calculation of the Relative Importance Index (RII) involves summing the average weightages (W) assigned by respondents and dividing this by the highest point of the Likert scale (A), multiplied by the total number of respondents (N), which in this case is 45. Since a 5-point Likert scale was utilized, A is equal to five. For instance, if the average weightage for Entrance Landscape is rated as 3 (Neutral) on the Likert scale, and 41 respondents gave this rating, the calculation would be (3 * 41) / 5 * 45, resulting in an RII value of 0.547 for Entrance Landscape features. The following Table 5 illustrates the RII rules.

Table 7: Rules of Relative Importance Index Valuation

Index Range	Index Rules
1.00-0.80	Most Likely and Very Practical
0.79-0.55	Likely and Practical
0.54-0.31	Relevant
< 0.30	Less Likely and Less Practical

The Relative Importance Index (RII), outlined by Rajgor et al., (2016), offers a structured framework for assessing Smart Living features' practicality in the Malaysian housing market. RII values from 1.00 to 0.80 indicate features as 'most likely and very practical' for implementation, while 0.79 to 0.55 are 'likely and practical.' Those from 0.54 to 0.31 are 'relevant,' suggesting moderate feasibility, and ≤ 0.30 are 'less practical and less likely.'

For instance, the Entrance Landscape feature is 'relevant,' implying potential implementation with necessary adjustments in Malaysian Smart Living

housing contexts. The Smart Features Index Rating (SFIR) tool uses a 4-point penalty system alongside index rules for systematic evaluations of Smart Living features. This approach enhances assessment accuracy, fostering transparency and informed decision-making among stakeholders. See Table 6 for the 4-point system related to each index rule.

Table 8: 4-points system related to RII Rules

4-Points System	Index Range	Index Rules
4	1.00-0.80	Most Likely and Very Practical
3	0.79-0.55	Likely and Practical
2	0.54-0.31	Relevant
1	< 0.30	Less Likely and Less Practical

By integrating these methodological strategies, the research seeks to contribute a comprehensive, evidence-based analysis that illuminates the nuanced interplay between Smart Living features and housing valuation dynamics specific to the Malaysian housing market.

FINDINGS AND DISCUSSION

The findings and discussion section reveals insights from literature reviews, quantitative analysis, and SFIR tool application in Smart Living housing valuation.

Unlike frameworks such as BREEAM and WELL, which measure environmental or wellness performance, the SFIR tool quantifies implementation feasibility through stakeholder perception. This provides a cost-oriented assessment model adaptable for valuation practice, addressing Malaysia's lack of measurable smart housing indicators.

Key findings highlight practical, feasible Smart Living features in Malaysian housing, categorised into building and townscape elements based on RII values. Discussions explore their implications on housing valuation, sustainability, and consumer preferences. Refer to Table 7 and Table 8 for RII evaluations of social aspects in building and townscape elements Smart Living features.

Table 9: Building Elements Features, the RII value and 4-Points System

Building Elements: Features on Social Aspect of Sustainable for Smart Living Housing	RII [ΣW / (A*N)]	4-Points System
Internet Connectivity	1.000	4
Video Monitoring System	1.000	4
Universal Design: Ramp & Assisted Washroom	1.000	4
Smoke & Fire Detector	1.000	4

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Building Elements: Features on Social Aspect of Sustainable for Smart Living Housing	RII [ΣW / (A*N)]	4-Points System
Wheelchair Lift at Stairs	0.911	4
Safety Panic Button	0.844	4
Portable Parcel Box	0.747	3
Occupancy, Motion & Sensory based Appliances System	0.733	3
Smart Security Lock System	0.711	3
Security-to-Household Intercom System	0.693	3
Smart Sensor Cloth Dryer	0.400	2
Drone/Unmanned Aerial Vehicle	0.213	1

Table 10: Townscape Elements Features, the RII value and 4-Points System

Townscape Elements: Features on Social Aspect of Sustainable for Smart Living Housing	RII [ΣW / (A*N)]	4-Points System
Universal Design: Ramp with truncated dome tactile strip	1.000	4
Health & Medical Centre	0.764	3
Recreational Facilities & Ancillaries	0.747	3
School & Education Centre	0.747	3
Pedestrian Friendly Street	0.747	3
Security Provision - Gated Guarded Community	0.711	3
Sport Facilities	0.711	3
Cycling Friendly Street	0.711	3
Public Transport Facilities	0.573	2
Entrance Landscape	0.547	2
Retail Facilities	0.462	2

The tables summarize building elements (Table 7) and townscape elements (Table 8), along with their Relative Importance Index (RII) values and 4-Points System ratings for social aspect in Smart Living context. In Table 7, building elements like Internet Connectivity and Safety Systems rank high, while elements like Smart Sensor Cloth Dryer rank lower. Similarly, in Table 8, the townscape elements such as Health & Medical Centre are highly rated, while Public Transport Facilities rank lower. Next, see Table 9 and Table 10 for RII evaluation of environmental aspects in building and townscape elements.

Table 11: Building Elements Features, the RII value and 4-Points System

Building Elements: Features on Environmental Aspect of Sustainable for Smart Living Housing	RII [ΣW / (A*N)]	4-Points System
Daylight-oriented Structure (Consultation)	0.867	4
Refuse Disposal - Garbage & Recycling Bin/Chute	0.800	4

Building Elements: Features on Environmental Aspect of Sustainable for Smart Living Housing	RII [ΣW / (A*N)]	4-Points System
Garden Works & Landscaping	0.747	3
Acoustical Environmental Structure (Consultation)	0.600	3
Remote Control Blinding/Shades	0.467	2
Private Farming Proximity	0.382	2

Table 12: Townscape Elements Features, the RII value and 4-Points System

Townscape Elements: Features on Environmental Aspect of Sustainable for Smart Living Housing	RII [ΣW / (A*N)]	4-Points System
Farming/Tree Cover/Tree Inventory	1.000	4
Disaster Risk Management (Consultation)	1.000	4
Hill Slope Structure	0.978	4
Flood Mitigation Structure/Facilities	0.889	4

Tables 9 and 10 outline building elements and townscape elements features, focusing on their Relative Importance Index (RII) values and 4-Points System ratings for environmental aspect in Smart Living contexts. In Table 9, elements like Daylight-oriented Structure and Refuse Disposal systems rank high, while elements like Remote Control Blinding/Shades score lower. Table 10 highlights townscape elements such as Farming/Tree Cover and Disaster Risk Management with top ratings, emphasizing their critical roles in enhancing environmental sustainability. See Table 11 and 12 for RII evaluation of the economic aspect in building and townscape elements.

Table 11: Building Elements Features, the RII value and 4-Points System

Building Elements: Features on Economical Aspect of Sustainable for Smart Living Housing	RII [ΣW / (A*N)]	4-PoiSnts System
Water Closet Items - Faucet Aerator, Dual Flush Toilet	1.000	4
Rainwater Harvesting System	1.000	4
Solar Panel on Building Roof	0.956	4
Light-emitting Diode (LED) type Lighting System	0.933	4
Solid Waste Management System	0.889	4
Energy Management Sensor & Meter for Electrical Appliances	0.800	4
Grey Water System	0.782	3
Smart Thermostat	0.711	3
Smart Siren	0.711	3
Cashless Payment Equipment & System	0.200	1

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Table 13: Townscape Elements Features, the RII value and 4-Points System

Townscape Elements: Features on Economical Aspect of Sustainable for Smart Living Housing	RII [ΣW / (A*N)]	4-Points System
Solar Panel on Pedestrian Walkway Roof	1.000	4
E-Governance System	0.747	3
Smart Tourism Area	0.533	2
District Cooling System	0.293	1
Smart Meter at Parking Area	0.200	1

Tables 11 and 12 detail building elements and townscape elements features, focusing on their Relative Importance Index (RII) values and 4-Points System ratings for economical sustainability in smart living contexts. Elements like district cooling system and Smart meter at parking area deem to be the less practical and less likely features for this aspect of Smart Living.

Hence, the presented tables offer a structured framework for identifying and prioritising Smart Living features crucial for sustainable and cost-effective environments. Through Relative Importance Index (RII) values and a 4-Points System, stakeholders can gauge the significance of elements in economical sustainability. Features like rainwater harvesting systems and solar panels receive high ratings, underscoring their roles in promoting sustainability and economic efficiency. Next step is to categorise these features based on their RII values and points into five-tier implementation levels.

The five-tier categorisation of Smart Living feature implementation in Malaysian housing, from Diamond to Certified, provides a structured framework for evaluating sustainability and innovation. At the Diamond level, the most comprehensive integration includes advanced features enhancing energy efficiency, user comfort, security, and environmental sustainability. Platinum, Gold, and Silver levels indicate progressively lower but still significant integration, meeting specific criteria. Certified, the lowest tier, ensures basic sustainability and technological standards across housing developments. This categorization facilitates stakeholder comparisons and encourages ongoing improvement towards sustainable and smart living environments.

Determining Smart Living feature levels involves assigning points based on integration. Diamond features score 1 to 4 points, reflecting the highest level. Platinum features score 2 to 4 points, indicating a slightly lower yet significant level. Gold features score 3 to 4 points, showing substantial integration. Silver features score 4 points, representing fundamental integration. Certified features, rated at 4 points, are divided based on Relative Importance Index (RII) values. This approach ensures acknowledgment of basic yet essential features, promoting sustainability and innovation across housing development

levels. See Table 13 for implementation levels, 4-Points System, RII values, and index rules.

Table 14: 5 Levels of Smart Living features implementation, 4-Points System, RII Value and Index Rules

Level	4-point System	Relative Importance Index Value	Index Rules
Diamond	4	0.89 – 1.00	Most likely & very practical
Platinum		0.80 – 0.89	
Gold	3	0.55 – 0.79	Likely practical
Silver	2	0.54 – 0.31	Relevant
Certified	1	Less than 0.30	Less likely & less practical

The categorisation of Smart Living Features into levels like Diamond, Platinum, Gold, Silver, and Certified provides a standardised framework for stakeholders to understand Smart Living integration in housing projects. This aids decision-making, fosters competition, guides developers towards higher standards, and supports regulatory compliance. Tables 14 summarize sample rating ranges for each level, aiding in implementation assessment.

Table 14: Rating Range for Each Level of Smart Living Features Implementation on Landed and High-rise Buildings

Level	Overall Rating Range			
	High-rise		Landed	
	Minimum	Maximum	Minimum	Maximum
Diamond	185	196	187	196
Platinum	156	184	164	186
Gold	128	155	124	163
Silver	77	127	77	123
Certified	-	76	-	76

The categorisation of Smart Living feature levels, as shown in Table 14 for high-rise and landed buildings, is essential due to the unique requirements of each building type. High-rise housing necessitates features tailored to spatial constraints and urban lifestyles, whereas landed housing allows for more expansive amenities. For instance, features like private farming proximity may be more relevant to landed buildings, whereas smart sensor cloth dryers cater to the space limitations of high-rise dwellings. This customised approach ensures that Smart Living features align with the practical needs of each building type, optimizing sustainability accordingly.

CONCLUSION

In conclusion, the Smart Features Index Rating (SFIR) tool emerges as a pivotal instrument for stakeholders, facilitating the quantification of Hedonic values and special attributes of Smart Living features. Through a methodical process

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involving feature identification, Relative Importance Index (RII) evaluation, and categorization into distinct implementation levels, the SFIR tool offers a systematic approach tailored to both high-rise and landed housing categories.

In contrast to international frameworks like BREEAM, WELL, and LEED, which primarily assess sustainability performance, the SFIR focuses on value quantification and implementation practicality within Malaysia's socio-economic context. It bridges the gap between theoretical sustainability standards and real-estate valuation metrics, promoting data-driven decision-making in Smart Living development.

This enables informed decision-making regarding Smart Living feature implementation based on quantifiable metrics and ratings and addresses conventional valuation limitations by systematically identifying, assessing, and categorizing Smart Living features based on RII values, enhancing precision and transparency in housing valuations. Its adaptability across diverse architectural contexts signifies a crucial step in aligning traditional valuation methods with the evolving Smart Living landscape.

ETHIC STATEMENTS

Ethical approval for this research was obtained under the Universiti Teknologi Malaysia Research Ethics Guidelines. All survey respondents participated voluntarily and provided informed consent prior to completing the questionnaire.

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A SYSTEMATIC LITERATURE REVIEW OF INDUSTRY 4.0 TECHNOLOGY APPLICATIONS IN MALAYSIAN ESTATE DISTRIBUTION

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Abstract

The dual legal system and the abundance of agencies responsible for inheritance, wills, Islamic asset management, and Muslim estate distribution in Malaysia often result in administrative delays and disputes. Against this background, Industry 4.0 technologies particularly blockchain have been recognized in both academia and practice as transformative tools for streamlining real estate and estate distribution processes. This study aims to evaluate the blockchain-based frameworks proposed in the reviewed studies. A systematic literature review was conducted on publications from 2019 to 2023 using Scopus and other databases, resulting in the inclusion of eighteen papers that met the defined quality and relevance criteria. The reviewed studies adopted methodologies such as interviews, theoretical, experimental, systematic literature review, case study, legal, and holistic approaches. Moreover, the proposed blockchain-based models in the reviewed studies were categorized into five types: digital land registration, inheritance, consensus algorithms, smart real estate buying or selling, and commercial real estate management frameworks. Based on these findings, the study further proposes a conceptual framework linking blockchain affordances (decentralized ledger, smart contract, integrity, transparency, security, immutability, interoperability, integrated, efficiency, cryptographic, and tamper-proof) to key challenges in Malaysia's dual legal estate distribution system (overlapping jurisdiction between Civil and Shariah High Court, lack of transparency about the entitlement of heirs, conflict of laws and rights, disputes in transfer of ownership, and data fragmentation between agencies that reduce efficiency). This framework provides a theoretical and policy-relevant foundation for future model development aimed at achieving a more transparent, efficient, and Shariah-compliant estate administration process.

Keywords: Dual legal system, blockchain technology, estate distribution, systematic literature review, Malaysia

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INTRODUCTION

Asset distribution, which is also referred to as estate distribution, is the act of separating and transferring a deceased person's assets and properties, which is also referred to as the estate, to the legitimate recipients or heirs (Richards, et al., 2011). The laws of intestacy, which vary by jurisdiction, govern how an estate is distributed when a person dies without a valid will or testament. However, the distribution of Muslim estates in Malaysia is complex and time-consuming, often leading to disputes and delays.

Under Malaysian law, three administrative bodies namely, the Civil High Court, Amanah Raya Berhad, and the Estate Distribution Section of the Director General of Lands and Mines can issue permission to handle a decedent's inheritance (Azmi & Mohammad, 2015). Due to the dual legal system and the abundance of agencies serving as administrative authorities, estate distribution in Malaysia for inheritance, wills, waqf, harta sepencarian, and Islamic asset management is complex, ineffective, and inefficient (Mohamad Al-Bakri, 2011; Anuar et al., 2023). By issuing specific authorization letters and orders that vary depending on each case, these institutions play a significant role in the estate administration process. Regarding the jurisdiction over movable and immovable assets, there is a loophole in inheritance law that leads to unduly long delays in estate administration and distribution (Nasrul et al., 2021).

This research aims to conduct a systematic literature review of previous studies on the applications of blockchain technology in real estate transactions, with a view to identifying those that have the potential for a blockchain-based model or framework applicable to ease the distribution of Muslim estate in Malaysia. This study uniquely contributes to the body of knowledge by bridging the gap between blockchain-enabled real estate systems and the specific procedural and legal requirements of Muslim estate distribution in Malaysia, offering insights into how decentralized technologies can enhance transparency, efficiency, and trust in Islamic inheritance processes.

The specific objectives to achieve this aim to examine the types of blockchain-based frameworks proposed by the screened papers. The remaining part of this paper will be structured into four sections: firstly, the literature review section; secondly, the methodology section; thirdly, the results and discussion section; and lastly, the conclusion section.

LITERATURE REVIEW

The real estate industry globally faces persistent challenges of inefficiency, lack of transparency, high transaction costs, and limited trust among stakeholders due to the involvement of multiple intermediaries (Yartagadda & Gampala, 2020; Saari et al., 2022). In response, blockchain technology has emerged as a disruptive innovation that enhances transactional integrity, security, and

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transparency. Since 2018, the Foundation for International Blockchain and Real Estate Expertise (FIBREE) has led global efforts to integrate blockchain into real estate by building a knowledge network that connects researchers, practitioners, and industry stakeholders (FIBREE, 2019).

The integration of blockchain into the real estate sector aligns with the broader transformation of the Fourth Industrial Revolution (Industry 4.0), which emphasizes digitalization through cyber-socio-physical systems (Schwab, 2016). Industry 4.0 technologies such as Artificial Intelligence (AI), Machine Learning (ML), the Internet of Things (IoT), and blockchain enable interconnected systems that automate, track, and verify complex processes (Mitchell, 1997; Parekh et al., 2020). Blockchain, in particular, provides a secure and immutable ledger that enhances traceability, auditability, and automation in property-related transactions. Within this paradigm, Building Information Modelling (BIM) integrated with blockchain has been proposed to improve documentation, transparency, and lifecycle management of built assets, thereby significantly easing the transfer and inheritance of estates (Ganter & Lützkendorf, 2019).

Moreover, real estate conveyancing is increasingly adopting blockchain and smart contracts a phenomenon referred to as "proptech" (Nasarre-Aznar, 2018). Proptech innovations demonstrate how blockchain can redefine real estate market operations by automating the verification and transfer of ownership. More broadly, digital technologies such as blockchain, AI, and IoT have the potential to increase market transparency, improve liquidity, and reduce transaction costs, thereby positively influencing the value of investment assets (Trofimov et al., 2016).

Empirical evidence across different jurisdictions supports these benefits. In Finland and the Netherlands, blockchain applications in land conveyancing and commercial property transactions have improved data accuracy, transparency, and trust while reducing intermediary costs (Kaczorow, 2019; Wouda & Opdenakker, 2019). Kim and Huh (2020) proposed a Legacy Inheritance Blockchain Model to address legal uncertainties in estate inheritance, while Chen et al., (2021) developed a Blockchain-Based Online Will system that automates property distribution and dispute resolution. These studies illustrate blockchain's dual potential to enhance transactional efficiency and legal compliance in estate management processes.

In the Asia-Pacific region, blockchain adoption is rapidly expanding through platforms such as BrickX, KASA, ADDX, and Minterest, which have successfully digitized real estate investment and tokenized assets in Australia, South Korea, and Singapore (Chow & Tan, 2022). In Malaysia, Jasimin et al., (2023) highlighted blockchain's potential in managing commercial office buildings, while Anuar et al. (2023) emphasized its role in consolidating fragmented estate distribution processes under a single digital platform.

Similarly, Abdulkader and Kumar (2023) and Ullah and Al-Turjman (2023) proposed blockchain-based frameworks for commercial real estate and smart property transactions, aiming to enhance transparency, efficiency, and data integrity.

Despite these developments, a major research gap remains in the application of blockchain to Muslim estate distribution (Faraid) within Malaysia's dual legal system, where inheritance matters are governed simultaneously by Civil and Shariah Courts. Existing studies have primarily focused on transactional, inheritance automation, or commercial real estate contexts but have yet to integrate Islamic legal principles, institutional coordination, and technological interoperability within a single framework. Therefore, this study advances the literature by systematically reviewing blockchain applications in real estate and proposing a conceptual framework tailored to Malaysia's socio-legal and Shariah context to facilitate a transparent, efficient, and compliant estate distribution process.

METHODOLOGY

A comprehensive review was conducted to synthesize current and prior studies on blockchain technology in real estate transactions and estate distribution, with a view to identifying gaps specific to the Malaysian context. This was done in line with the view of Petticrew and Roberts (2006) that states systematic literature review is "a set of scientific approaches in reporting, previous studies with the expressed purpose of reducing the error of bias, through identifying, appraisal, and synthesizing of all relevant studies in whatever paradigm so as to provide an answer to some set of questions".

Search Strategy

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). A structured database search was conducted primarily in Scopus, complemented by manual searches of Google Scholar, SpringerLink, and ScienceDirect to identify additional relevant studies. The search was restricted to publications between 2019 and 2023 to capture the most recent advancements in blockchain applications in real estate and estate distribution. The search string combined relevant keywords using Boolean operators as follows:

("Blockchain Technology" AND "Real Estate") OR ("Blockchain" AND "Estate Distribution") OR ("Blockchain" AND "Property Transactions").

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Filters were applied to limit the search to English-language publications in peer-reviewed journals, conference proceedings, and book chapters. A total of 239 records were retrieved initially (234 from Scopus and 5 from other sources).

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were developed to ensure the relevance and quality of the selected studies.

The inclusion criteria include: studies published between 2019 and 2023, publications written in English, studies that focus on blockchain applications in real estate, property management, or estate distribution, and Peer-reviewed journal articles, conference papers, or book chapters with full-text availability.

The exclusion criteria are: papers without full-text access, publications not directly related to blockchain technology or real estate, and non-English or duplicate records.

Screening and Selection Process

The selection process followed four sequential phases: identification, screening, eligibility, and inclusion, as presented in Figure 1 (Adapted PRISMA Flow Chart). After removing duplicates and irrelevant items, 216 records were screened based on title, abstract, publication year, and language. Nineteen (19) full-text papers were then reviewed for relevance, out of which one (1) was excluded during the quality assessment stage. Consequently, eighteen (18) papers were included in the final systematic review.

Data Extraction and Coding Procedure

Data from the included studies were extracted and coded using a standardized template developed for this review. Each study was coded for:

1. Publication details: author(s), year, publisher, and source type.
2. Research focus: blockchain application domain (e.g., real estate, inheritance, or land administration).
3. Methodological approach: interview/focus group, theoretical, experimental, case study, literature review, legal, or holistic approach.
4. Proposed framework/model type: digital land registration, consensus algorithm, inheritance system, smart property transaction, or commercial real estate management model.

The authors manually cross-checked the coding process to ensure consistency and accuracy. A qualitative synthesis approach was adopted to identify common patterns, methodological trends, and emerging research

directions relevant to blockchain adoption in real estate and Muslim estate distribution.

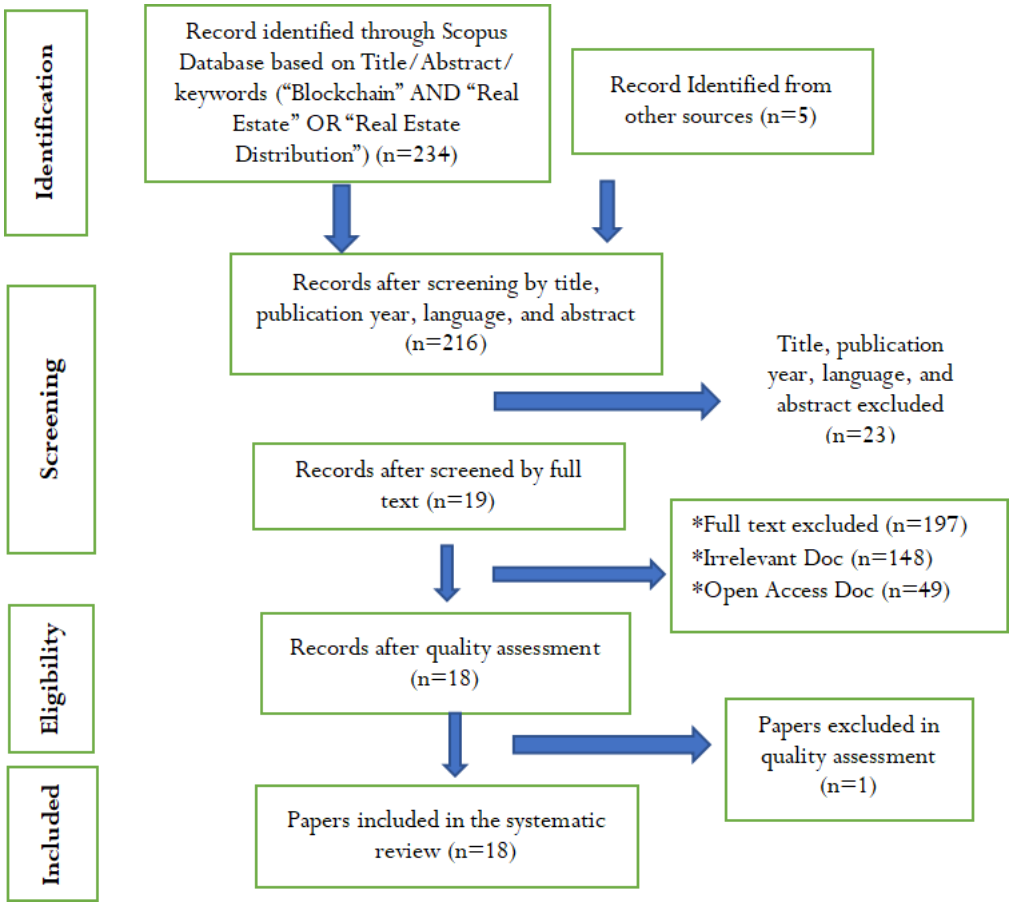


Figure 1: PRISMA Flowchart for the Selection Process
Source: Adapted from Moher et al., (2009)

RESULTS AND ANALYSIS

A systematic review of contributions to knowledge from various research on Industry 4.0 technology was conducted to propose a blockchain-based model or framework to ease Muslim estate distribution in Malaysia. This section details the results and approaches adopted in each study reviewed on blockchain technology applications in real estate transactions and estate distribution.

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Illustration of Papers by Year of Publication

Eighteen (18) papers were identified as relevant and useful for the study, out of the initial two hundred and thirty-four (234) papers identified from the Scopus online database and other sources. These eighteen papers comprise journal articles, conference proceedings, and book chapters. Moreover, the years 2020 and 2023 have the highest number of publications, with five (5) papers each and a percentage rate of 27.78%, followed by 2021 with four (4) papers and a percentage rate of 22.22%. Meanwhile, the years 2019 and 2022 recorded three (3) and one (1) publications, with percentages of 16.67% and 5.56%, respectively, from the included papers. This statistical information is illustrated in Figure 2.

The steady increase in publications from 2019 to 2023 indicates a growing academic interest in applying blockchain to real estate management and asset distribution. Notably, 2020 marked a turning point when blockchain research shifted from purely theoretical exploration to more experimental and framework-oriented studies, reflecting a maturing interest in practical implementation. However, the relative decline in 2022 suggests a temporary slowdown, possibly due to global economic disruptions and reduced institutional research funding during the post-pandemic period.

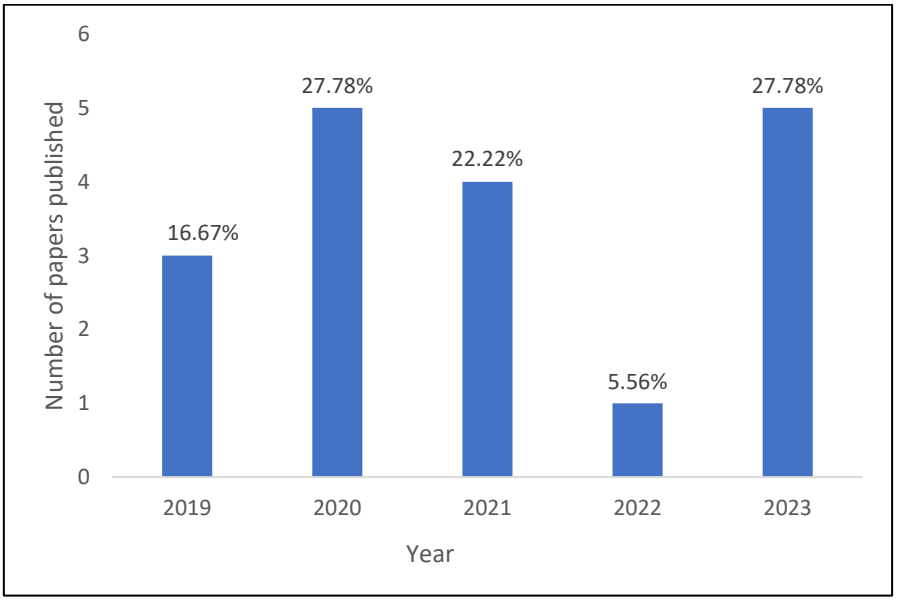


Figure 2: Papers Publication Graph

Illustration of Screened Papers Distribution

The final list of papers considered from the digital library after the exclusion and inclusion criteria is eighteen (18), between the years 2019 and 2023. As shown in Figure 3, Emerald Group Publishing Limited has the highest number of publications, with 5 papers, followed by MDPI and Sciendo, each with 3 publications. On the other hand, Springer Science, Institute of Electrical Publishing, Taylor and Francis, Nova Science Publishers, KeAi Communications, International Journal of Supercomputing, and the Malaysia Institute of Planners each have one publication.

This distribution indicates that most blockchain-related studies in real estate are disseminated through multidisciplinary and technology-driven publishers rather than domain-specific property journals. The dominance of MDPI and Emerald suggests a preference for open-access, practice-oriented journals that facilitate global visibility for emerging blockchain frameworks. Regionally, the reviewed papers were predominantly authored by researchers from Asia (China, India, Malaysia) and Europe (Estonia, the UK), with limited representation from Africa and the Middle East, highlighting the need for contextualized research on Islamic inheritance systems and on land governance in developing economies.

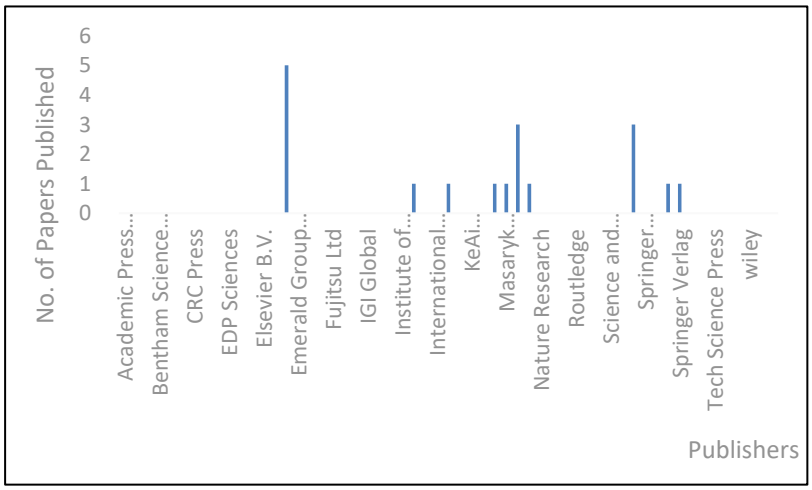


Figure 3: Papers Publication Graph

Analysis of Paper Review by Methodology

Table 1 summarizes the methodologies adopted across the eighteen reviewed studies. The studies were classified into eight methodological categories:

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experimental, systematic literature review, case study, theoretical, traditional literature review, legal, holistic, and interview-based approaches.

A significant proportion (33.33%) adopted experimental designs, reflecting an emphasis on testing blockchain prototypes, simulation environments, and smart contract algorithms. The use of systematic reviews and case studies (16.67% each) indicates growing attention to comparative and integrative analyses rather than isolated proofs of concept. However, legal, theoretical, holistic, and traditional literature review approaches were underrepresented (5.56% each), suggesting limited exploration of regulatory harmonization and ethical implications critical aspects for Muslim estate administration in Malaysia's dual legal system.

Comparatively, studies conducted in Western contexts (e.g., Estonia and the UK) tend to employ empirical and technical frameworks, focusing on interoperability and data integrity, whereas Asian studies, including those from Malaysia and Indonesia, lean toward conceptual and normative approaches, emphasizing legal compatibility with Islamic principles. This methodological divide underscores a gap in cross-regional empirical validation of blockchain-based inheritance systems.

Table 1: Paper Review by Methodology

No.	Research Methodology	Frequency	Percentage (%)
1	Focus Group Discussion/Interview	3	16.67
2	Theoretical	1	5.56
3	Experimental	6	33.33
4	Systematic Literature Review	3	16.67
5	Case study	2	11.11
6	Traditional Literature Review	1	5.56
7	Legal	1	5.56
8	Holistic	1	5.56
	Total	18	100

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Illustration of Paper by Proposed Framework/ Model

Fourteen (14) of the eighteen (18) reviewed papers proposed blockchain-based models capable of transforming real estate transactions and estate distribution into more transparent and digitized systems. These frameworks were grouped into five main categories (Table 2):

1. Blockchain-based Digital Land Registration Models (28.6%): focus on transparent, tamper-proof property record systems integrated with national cadastral databases.
2. Blockchain-based Smart Real Estate Buying/Selling Models (28.6%): designed to automate property transactions and payment verification through smart contracts.
3. Blockchain-based Commercial Real Estate (CRE) Management Models (14.3%): emphasize real-time data sharing and risk mitigation in large property portfolios.
4. Blockchain-based Inheritance Models (14.3%): propose distributed ledgers for estate division and Shariah-compliant inheritance validation.
5. Consensus Algorithm Models (14.3%): address transaction security, latency, and removal of intermediaries.

Compared with land registration and transaction models, the dominance of blockchain applications in property administration highlights their technological maturity, while the limited focus on inheritance frameworks reflects an early-stage research area. Few studies integrate Islamic jurisprudence or Malaysian estate administration protocols, revealing a critical research gap that this review seeks to address.

Overall, the findings reveal a strong global movement toward digital transformation of real estate through blockchain, yet a lack of contextual adaptation to the unique religious, legal, and cultural realities governing Muslim estate distribution in Malaysia. Future research should thus emphasize hybrid frameworks combining blockchain with Islamic legal principles, GIS integration, and institutional collaboration to enhance transparency, efficiency, and legitimacy in estate distribution.

Table 2: Paper by Proposed Framework/ Model

No.	Proposed Blockchain Model/Framework	Frequency	Percentage (%)
1	Blockchain-based digital land registration model	4	28.6
2	Consensus algorithm-model	2	14.3
3	Blockchain-based inheritance model	2	14.3

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No.	Proposed Blockchain Model/Framework	Frequency	Percentage (%)
4	Blockchain-based smart real estate buying/selling model	4	28.6
5	Blockchain-based commercial real estate (CRE) management model.	2	14.3
	Total	14	100

Conceptual Framework

Since Malaysia has dual legal system comprising Islamic and Civil laws, in matters of inheritance of Muslims, the conflict between rules of substantive and procedural laws of the two systems is possible. As long these rules are different they conflict, and as long as they are not in line with Muslim personal law, Muslim beneficiaries of an estate are denied their rights, in accordance with the provisions of the Federal Constitution of Malaysia.

A system may treat one thing as property or right or powers, and the other may not do so. This is so because there is express conflict of rules to that effect or there is an ambiguity of rules, or an apparent silence of the rules. Hence, a property may not be an estate of a deceased under one legal system while it could be so under another for the same reasons. The two systems may recognize different rights, powers, or restriction thereof, which consequently may result in conflicting claims to the estate in the Civil or/and Shariah Courts.

Overlapping agencies could be one of the estate distribution challenges whenever the claiming process has been made in multiple agencies. In this case, the claimant confused over the multiple agencies jurisdiction (Azmi & Muhammad, 2015). Other issue relating to overlapping agencies is found in *Abdul Shaik bin Md Ibrahim & Anor v. Hussein bin Ibrahim & Ors.* [1999] 5 MLJ 618, the first issue is a matter of declaration whether the Registration of Adoption Act 1952 (a federal law) was applicable to Muslims and the second issue was relating to custody (state matter). The court held that the former fall within the jurisdiction of Civil High Court while the second issue was within the jurisdiction of Shariah High Court. All these could be cumbersome procedures since it was conducted in the two adjudicative agencies.

Besides, lack of transparency about the entitlement of heirs of a deceased. Issues may be complicated and conflicting when the judge has to decide as to whether he has to rely on the principles of Islamic or Civil law. In *TM Feroze Khan & Ors v Meera Hussain TM Mohamed Mydin* [2006] 3 CLJ 616, the judge erred to hold that "the applicability of Islamic law is subject to the Civil law and here there are no preserving rules of Islamic law in the applicable land law and the law of trust that govern this case" (p. 625). The contention was

whether the subject property was subject to trusts or hibah. Had the judge considered the above provision of the Federal Constitution, and had explored the Islamic law of waqf and hibah, such a mistake could be avoided. The case may have been no more binding, in light of *Latifah bte Mat Zin v Rosmawati bte Sharibun & Anor* [2007] 5 MLJ 101.

The conflict of laws and therefore the conflict of rights are illustrated in cases where purposive effort was made by civil court to avoid the application of Islamic law. In *Abdullah Sani Bin Jaafar (Suing As Administrator Of The Estate Of The Late Datuk Jaafar Bin Hussain, Deceased, And On Behalf Of Himself As Beneficiary) V Mohamad Bin Bakar & Anor* - [1997] 5 MLJ 477 the judge excluded the application of Islamic law to an estate to which a creditor had claim. He though that the Syariah court had no jurisdiction over the case under s 10(2) of the Sabah Enactment because a claim by a creditor against the estate of a deceased does not come within the ambit of s 10 (2) (b) (viii), for inheritance is claimable 'through genetic descent' while creditor of the estate of the deceased is not claiming it through genetic descent but only for a debt due from the estate of a deceased. He mislead himself to presume that 'all claims by one Muslim against another for a debt [can] be filed in the civil court' while ignoring the main cause of action that is the claim in the case before him involved a claim to an estate of Muslim that was considered property of heirs and was subject to Muslim law. Such claim could be determined only if it is contested by heirs under Islamic law including incidental questions relating to claims of creditors, and other beneficiaries under an instrument of wasiyah or waqf. Obviously, if one had to follow this ruling, estates will be claimable only by those recognized under faraid system, which is an absolute misrepresentation of Islamic law.

Disputes may occur in transfer of ownership as been seen in the case of *Haji Osman bin Abu Bakar v. Sayed Noor bin Sayed Mohamed* [1952] MLJ 37, it also held that, when the landowner died before the completion of transfer of ownership, the legal personal representative of such deceased person was the trustee for the purchaser. The purchaser was entitled to the possession of land. The question however may be raised if on evidence it is proved that the transaction was valid under Islamic law but the deceased had failed to take aforementioned steps about the registration of the transaction. Non-recognition of which will lead to the exclusion of the claimant.

Estate distribution challenges include data fragmentation between agencies that reduce efficiency. Among the data/ documents that need to be submitted for the estate distribution procedure are death certificates, marriage documents, divorce papers, change of religion letters, heirs identification cards provided by the Department of National Registration, faraid certificates issued by the Shariah High Court, as well as documents of the deceased's assets that include all his property including land grants from the Land office, account bank

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statement, unit trusts, salaries and others from different agencies (Zulkafli & Ahmad, 2016; Muhammad Saifullah, 2020).

Using blockchain, the ledger in the smart contract is copied between different nodes, simultaneously eliminating the possibility of falsifying records (Alharti, 2021). Chen et al. (2021) introduced blockchain technology with the characteristics of decentralized, open, anonymous, and times of interruption, which simultaneously can maintain the integrity of the content of data. The hybrid blockchain architecture is distinguished because it is not publicly accessible yet retains the benefits of blockchain technology, such as integrity, transparency, and security (Anuar et al., 2023).

Blockchain technology also has the characteristics of immutability that it cannot be altered once the records are generated into the block and uploaded into the chain (Chen et al., 2021). Besides, blockchain affordances include interoperability that able to integrate all operations into one platform to enhance efficiency. According to Popov (2016), smaller networks may face security limitations, while large-scale applications demand high transaction speeds and robust cryptographic to create tamper-proof. Thus, real estate or estate distribution applications, in particular, require solutions that balance these demands to ensure seamless integration and widespread adoption.

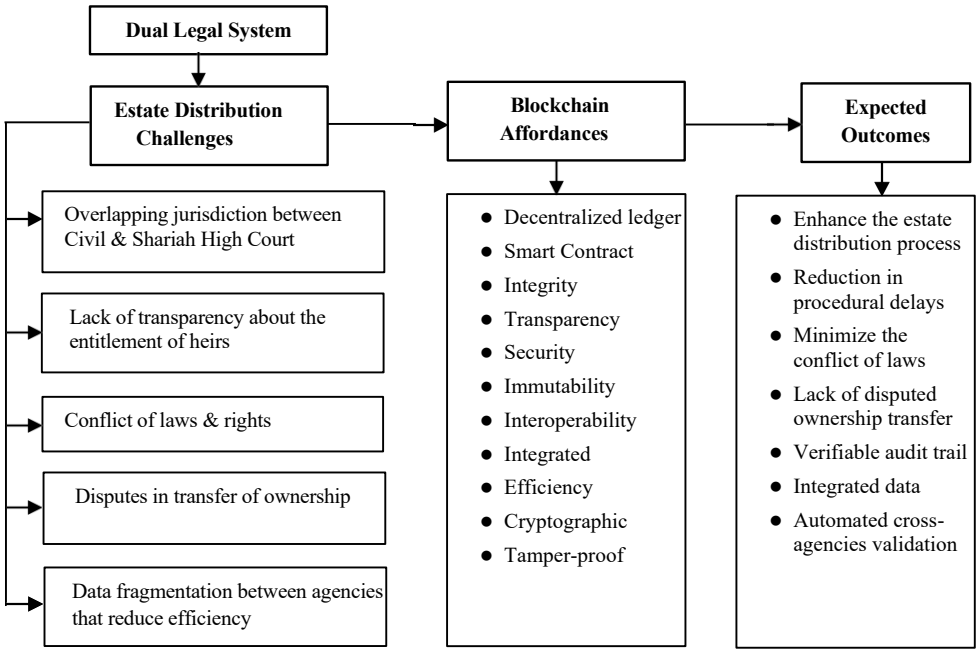


Figure 4: Conceptual framework linking blockchain affordances to estate distribution challenges under Malaysia's dual legal system.

Building on the systematic review's results, a conceptual framework in Figure 4 was developed to illustrate how blockchain's affordances such as decentralized ledger, smart contract, integrity, transparency, security, immutability, interoperability, integrated, efficiency, cryptographic, and tamper-proof can address key challenges in Malaysia's estate distribution process. The framework links these technological features to the persistent issues of overlapping jurisdiction between Civil and Shariah High Court, lack of transparency about the entitlement of heirs, conflict of laws and rights, disputes in transfer of ownership, and data fragmentation between agencies that reduce efficiency. By integrating blockchain into the estate administration workflow, the framework envisions a unified system that harmonizes institutional processes and enhances auditability. This framework extends the analytical findings by translating observed trends in blockchain applications into a localized, policy-relevant structure tailored to Malaysia's dual legal system.

CONCLUSION

This study employed a systematic literature review to synthesize recent research on blockchain technology in real estate transactions and estate distribution from 2019 to 2023. The reviewed papers utilized eight methodological approaches: interview (focus group discussion), theoretical, experimental, systematic literature review, case study, traditional literature review, legal, and holistic. Fourteen of the eighteen included papers proposed blockchain-based frameworks, categorized into five major purposes: digital land registration, consensus algorithm, inheritance, smart real estate buying/selling, and commercial real estate (CRE) management models. The results reveal growing scholarly and practical interest in blockchain applications within the real estate industry, but limited adoption of systematic literature review approaches.

This study contributes to knowledge by providing a structured synthesis that connects blockchain innovations to the unique administrative, adjudicative, and Shariah-compliant requirements of Muslim estate distribution in Malaysia. Furthermore, the proposed conceptual framework links blockchain's core affordances decentralized ledger, smart contract, integrity, transparency, security, immutability, interoperability, integrated, efficiency, cryptographic, and tamper-proof to the institutional and legal challenges in Malaysia's dual estate distribution system. This strengthens the study's theoretical and policy relevance while laying the foundation for a localized blockchain-based inheritance framework to guide future research and policy reform.

ETHICAL STATEMENT

This study relied exclusively on secondary data obtained from published scholarly sources; hence, no human participation or primary data collection was

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involved, and ethical clearance was not required. All materials were properly cited to uphold academic integrity and ensure transparency. Data identification, selection, and synthesis followed systematic review procedures consistent with PRISMA guidelines. The authors declare that there are no conflicts of interest regarding the conduct or publication of this research.

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INTEGRATED APPROACH FOR RESILIENT OFFICE BUILDINGS TOWARDS REDUCING FLOOD DISASTER RISKS

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Abstract

Every year, flooding affects Malaysia, especially during the northeast monsoon season. Whilst flash floods only last a few hours, monsoon floods might take a week or longer to restore to normal water flow levels. In the interest to lessen vulnerability towards natural disasters such as floods, development of resilience building is essential since this natural phenomenon can bring considerable damages to properties such as buildings. Office buildings are one of the fundamental elements of a nation's economy as they provide essential space and services for the community. Thus, any significant changes in their abilities to provide services for the public can bring impacts to the lives of people around them. Through the concepts of "living with floods," flood resilient construction has been widely acknowledged as a crucial part of the integrated approach to flood risk management. This can be accomplished by being aware of, and sensitive to any prospective disruptions caused by disasters, as well as studying previous disruptions. This paper aims to present an integrated approach for resilient office buildings towards reducing flood risks by choosing areas that are often exposed to flood hazards in Malaysia as the sampling sites namely Johor, Pahang, and Kelantan. This research commenced with a survey questionnaire to get preliminary information of the office building involved, followed by case study of selected buildings and Focus Group Discussion to get more in-depth understandings of the risks and challenges faced by building owners and managers. The findings revealed that by applying the core elements of office building resilience towards having an integrated approach for resilient office buildings can help mitigating the risks from the planning stage of land use and focus down to reduce the risks for the office building itself. This integrated approach was divided into generic and specific mitigation approaches for resilient office building towards reducing flood risk, which can be used by the building operators and related stakeholders to enhance the resilience of their office buildings.

Keywords: Flood, Disaster Risk, Office Building

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INTRODUCTION

Floods have been a yearly event in Malaysia, particularly in the monsoon season. The disaster is expected to occur in the month of October to March, along the northeast monsoon season in the states along the east coast of peninsular Malaysia which is most vulnerable to floods. This natural hazard could bring considerable impacts to buildings, including the office as this type of building is one of the fundamental elements of the country's economy. Office building provides imminent space for human activities whilst offering essentials services to the public. In this respect, any significant alteration to their function could affect the condition of lives for people depending on the services provided by the office building in local, regional, and even global settings [1]. Therefore, it is crucial for Malaysia to structure a coping mechanism to deal with the flood situation, that should not be used only for the people and community but also tackled the context of building resilience towards reducing disaster risks.

Most of the previous research focused on the single mitigation approach rather than developing a holistic approach in which this study will be focussing on. During flood, most of the attention were directed to the loss of properties or lives, but less emphasise was put on the losses suffered by office building such as the damage on critical documentations or assets. As for building, most studies concentrated on residential properties, whilst another study on the literature review of reducing flooding impacts to the built environment by [2] considered built environment as buildings and infrastructures in general, such as transportation, waste, water, energy, and services associated with them, including commercial properties and construction industries.

To evaluate the damages brought by flood, the buildings are categorised based on the ownership and types as each category of buildings have identical design criteria and features in terms of materials used in construction, contents, and sizes. These resemblances influenced how each building respond to flood in a similar way, in which it will represent comparable damages to their structures and capacities [3]. Therefore, this calls for research that focuses on the office building, with the enhancement through holistic approach by introducing an integrated approach as guideline. The established guideline from this study combined all the mitigation measures, involving all agencies and stakeholders in disaster management to reduce the impact of disaster, especially flood. This research encourages the requirement of creative innovation and cross-sectoral alliance, which links to practices and diversified stakeholders in supporting the evidence-based decision-making to reduce the current risk, as well as preventing future risks of disaster.

The novelty if this study lies in its contribution to disaster resilience literature by offering a localised, empirically validated guideline that integrates structural and non-structural measures within Malaysia's office building context. Through a mixed-methods approach and the development of a resilience

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scorecard for office building, this study has bridged policy, practiced, and experience, providing a replicable model for urban resilience planning in Malaysia.

LITERATURE REVIEW

Floods are natural phenomenon; however, when they exceed the coping capacity and damage life and properties, then they become a major source of concern. Malaysia, a country that is very prone to flood risks, mostly by the nature of its physical (e.g., topography and drainage) as well as its human geography (e.g., settlement and land use patterns). In Malaysia, previous research concluded that flood is the most frequent calamity that affected multitude regions particularly the low areas ever since the 1920s. Previous research found out that almost 9% of the total disaster was due to the land expansion whilst approximately 22% of the total population is directly impacted by floods [4], [5], [6], [7], [8].

Monsoon Flood in Malaysia

In general, there are two types of floods occurred in Malaysia, namely the monsoon flood and flash flood. Monsoon flood usually took place in May until August (Southwest Monsoon) and November until February (Northeast Monsoon) [8]. In contrast, flash flood often hit the city, caused by unrestrained human activities such as developing infrastructures nearby the rivers and rampant littering that blocked the ditch and waterways [4], [9]. This condition has brought some concerns among the community members as it can bring adverse effects on their lives and health, as well as damaging the infrastructures, properties, and agricultures [7], [10]. Commonly, the east coast states of Pahang, Terengganu, and Kelantan were affected by the northeast monsoon floods which occurred in November to March. The floods usually took three days to a week to be fully subsided, but it also depends on the amount of rainfall received during that period. For instance, if heavy rains continued for a longer period, the flood would take a longer time to recede.

The Affected Office Building during Flood

Office buildings were among the buildings that experienced the impacts of flood. During major flood that had paralysed the town of Kota Baharu, Malaysia in 2014, one of the most affected office buildings was the Kelantan Contingent Headquarters of Royal Malaysian Police in Kota Bharu Kelantan. The damage was estimated to be around MYR15.3 million, which involved the buildings, vehicles, along with the Information and Communication Technology (ICT) devices. The losses also covered 19 other police stations in five other territories,

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namely Kota Baharu, Pasir Mas, Tumpat, Kuala Krai, and Gua Musang that had been also hit by flood [11].

Office buildings required distinguished necessities which differentiate them from the other types of buildings. As this type of building deals with large populations, it requires specific design such as the heavier floor loadings and particular free stretch over between the structural columns and open plan floors that allows occupation flexibility, advanced EP (Mechanical, Electrical and Plumbing) system, along with the central system air conditioning, that involves special care for energy efficiency and infrastructure [12]. According to [13] Purpose-Built Office (PBO) signifies the buildings that were constructed to be used primarily as an office, which means that it should be more than 75% of the net capable area to be rented is used as office. The net lettable floor area is calculated to match the Uniform Method of Measurement of Buildings from the Royal Institution of Surveyors Malaysia (RISM). Office building contains various spaces, not only limited to the working, but also for storing up documents and other. As a workplace, an office will reflect what kind of works that have been carried out in the building.

According to the photos uploaded by Pasir Mas District Council on their official webpage on 29th November 2017, the office was hit by flood as continuous heavy rains had caused the overflow of Sungai Golok. The office and other buildings around Lubok Jong, Pasir Mas was submerged in water for a few days. Another office building that was affected by flood in Batu Pahat on 5th April 2021 was The Batu Pahat Magistrate's Court [14]. The flood was triggered by heavy rains, coupled with the high tide phenomenon.

Throughout the years, the development of flood resilient constructions has become a crucial element of the integrated measures to manage the risks of flood, and it is currently acknowledged by promoting the concept of living with floods and creating space for water. Resilient constructions have been accessible for centuries, but only in recent years have they been acknowledged as one of the components of further strategy in flood risk management. Buildings and the larger man-made environment are known to be the fundamental elements in flood risk management, and when buildings are developed on or nearby flood prone areas, there is an apparent requirement of protecting those aspects [15].

Core elements of Disaster Resilience

According to [16], coping capacity is defined as "the ability of people, organisations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters". In this paper, coping capacity is defined as "the ability of the building owners to control the impacts of natural hazards using available resources and capabilities to reduce the impacts of flood." To better understand how the appropriate coping strategies can be built in facing disaster situation, the core elements of disaster resilience were used to

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understand the context, disturbance, capacity to respond, and reaction to disaster. Therefore, after the concept of disaster and resilience has been understood, then only the risks that might occur can be identified. Risks are the probability that a community's structure or geographic area to be damaged or disrupted by the impact of a particular hazard (flood in the context of this study) on account of their nature, construction, and proximity to a hazardous area. A framework of resilience in a DRR and (climate change adaptation) CCA context is simplified in Figure 1 below:

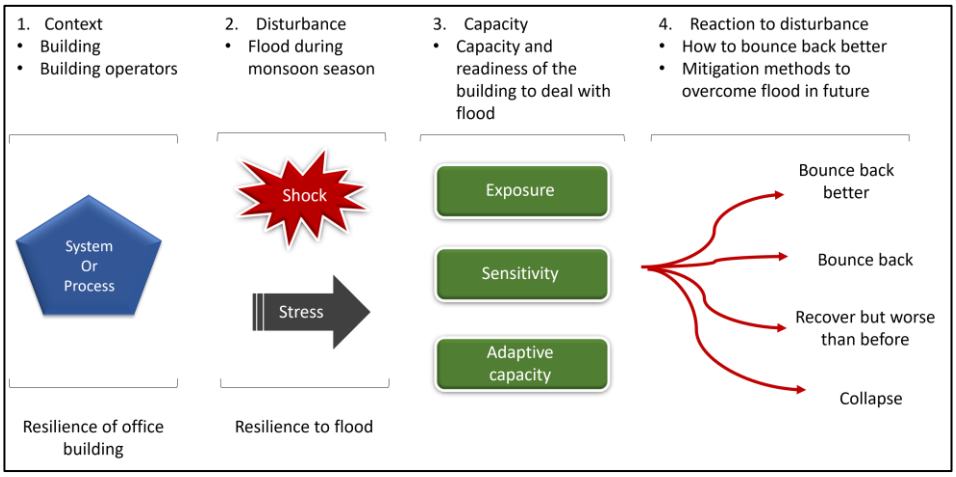


Figure 1. The Four Elements of Resilience Framework [17]

Core Elements of Office Buildings Resilience towards flood

In general, resilience is described as the capacity of a society, system, or area to respond, assimilate, and adjust to the current situation, and finally bounce back from the disturbing incidents quickly and effectively [16]. Meanwhile, Infrastructure Resilience (IR) refers to the capability of restoration across the system after disaster strikes, when the infrastructure systems were damaged due to the severe natural or human-made disruptive incidents [18]. The effectiveness of a resilient infrastructure or enterprise depends upon its ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event. This definition is widely used to describe the resilience of any infrastructure, including the buildings.

The National Institute of Building Science (NIBS), United States had determined that resilience can be characterised by four key features: robustness, resourcefulness, rapid recovery, and redundancy (the 4R). There is a fundamental difference between asset resilience and community resilience in which asset

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resilience is the resilience of a sole asset such as an individual building. There are multiple forms of feasible assets such as bridges, mass transit stations, transmission towers, or tunnels. Asset resilience can be characterised through the definition of resilience above, by using the 4Rs. Within an asset, its resilience is controlled by contrasting parameters (sometimes regarded as considerations). These parameters can be categorised as components from one or more of the 4Rs. Table 1 below shows a simplified example of building components and categorisations in an asset resilience setting.

Table 1. Resilience Example of Individual Building as an Asset [18]

RESILIENCE COMPONENTS	BUILDING PARAMETERS (CONSIDERATIONS)
R1: Robustness	Structural connections
R2: Resourcefulness	Maintenance of building Memorandum of Understandings (MOUs) between different organisations
R3: Recovery	Roadways leading to building Training of all kinds
R4: Redundancy	Main water pipes into building Electric and/or power lines

Assimilating resilience into new building designs, actual retrofits, and continuous building activities will imply considerable expanses. Thus, it is necessary to evaluate the investments in building resilience to assess the benefits of such expenditure throughout the life cycle of the facility. Meanwhile, the enhancement of resilience should be assessed as it is crucial to identify performance (or for security and protection) levels and their impacts on reducing the risks and increasing resilience. The four (4) core elements of resilience framework and four (4) resilience components of the buildings were used as a foundation in designing the integrated approach. By building the capacity for disaster resilience of office building, it will lead to another phase in the process of managing and mitigating disaster known as Disaster Risk Reduction.

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METHODS

This study adopted mixed method approach with sequential explanatory design which commenced with the needs of quantitative data collection, followed by qualitative data collection. The quantitative data were required to represent the affected population based on the samples selected. This helped the researchers to get the big picture from the respondents based on what they have been through and the challenges they faced during flood in monsoon season. Then, data

collection continued with qualitative data using selected case study. It was carried out by identifying several buildings to get an in-depth understanding on the risks and challenges faced by the building operators, along with proposing coping strategies. Figure 2 below illustrates the mixed method approach with sequential explanatory design used in this study.

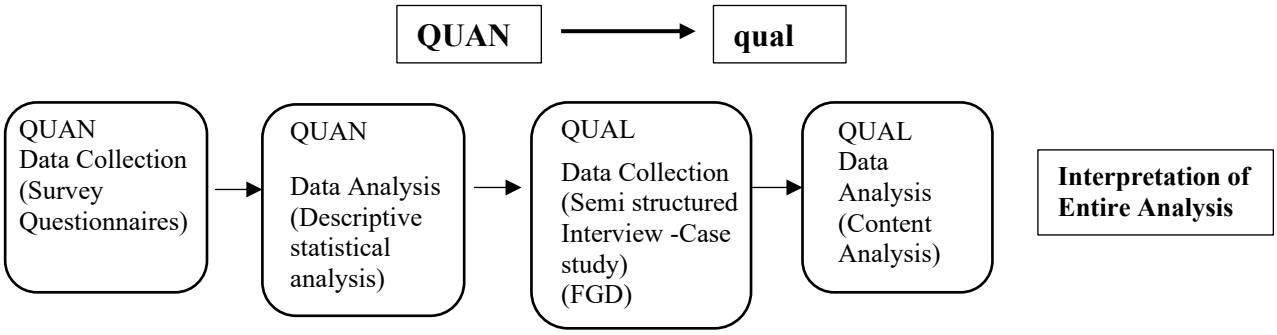


Figure 2. Sequential Explanatory Design [19]

Accordingly, the focus of this study is to investigate office buildings which had been affected by floods during monsoon season. This comprehensive data collection was conducted in three (3) phases.

Phase 1: Survey Questionnaires were distributed to 120 office building owners/managers from the states affected by the floods, namely Pahang, Johor & and Kelantan, (purposeful sampling). This sample size was selected to ensure proportional representation from the three states, capturing regional diversity relevant to the objectives of this study. Participants of this study was determined using available literatures to identify the office buildings involved in 2014 monsoon flood and used them as the marking point for each state. Subsequently, the nearby office buildings that could have been also hit by flood were identified using Google Earth. The total number of the samples from each state can be summarised in Table 2 below:

Table 2. The Total Number of Office Buildings Affected by Flood in Kelantan, Pahang, and Johor

State	Total no. of Office Building
Kelantan	40
Pahang	40
Johor	40
TOTAL	**120**

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Throughout the survey, eighty (80) from the total of 120 buildings have responded to the questionnaire. This was due to the limitations of the building owners or managers. Some of the buildings refused to answer the questionnaire as it was out of their position. For the buildings that participated in the survey, most of the building owners or managers agreed that the essentials put in the questionnaire are important in enhancing the resilience of office buildings. Meanwhile, Figure 3 below shows the map of Peninsular Malaysia, and the highlighted states are the sampling sites for this study.

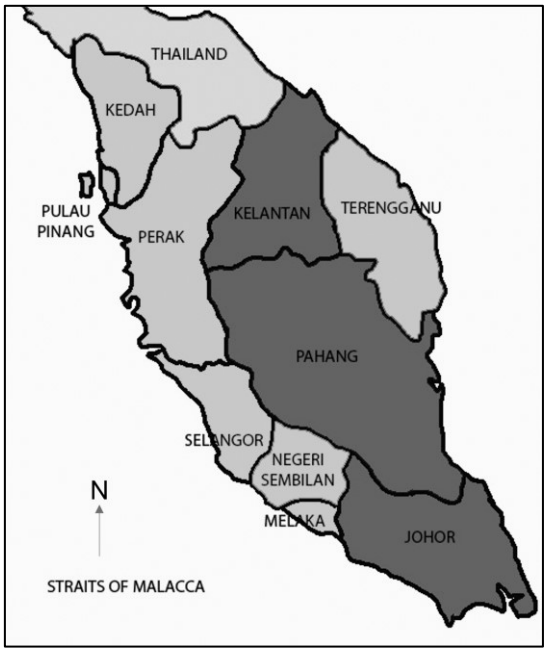


Figure 3. Sampling Sites

Whilst the districts chosen for the case study were depicted in the figures below, according to their respective states.

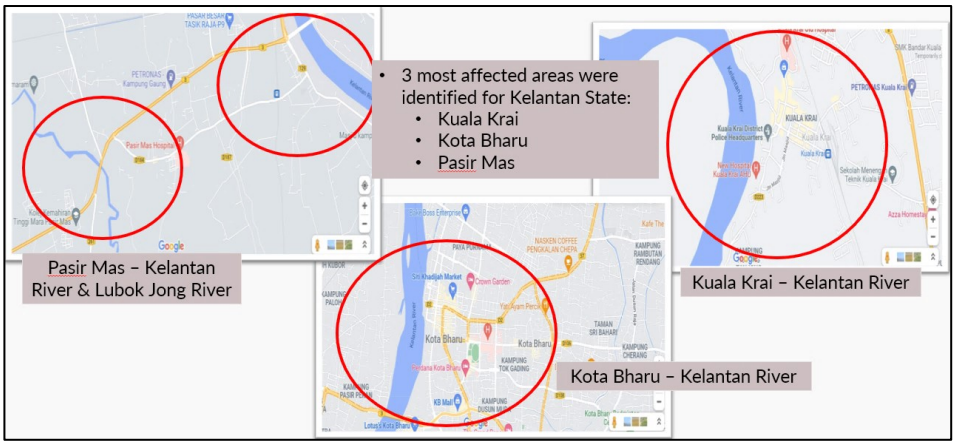


Figure 4. Study Sites for Kelantan State (Source: Google Earth)

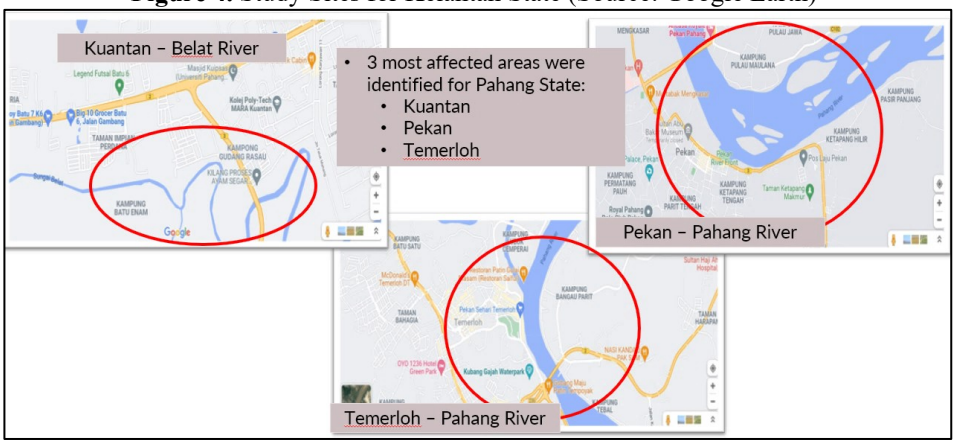


Figure 5. Study Sites for Pahang State (Source: Google Earth)



Figure 6. Study Sites for Johor State (Source: Google Earth)

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Before commencing with the survey, Cronbach's Alpha was used to measure the internal consistency and reliability of the essentials in the questionnaire. The result of the Cronbach's Alpha for each Essential in the questionnaire is listed in Table 3 below:

Table 3. The result of the Cronbach's Alpha for each essential in the questionnaire

No.	Essential	Cronbach's Alpha value
1	Developing and Maintaining the Office Building Resilience in General	0.967
2	Identifying, Understanding, and utilizing the current and future risk scenarios	0.977
3	Enhancing Financial Capability for Resilience	0.838
4	Pursuing the Development of Resilient City to Achieve of Exceed the Resilience Requirements	0.950
5	Empowering Institution's Capacity for Resilience	0.938
6	Enhancing Infrastructures' Resilience	0.950
7	Ensuring Effective Response Towards Disaster	0.949

From the result, all the essentials were categorised as good and excellent. Hence, all the essentials were accepted to be put in the questionnaire.

Phase 2: In depth investigation via interview sessions with the selected case studies involved eight (8) buildings; two (2) from Pahang, three (3) from Johor, and three (3) from Kelantan. These buildings were chosen based on three most affected districts during flood from the respective states. In depth investigation via interview comprised the building management/facilities management team for the respective buildings. The findings of the interview were used to develop the questions for the next stage of the study, which is Focus Group Discussion.

Phase 3: Focus Group Discussion (FGD) was conducted with the relevant stakeholders such as government agencies involved in disaster management, academicians, and insurance company to gain more information on the mitigation measures that can be adopted in reducing the risk of disaster for office buildings. FGD was conducted face to face with all the stakeholders, and the findings were used to develop the final guidelines for this study.

Prior notice was given to the participants on the purpose of the study, and their permission were asked before the interviews commenced. It was stated in the official letter, that all particulars of the participants and/or organisation details would remain confidential and the contents of the interview would be used solely for the research purposes. The interview process was then conducted after the participants gave their consent, based on their convenience through agreement on the date, location and time. Thus, this study has adhered to the ethical research standards.

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ANALYSIS RESULT

Survey questionnaire results

There were seven (7) essentials in the questionnaire that were used to develop the Office Building Resilient Scorecard in Malaysian context. Within the essentials, there were several components that can be used to determine the status of the office building resilience. The level of importance for each component and the current practice of the components in the management of buildings under investigation were summarised in Table 4 below:

Table 4. Survey Questionnaire Results for Disaster Resilience Scorecard for Office Building

Essential	Level of importance	Current practise
Essential 1 - Developing and Maintaining Office Building Resilience in General	>70%	**<70%**
Essential 2 - Identifying, Understanding, and utilising the current and future risk scenarios	>70%	**<25%**
Essential 3 - Enhancing Financial Capability for Resilience	>70%	>70%
Essential 4 - Pursuing the Development of Resilient City to Achieve or Exceed the Resilience Requirements	>70%	**<70%**
Essential 5 - Empowering Institution's Capacity for Resilience	>70%	**<70%**
Essential 6 – Enhancing Building' Resilience	>70%	**<70%**
Essential 7 - Ensuring Effective Response Towards Disaster	>70%	>70%

In conclusion, the survey questionnaire has reflected the importance of all the components in the proposed essentials towards developing the Disaster Resilience Scorecard for Office Building in Malaysia. The scorecard can be used to assess the current state of the office buildings in Malaysia and the level of awareness in managing the building towards reducing disaster risks, specifically for flood. As part of the integrated approach, this scorecard will help the building managers and operators to evaluate the current state of their buildings and constructing the mitigation methods that can be adopted in facing the disaster of flood in future.

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The score will be used to evaluate the status of the building management, according to the score in each component within the essentials. The measurement can be interpreted as the percentage of involvement among managers and staff of the building in the components stated in the scorecard or how far have the components have been adopted in the management of the building towards reducing the current and future risks of flood. Each score indicated that 1 signifies zero or no preparation at all whilst 5 signifies perfection, or resilience has been achieved in that element. The exhibitive assessment scales can be categorised as follows:

- 5 – Single point of coordination exists with agreed roles and responsibilities
- 4 – Single point exists but with some minor exceptions
- 3 – Single points exists in principle, but with some major exclusions, or lack of agreement on some major areas
- 2 – Initial steps taken to create a single point of coordination
- 1 – No single point but plans exist to create one

All the scores will be added up and the total scores could be determined. The measurement of the scorecard is summarised as in Table 5 below.

Table 5. The indication of the score from the Disaster Resilience Scorecard for Office Building

	Red Zone	**Caution Zone**	**Going Well Zone**
Overall score	**25% (55-56)**	**26-75% (57-167)**	**76-100% (168-220)**
Building resilience	25% (6-7)	26-75% (7-18)	76-100% (19-25)
Current & future risks	25% (7-8)	26-75% (8-22)	76-100% (23-30)
Financial Capacity	25% (7-8)	26-75% (8-22)	76-100% (23-30)
Resilient city	25% (6-7)	26-75% (7-18)	76-100% (19-25)
Empowering institutional capacity	25% (9-10)	26–75% (11-30)	76-100% (31 -40)
Enhancing building resilience	25% (7-8)	26-75% (8-22)	76-100% (23-30)
Effective response	25% (10-11)	26–75% (11-30)	76-100% (31 -40)

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Focus Group Discussion Result

Analysis done was run through Nvivo R1 software analysis. The findings were divided into three themes:

1. Theme 1 - Building
2. Theme 2 - Surrounding and location
3. Theme 3 - 'Others'

The main findings of theme 1 are illustrated in Figure 7 below:

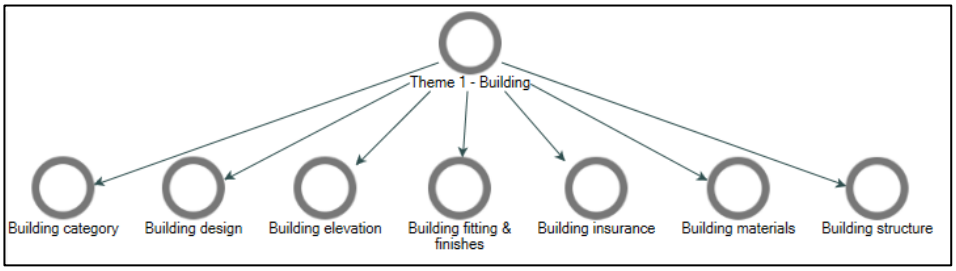


Figure 7. Main findings of theme 1 - Building

As seen in the figure above, there were seven (7) subthemes under building, which are:

i) Building category
ii) Building design
iii) Building elevation
iv) Building fitting and finishes
v) Building insurance
vi) Building materials
vii) Building structure

The following table (Table 6) shows part of the content analysis result from the interview.

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Table 6. Data display of content analysis process – Sub Theme 1

Ground floor and open space concept.	Finishes such as carpet, vinyl & curtains.	Using waterproof doors such as steel door.
The areas involved might be gazetted. So, we don't have to use the ground floor or basement. The operation should start at the next floor. Ground floor should be left empty as the flood mitigation method. The ground floor should be exposed. So, the damages can be minimised during flood.	These finishes are considered as moveable assets which are not part of the building.	The are some offices that change their doors into steel doors as the existing doors were damaged during flood.
Choosing waterproof finishes is crucial	**Damaged doors and cabinets**	**New building should be insured**
Choosing the right types of building finishes is fundamental. Building finishes such as floor, wallpaper, ceiling, and door and window are always expensive and should be insured if it is a new building. Selecting the high resilient building finishes is very important in reducing the risks of flood for any buildings or office buildings.	Involving specific components only. Properties such as cabinets and doors will be destroyed.	Might be applicable to the high-risk buildings, the buildings aged less than two years, or the newly built buildings.

Accordingly, there are three (3) subthemes under theme 2 (surrounding and location), which are:

i.) Drainage
ii.) Information sharing between agencies on development area
iii.) Location for development

The example of data display of analysis conducted through Nvivo software using content analysis technique for the sub-themes under theme 2 is listed in Table 7 below.

Table 7. Data display of content analysis process – Sub Theme 2

Drainage system for flash flood is still functioning and can be improved.	Monsoon flood _ existing drainage design will often fail.	Types of soil trench under JPS
Firstly, need to look at the flood category – flash flood or monsoon flood. Drainage and landscape system, such as the 'Manual saliran mesra alam' each development will control its own water flow before releasing it to the river. Every candidate should follow the manual.	During monsoon flood, most of the designs will oftentimes fail.	In terms of trench, to put it simple, if it is soil trench, then it is under JPS.

Complying with the drainage design by Local Council	The buildings were developed in the flood prone areas	Risk Assessment in the new development areas
The issue is whether the developers followed the plan or not as it is under the jurisdiction of Local Council.	The location has been fixed. So, need to think of other ways to handle the problems in the area.	The existing flood risk map can be used to develop a flood mitigation map for the specific areas. Assessing the risks of flood in the areas according to the maps provided – either urbanisation or agricultural areas.

Meanwhile, the final theme which is categorised under 'others' can be classified into six (6) subthemes as the following:

i.) Coordination between agencies
ii.) Digitalised document
iii.) Educate and raise awareness
iv.) Flood risk mapping and risk evaluation
v.) Living with flood concept
vi.) Strict rules and regulation enforcement

The content analysis result from is shown in Table 8 below, which listed the codes list under theme 3.

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Table 8. Data display of content analysis process – Sub Themes 3

Digitalising existing documents	Confidential Documents & damaged tenders	New development, risk assessment on the environment should be conducted
Proposed only for the crucial documents Need to be justified – but can be printed whenever needed. Need to have the digitalised data to ease the process of storing the documents especially for drawings. This is because the risks of redrawing the documents often lead to problems such as the consultants closed their business or dead, hence the documents should not be stored in hardcopy only. The cost of redrawing measured drawing is very high.	The confidential and tenders were destroyed during the flood as they were stored at ground level.	Should consider and look at the surroundings before increasing the level of development in any areas. As in one area where NADMA is involved – should assess the surrounding. Once forecasted if the surrounding become worse, new methods should be implemented.

Risk evaluation in the new development areas	In development cannot be avoided - educate the concept of living with flood	Requirement to re-establish floodplain areas
Flood Risk Map which is readily available can be used to develop a flood mitigation map. Assessing the risks of flood in the areas according to the map – whether the urbanisation or agricultural areas.	Office building owners can be aware of the condition and mitigation approaches taken in their areas and can lend their help. need to be supported with the insurance coverage and flood proofing, The resilient building towards disaster, by following the concept of living with flood as it cannot be avoided anymore.	Farmers will get the insurance coverage for their crops NAFAS dan FAMA will be involved. Suggesting the re-establishment of flood plain areas, to make room for water in the existing strategic plan.

From the data display above, all the elements mentioned in the previous part of the themes and subthemes are listed in the table such as the requirement of digitalising important documents, assessment and evaluation of the new development areas, educating the concept of living with flood, and the requirement of re-establishing the flood plain areas to reduce the risks of disaster, especially flood. All these elements are crucial in minimising the impact of disaster in constructing the final guidelines of this study. The results from this FGD have helped the researchers to validate the initial guidelines outlined for this study. All the comments and suggestions are put into consideration regarding improving the guidelines so that it can benefit the stakeholders involved.

FINDINGS AND DISCUSSION

The integrated approach developed is centred around the core elements of disaster reliance framework and the core elements of resilient buildings. The core elements from both inputs were then combined to establish the core elements of office building resilience for this study The seven (7) essentials in the scorecard reflected the capacity to deal with reaction in the core elements of office building resilience, which is summarised in Table 9 below:

Table 9. The core elements of office building resilience (Adapted from [17], [18])

Context	Disturbance	Capacity to deal with disaster	Reaction to disturbance
Office Building	Monsoon Flood Disaster	Exposure Robustness Redundancy Resourcefulness Recovery Sensitivity	Bounce back better

Accordingly, the specific components of the integrated approach related to the office building were built upon the core elements of building resilience. It is translated into the Disaster Resilience Scorecard for Office Building which can be used by the building managers and operators. All the seven essentials were embedded under the capacity to deal with disturbance. Table 10 below summarised the specific components of disaster mitigation approach related to office building, in terms of the non-structural measures.

Table 10. Specific components of disaster mitigation approach related to office building (Non-structural measures)

Capacity to deal with disturbance	Office Building Disaster Resilient Scorecard (7 Essentials)
Robustness	Essential 1 Developing and maintaining office building resilience
Exposure	Essential 2 Identifying, understanding, and utilizing the current and future risk scenarios
Resourcefulness	Essential 3 Enhancing financial capability for resilience
Sensitivity	Essential 4 Pursuing to achieve of exceed the resilience requirements
Resourcefulness	Essential 5 Empowering capacity for resilience
Recovery	Essential 6

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	Enhancing building structure/infrastructure resilience
Robustness Redundancy	Essential 7 Ensuring effective response towards disaster
Reaction to disturbance – 'Bounce Back Better'	
Location selection	• New development on the flood free area • Flood Risk Mapping and assessment
Insurance	• Educate and raise awareness of building owners (i.e government buildings) • Group insurance for building within the same areas under one owner/building manager
Document Digitization	• Create digital backups of all essential documents, such as financial statements, leases, agreements, contracts, design etc. • Using inexpensive/free software applications OR Specialised Optical Character Recognition software (OCR)
Information sharing on new development area	• The proposed new development area can be reviewed by referring to the 'Integrated Land use Planning Information System (I-Plan) PLANMalaysia and cross evaluated with flood risk mapping in the area. • This information on risk evaluation report should be shared with the respective agencies and information of data confidentiality should be considered.
Educate building owner and users	• To raise awareness and educate business owners on the capacity building requirements to manage the building better • To ensure business continuity or uninterrupted/ less effected business activities on post-disaster event
Raise awareness on concept living with flood	• To have resilience strategies for flood risk management within flood prone area • Flood mitigation measures can significantly reduce flood damage and, as a result, help to reduce risk.

Referring to the table above, for the non-structural measures which represented the Essentials in the Disaster Resilience Scorecard for Office Buildings, specifically Essential 1 and 7 are related to the core element of robustness. It refers to the capability to continue the critical operations and functions amid critical situation in which the building and its crucial support systems can be constructed to minimise interruption. Meanwhile, Essential 2 is related to exposure in which the building is exposed to the current and future risk scenarios whilst Essentials 3 and 5 can be associated with resourcefulness. Resourcefulness can be referred as the capacity to get ready for, react to, and conduct any ongoing catastrophe or interruption through effective mitigation measures.

Whilst sensitivity can be related to Essential 4 as all the building users will be accounted in the mitigation approaches, including those who are disabled. The recovery elements can be seen in Essential 6 as it refers to the ability to bounce back to normal operations as soon and as efficiently as possible after a disaster by enhancing the resilience of building structure and infrastructures. Another core elements that can be related with the mitigation approach for office building is redundancy, which is reflected in Essential 7.

To complement the non-structural measures listed in Table 10 above, building owners and operators can refer to Table 11 below which specified the structural measures that can be adopted towards reducing flood risks for their office buildings.

Table 11. Specific components of disaster mitigation approach related to office building (Structural measures)

Reaction to disturbance – 'Bounce Back Better'	
Construction Materials / foundation Material absorbency categorized by Class	• Class A - minimal damage under most circumstances • Class B - susceptible to physical damage when wet, otherwise no long-term damage • Class C - C subject to damage after prolonged immersion, but will recover when effectively dried • Class D - subject to permanent damage if subjected to relatively short periods of wetness • Building built on less permeable soil should add 6 inches of topsoil
Building elevation (from the ground level)	• 1 or 2 feet from the ground level • Not more than 2 meters from the ground level • Building elevation standard from UN not exceeding 2 meter
Requirement for flood proofing measures in the building (basement car park) - *Dept. of Town and Country Planning (Peninsular Malaysia) JPBD (PlanMalaysia) 7/2003 source* *Planning Standards & Guideline – Multi-storey Carparks of New Buildings* - *JKR (PWD)source* *2nd Edition of Garis Panduan Reka bentuk Parkiran (Tempat Letak Kereta) Bawah Tanah Kalis Banjir* - *JPS (DID)source*	All basement carparks of new building should be equipped with flood gates to obtain construction approval by Authorities <u>Part 1</u> • Planning Criteria • Space • Location • Arrangement • Traffic • Instrument <u>Part 2</u> • Guideline on the design of flood proofing • Flood record analysis • Flood warning system • Security & Access • Flood emergency plan • Inspection and maintenance plan • Flood risk assessment • Hydraulic computation • Flood surveillance & warning system • Emergency plan action

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Reaction to disturbance – 'Bounce Back Better'	
Guideline of Flood Prevention for Basement Carpark (2006)	• Flood proofing designs and methods application technique **Note: All indicators listed under each part is adapted from related government agencies (PlanMalaysia, PWD, DID)*
Building design to reduce flood risk	• Pillared buildings reduce losses • The ground floor is open concept
Building fittings and finishes materials	• Class A and Class B absorbent materials • Flood resilient flooring (i.e., solid concrete floors or floor laminates) • Flood resistance door (i.e., steel doors)
Guideline according to building category *-JKR sources:* *i) Manual Panduan JKR Standard* *ii) Garis Panduan BIM JKR*	• New develop building • Less than 10 years • More than 10years • Exceeding 20 years • Heritage building • Prestige building
Drainage systems within the surroundings *-DID sources:* *Manual Saliran Mesra Alam*	• Enforcement and compliance with drainage design under local government • Schedule and preventive maintenance

The integrated approach for Resilient Office Buildings Towards Reducing Flood Disaster Risks can be seen through a comprehensive measure that it offers. It is a combination of an assessment of the office building status through the disaster resilience scorecard for office buildings, followed by the list of mitigation measures that can be taken by the office building towards enhancing their resilience to reduce the risks of disaster, specifically for flood.

The specific components which comprise specific elements of resilient office building also adopted the multi approach criteria through the proposed structural and non-structural approaches. The combination of these two approaches have shown the robustness of the guideline as it provides comprehensive mitigation approaches that can be adopted by the office buildings towards enhancing their resilience and reducing the risks of disaster.

CONCLUSIONS

It can be concluded that this integrated approach can be used by the building owners, managers, operators, and other relevant stakeholders. This guideline

provides a scientific approach in the non-structural and structural measures that can be used to enhance the resilience of office buildings towards reducing the risks of water related disaster, specifically flood in Malaysia. From the three stages of data collection adopted in this study, the risks of flood on the office buildings were identified and mitigation approaches were structured to develop a guideline for resilient office buildings in the context of Malaysia. It can be utilised to enhance the resilience of the office building and simultaneously reduce the risks of future disaster by implementing the measures outlined in the guidelines into the management of office buildings that are vulnerable to floods.

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QUANTIFYING NATURE'S IMPACT: FLOOD VULNERABILITY AND THE MALAYSIAN RESIDENTIAL MARKET

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Abstract

Flooding, a frequent and devastating natural disaster, poses significant risks to residential property markets, including in Malaysia. This study aims to quantify the impact of floods on house prices in Johor Bahru, a region increasingly prone to flash floods. Approximately 468 property transactions from 2013 to 2022 were analysed using the Hedonic Pricing Model to determine how flood risk influences house prices. Contrary to the global consensus that flood exposure depresses property prices, the results indicates a modest price premium effect for properties located within flood-prone areas. This suggests that local market dynamics including strategic location, established neighbourhood amenities, and community risk adaptation offset the typical price discounts observed internationally. The findings offer new empirical insights for Malaysian urban studies and highlight that environmental risks may not be universally internalised in the same way across markets. The findings also offer insights for homeowners, buyers, planners, valuers, insurers, financiers, and policymakers, guiding informed decision-making in flood risk management and urban planning. Future research may explore other regions and incorporate additional spatial and environmental variables to better understand hazard-related price behaviour across diverse Malaysian contexts.

Keywords: Housing Prices, Real Estate Market, Flood Impact, Natural Disaster

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INTRODUCTION

Flooding is the inundation of land surfaces caused by water channels overflowing their banks, a river bank being overtopped, water overflowing onto normally dry land, or the presence of water in normally dry areas. Floods, which also significantly damage property, destroy crops, spread disease epidemics, and cause other losses, are the most frequent and significant losses each year. Land prices, according to land economics theory, represent the land's existing usage and future applications (Huang et al., 2006). Hence, floods may have an effect on the land's production and are likely to affect proximate property values. Residential areas affected by negative externalities are considered unattractive and undesirable for purchase, rent or investment resulting in price or rent discounts that may fetch up to 58% of discounts in price as disclosed by Jung and Yoon (2018).

Floods are one of Malaysia's most formidable and frequent natural disasters. The Department of Irrigation and Drainage 2012 research, which revealed that 10.1% (33,298 km^2) of Malaysia's total land area of 330,436 km^2 is located within flood-prone zones and effects about 5.7 million Malaysians, highlighted the scope of this issue. The geographical location and climate of Malaysia make it susceptible to heavy rainfall and monsoons, leading to increased flood risk (Klijn et al., 2011). Between 2012 and 2019, Malaysia had the highest rate of flood hazards among ASEAN Member States. These flood events can have significant consequences for the residential property market, affecting property values, buyer behaviour, and overall market dynamics. Previous research has identified various factors influencing house prices in Malaysia, including government housing regulations, the country's economy, and demographics. However, there is a lack of research on the influence of flash floods on the Malaysian housing market. Thus, to address the knowledge gap, this research aims to ascertain the impact of floods on Malaysian house prices by utilising the Hedonic Pricing Model (HPM).

This paper offers two benefits. Firstly, it expands academic knowledge on flood impacts on house prices, particularly in Malaysia. This study significantly contributes to the discourse by juxtaposing worldwide assumptions, which uniformly indicate adverse pricing consequences of flood risk, with the actual dynamics of the Johor Bahru property market. International literature predominantly indicates price discounts; however, the Malaysian setting may reveal a distinct market logic influenced by local tastes, urban dynamics, and socio-economic adaptations. This constitutes a significant innovation of the study and highlights the necessity of localised empirical evidence for Malaysian urban research. The HPM approach allows for the estimation of the marginal contribution of various property attributes, including flood risk, to property values. By examining the relationship between flood exposure and property

values, this research will provide a comprehensive understanding of the impacts of floods on the Malaysian residential property market.

Secondly, the findings from this study guide property market participants in making decisions. Property owners will be aware of the potential risks and depreciation in property values associated with flood-prone areas and can make informed decisions regarding flood risk management and property investments (Shah et al., 2015). Buyers can use the findings to assess the potential risks and value of properties in flood-prone areas (Atta-ur-Rahman & Khan, 2011). Insurers and financiers can develop appropriate insurance and financing options tailored to the specific needs of properties in flood-affected regions (Muthusamy et al., 2019). Policymakers can utilise the research findings to formulate effective flood management and urban planning policies that mitigate the negative impacts of floods on the residential property market. This research elucidates the disparity between international findings and the pricing dynamics in Johor Bahru, so offering novel insights to Malaysian real estate scholarship and enhancing the comprehension of how urban markets in Southeast Asia assimilate environmental issues.

This paper is structured as follows. The second section gives a brief overview of the literature on how floods affect the housing market, and the third section elaborates on the methodology. The fourth section examines the impact of floods on house prices and discusses the results. The fifth section concludes the findings of this study. Based on previous studies findings, it is hypothesised that flooding will negatively impact the housing market through price discounts.

FLOOD IMPACTS ON THE HOUSING MARKET

Real estate's value is intrinsically tied to its purpose, utilisation, and the efficiency with which it fulfils its utility beyond its physical components of bricks and mortar. Among its defining features, the consumer's chosen location, the surrounding neighbourhood, and the quality of infrastructure stand out prominently. Within the global real estate industry, property values hold a pivotal position and are subject to a multitude of influencing factors. These encompass locational, structural, and neighbourhood attributes, each contributing to the overall value equation (Mohd Nazri et al., 2022; Suhaimi et al., 2021; Zihannudin et al., 2021). Structural attributes encompass elements such as bedrooms, bathrooms, fireplaces, garages, square footage, lot size, structural age, and even the presence of a pool. Meanwhile, neighbourhood attributes encapsulate the socio-economic characteristics of neighbours, the condition of neighbouring structures, ownership or rental status, ethnic composition, proximity to schools, tax districts, and the overall environmental quality. The concept of location holds particular prominence, encompassing access to various amenities and services.

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Alonso's bid-rent theory further elucidates the significance of location, stating that individuals are willing to allocate a portion of their income based on the value of location. A residence positioned in a desirable locale will command a higher price during the bidding process, whereas a property in a less favourable area will naturally elicit a lower valuation.

A number of studies have observed that flooding events reduce property values compared to similar properties without flooding as a result of lower demand from buyers. An extensive literature has explored the effect on property sale prices from being located in a floodplain and flooding events. The consensus is that a property's location in a 100-year floodplain lowers its sale price by 4% to 21.5% (Bin & Landry, 2013; Miller & Pinter, 2022; Netusil et al., 2019; Zhang & Leonard, 2018) and 500-year floodplain lowers its sale price by 5% to 7% (Miller & Pinter, 2022). Meanwhile, in some studies major floods are estimated to cause price discounts that exceed 75% (Beltrán et al., 2018).

In research based in Australia, Fuerst and Warren-Myers (2019) demonstrate a discount of 1 to 3% for properties and a 2 to 5% discount in land value for properties located in a flood risk area. Meanwhile, in the Vietnamese housing market, Bui et al. (2022) revealed that houses exposed to the flood event underwent a notable price reduction of 9% following a substantial flood occurrence on September 30, 2017. Rabassa and Zoloa (2016)'s study in Argentina indicated that residences in floodplains are valued around 3.5% less than comparable houses. In fact, residences in higher risk locations receive a double discount on prices. This indicates that risk exposure leads to greater negative effects on property values.

Hurricane events may also lead to flood events that may impact the value of properties inundated. Ortega and Taşpınar (2018) discovered a significant 9% drop in house prices post-hurricane Sandy. Bin and Landry (2013) analysed homes in Pitt County, North Carolina, that were hit by hurricanes in both 1996 and 1999 to estimate the reaction of prices post hurricane. Their estimates indicated that homes affected by floods fall in value by about 7% in immediate aftermath. Nevertheless, the discount dissipated within six years. These results echoed the findings of Atreya et al. (2013) and Atreya and Ferreira (2015), who documented that homes in flood plains that have not recently flooded do not sell at a discount relative to homes outside of flood plains. In another United States based study, Aliyu et al. (2016) also observed that the price discounts only affect properties temporarily. Flood price discounts may vary both temporally and geographically.

A study in the US by Zhang and Leonard (2018) observed a rise in price discounts by almost 13% following flood events and that the price discount increases by 8.6% when comparing properties inside the floodplain to those 1000-1500 ft away, compared to those immediately outside the 100-year floodplain.

Meanwhile, in South Korea, Jung and Yoon (2018) discovered that the impact of the distance of a flooding disaster is within 300 m of an inundated area. Market values of housing located 0–100 m, 100–200 m, and 200–300 m from inundated areas were lower by 11.0%, 7.4%, and 6.3%, respectively. Nonetheless, the effect lasted for 12 months' post-disaster. During the first month, first three months, and second three months after impact, houses located within 300 m of the inundated area experienced a price discount of about 57.6%, 49.2%, and 45.9%, respectively. However, after six months, the discount effects were reduced to 33.2%.

Overall, the existing studies provide limited evidence that natural disasters exert lasting effects on property prices. In the short run, price effects are limited to those homes that sustained damage, and prices will return to their previous pre-disaster level after 2–3 years at most, according to studies of Atreya et al. (2013) and Miller and Pinter (2022). In Australia, Rajapaksa et al. (2016; 2017) analysed the impact of flood on single dwellings and observed between 5% to 18% price discount. Nonetheless, this impact fades from the property market over time. Regions with more amenities and located in high income areas were shown to recover faster in spite of flood risks than regions without these characteristics (Rajapaksa et al., 2016; 2017).

Previous studies have disclosed findings for various countries except for Malaysia. This causes difficulties to draw conclusions on the impact of flood risk on property values in Malaysia. Homebuyers' flood risk perception may be impacted by government flood management initiatives, damage compensation laws, and insurance policies (Mutlu et al., 2023). Thus, the findings are expected to vary by country, including Malaysia. To the authors' knowledge, Ismail et al. (2016) is the only Malaysian study that quantified flooding's influence on property prices. The study found that a one-hour increase in flood duration decreased urban and rural land prices by 4.2% and 4.7%, respectively. This shows that prolonged flooding lowers property prices in urban and rural areas. The constant flooding causes property damage, leading to this depreciation tendency.

In another study based in Malaysia, Razali et al. (2018) examined the repercussions of flood hazards on residential property value within the Langat River area and concluded that the residential properties prices within the study area experienced only marginal effects. This study encompassed a range of housing estates, spanning both suburban and rural areas. A recent study in Kelantan by Abd Hamid et al. (2020) found that property values were unaffected by flood due to the strategic economic location and local people's adaptability and risk-taking mindsets when residing or working at flood-prone locations.

The emphasis on house price effects distinguishes the study from Ismail et al. (2016), who investigated land price impacts. By concentrating on a dense urban area with frequent flash-flood occurrences, this study contrasts with

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Razali et al. (2018), who focused on low-density locations. It also differs from Abd Hamid et al. (2020), which explored flood impacts at a broader macro level instead of the micro-level perspective adopted in this paper.

RESEARCH METHODOLOGY

The research was conducted in Johor Bahru, Malaysia's second-largest metropolitan centre, home to over 876,000 residents (Mohd Nazri et al., 2022). Notably, Johor Bahru holds the unfortunate distinction of having the highest number of flash floods in Johor State, with the frequency of these floods showing a concerning upward trend over the years (Department of Irrigation and Drainage Malaysia, 2012). This surge in flood occurrences has direct implications for all types of properties in Johor Bahru, a city characterised by rapid development. It's expected that properties situated within flood-risk zones will face value depreciation. The research specifically scrutinised properties located within flood areas as well as areas outside flood areas to facilitate price impact comparisons between both areas. Residential areas under study encompass Taman Kempas, Taman Kempas Baru, Taman Kempas Permatang, Taman Setia Indah, Taman Sri Tebrau, Taman Tampoi Indah, Taman Tampoi Utama, and Taman Dahlia. Figure 1 illustrates the study area.

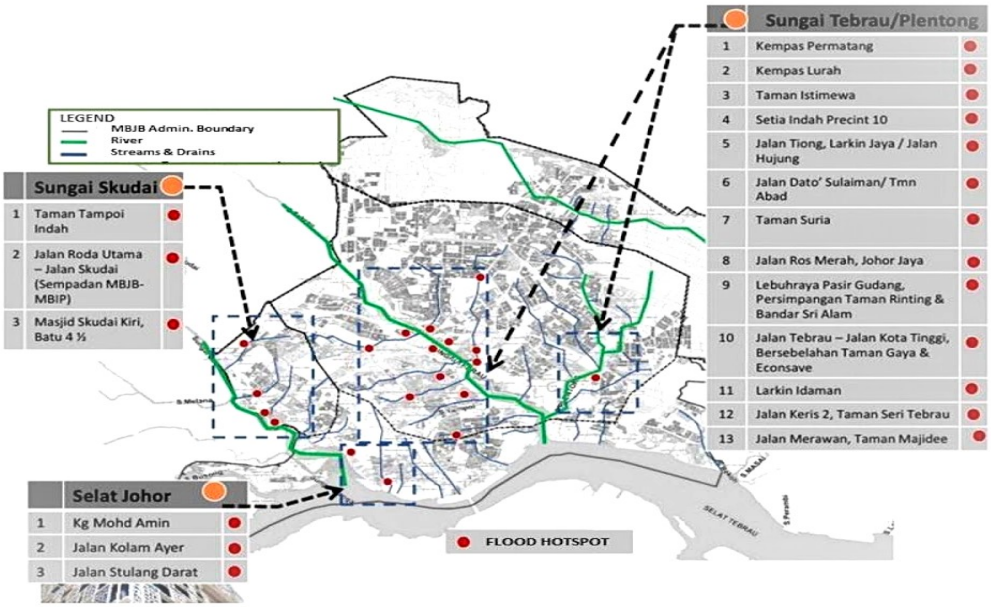


Figure 1: The Study Area
Source: Johor Bahru City Council Data (2023)

The study's dataset comprised 588 property transactions spanning from 2013 to 2022, meticulously collected from the Valuation Management System. The database contained property transaction prices, location, structural features, and neighbourhood characteristics, which are theorised to affect property prices. To ensure high quality results, data containing anomalies and missing attributes were excluded. The accepted data range were as follows; transaction price between RM 115,000 and RM 890,000, land area between 1,040 ft^2 and 2,939.73 ft^2, terrace and semi-detached house types; single storey and double storey houses. Most homes (92%) were either intermediate, end, or corner terrace houses. This thorough cleaning process resulted in the elimination of 120 observations, yielding 468 observations as the final estimation sample. The dataset underwent analysis employing the Hedonic Price Model to assess the impact of various housing attributes on prices, encompassing flood-prone regions. Table 1 tabulates the dataset.

Table 15: Descriptive Statistics

Variables (N=468)	Min.	Max.	Mean	Std. Dev.
Price (RM)	115,000	890,000	468,821.97	147,569.42
Hostspot Flood Area	0	1	.55	.498
Land Area (ft^2)	1,040.00	2,939.73	1,624.32	506.10
Taman Dahlia	0	1	.03	.009
Taman Kempas	0	1	.13	.335
Taman Kempas Baru	0	1	.02	.007
Taman Kempas Permatang	0	1	.01	.004
Taman Setia Indah	0	1	.57	.023
Taman Sri Tebrau	0	1	.08	.012
Taman Tampoi Indah	0	1	.09	.014
Taman Tampoi Utama	0	1	.06	.011
Year 2013	0	1	.1538	.36119
Year 2014	0	1	.0385	.19251
Year 2015	0	1	.0983	.29803
Year 2016	0	1	.1004	.30089
Year 2017	0	1	.1303	.33704
Year 2018	0	1	.1197	.32491
Year 2019	0	1	.1068	.30927
Year 2020	0	1	.0513	.22081
Year 2021	0	1	.0598	.23742
Year 2022	0	1	.1410	.34842

Source: Author's Analysis

The subsequent equation depicts the house price function.

$$P = f(L, S, N) \quad \text{(Eq. 1)}$$

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P represents house prices, L represents locational attributes, S represents structural attributes, and N represents neighbourhood attributes.

Equation 2 below defines the general equation for the Hedonic Price Model:

$$Yit = \beta_0 + \beta_1(X_{1m1}) + \beta 2(X_{2m2}) + \beta 3(X_{3m3}) + \beta 4(X_{nmn}) + \varepsilon_i \quad \text{(Eq. 2)}$$

Where; Y_{it} = Forecasted House Price; m = Price of house i at time period t; X = Property attributes; β = Regression coefficient; ε_i = Error term

In this study, the response variable was Price (RM), while the predictor variables encompassed land area, housing scheme, transaction year, and flood-prone regions. The model's performance was evaluated through statistical tests including R Squared (R^2), Adjusted R Squared ($\bar{R}^2$), F value and Sum of Estimated Errors (SEE). A robust model is characterised by R^2 and $\bar{R}^2$ values that approach 1, a substantial F value, and a minimal SEE value (Adi Maimun, 2011; 2016; Adi Maimun et al., 2015; Adi Maimun & Choon, 2024). Meanwhile diagnostic test through Variance Inflation Factor (VIF) and tolerance was conducted to detect any presence of multicollinearity or strong relationship between independent variables. Multicollinearity causes high variances and specification errors (Kennedy, 2003) leading to inaccuracy in prediction (Rahman et al., 2019; Sa'at et al., 2021). A model with a VIF value under five and a tolerance value exceeding 0.2 indicates no evidence of multicollinearity (O'Brien, 2007).

RESULTS AND DISCUSSION

Table 2 presents the regression findings. Linear Model delineates the price impacts of flood measured in monetary value (RM), while Semilog Model elucidates the outcomes measured in percentage (%). Overall, considering the R^2 and $\bar{R}^2$, values, both models demonstrate the ability to account for 84% of the price variation, employing factors like land area, housing scheme, transaction year, and flood-prone regions, yielding a Sum of Estimated Errors (SEE) of 60,924 or 16%. Importantly, neither model exhibited any indications of multicollinearity.

Table 16: Regression Results

Variables	Linear Model		Semilog Model	
	B	**t**	**B**	**t**
Constant	-29197.706	-1.453	11.636	225.971
Hostspot Flood Area	33976.428	4.433	.063	3.227
Land Area (ft^2)	82.720	10.614	.000	8.749
Taman Dahlia	Reference	Reference	Reference	Reference
Taman Kempas	84758.890	4.874	.373	8.373
Taman Kempas Baru	34521.710	1.376	.175	2.720
Taman Kempas Permatang	-25120.195	-.628	.072	.698
Taman Setia Indah	301404.862	17.446	.948	21.428
Taman Sri Tebrau	155195.372	6.796	.628	10.740
Taman Tampoi Indah	187513.261	9.287	.708	13.694
Taman Tampoi Utama	155111.946	7.989	.602	12.112
Year 2013	Reference	Reference	Reference	Reference
Year 2014	37083.440	2.289	.094	2.268
Year 2015	84871.376	6.937	.191	6.083
Year 2016	89937.344	7.698	.224	7.476
Year 2017	132540.397	12.256	.320	11.533
Year 2018	152344.170	13.827	.375	13.289
Year 2019	166958.076	14.731	.400	13.764
Year 2020	175689.755	12.069	.404	10.820
Year 2021	167337.273	12.030	.416	11.680
Year 2022	210148.975	20.001	.500	18.576
R	0.914		0.916	
R Squared (R^2)	0.836		0.838	
Adjusted R Squared ($\bar{R}^2$)	0.830		0.832	
Sum of Estimated Errors (SEE)	60923.764		0.156	

Source: Author's Analysis

All variables corresponded the theoretical principles. Referring to Table 2, it's evident that land area significantly influences the property value per square foot, as indicated by the positive Beta value of 82.720. This suggests that a mere increment of one square foot in land area could potentially lead to a price augmentation of RM82.72 in the property's overall value. Notably, for transaction years, most variables displayed significant values below 0.05. The upward trajectory of Beta values from 2014 to 2022 underscores the trend of ascending property values observed in recent transactions, indicating a potential continued increase in property values.

The influence of floods on residential properties in Johor Bahru stands as a significant point of insight for researchers. The coefficient for the hotspot flood area was unexpectedly positive (RM33,976.43 or 6.3%), implying that properties located within this zone do not experience a detrimental impact that would lead to decreased property prices. The findings of this study diverge from prior research which asserted a negative correlation between floods and property prices. Rather, this finding echoes with Abd Hamid et al. (2020) who discovered

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that flood did not impact on property prices. This contrast is attributed to the infrequent occurrence of floods and a confluence of other factors that enhance property value, including the strategic housing location, land size, built-up areas, number of floors, and various other variables.

CONCLUSION

This research aimed to investigate the influence of floods in the Johor Bahru property market in Johor Bahru. Through a comprehensive examination involving both the flood and its adjacent residences in Johor Bahru, this study effectively discerned the repercussions of the flood's impact on house prices within its vicinity. Drawing from a sample of 468 house observations spanning from 2013 to 2022, the application of hedonic analysis did not demonstrate a negative response of house prices to floods. The price risk associated with owning residential properties in both flood-prone and non-flood zones was comparably similar. Interestingly, property owners in flood-prone areas seem to pay slightly higher prices compared to those in non-flood prone regions. This study's analysis uncovered a positive coefficient value, an outcome contrary to the anticipated norm as disclosed in previous studies, which suggested that flood occurrences typically correlate with a decrease in property prices. This leads to the conclusion that, perhaps due to the relatively minor scale of the floods under investigation, they did not exert a detrimental impact on residential property prices in Johor Bahru.

This insight has implications for the real estate profession; valuers can proceed with their property assessments in Johor Bahru without immediate concern for flood risk, unless findings indicate otherwise, prompting adjustments in flood-prone areas. Notwithstanding, it is foreseeable that the flood-hazard element could significantly influence property values in the future. This concept warrants further exploration in comparable case study locales in forthcoming research endeavours. The findings of the study yield a robust model; however, its precision could be augmented by incorporating all factors influencing property values.

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ETHICS STATEMENT

This research complies with established ethical standards for the use of secondary administrative data in real estate and urban studies. All transaction records were

obtained from the Valuation Management System through authorised channels and used strictly for academic purposes. No personal identifiers, confidential information, or sensitive individual-level data were accessed or disclosed. Analytical procedures adhered to Universiti Teknologi Malaysia's research integrity guidelines, ensuring accuracy, transparency, and responsible handling of data throughout the study.

DISCLOSURE STATEMENT

The authors declare that they have no relevant financial and non-financial interest to disclose. The authors also declare no competing interests.

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EXAMINING THE TRANSIT ACCESSIBILITY PREMIUM OF BUS RAPID TRANSIT ON HOUSING PRICE

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Abstract

Public transportation system is crucial in supporting the urban mobility of a country including Malaysia. This system is built to alleviate the urban congestion in the cities. Good connectivity between locations can be achieved through a combination of bus and rail transit. Among these transit systems, Bus Rapid Transit (BRT) holds both characteristics of bus and rail transit. BRT not only operates on a specific express lane but also offers benefits such as ease of deployment and lower investment costs compared to rail transit systems. However, the impacts of BRT on residential prices has yet to be explored for Malaysian context. Understanding the response of residential market to BRT could provide valuable insights for stakeholders in formulating appropriate strategies and policies. This study applies the difference-in-differences (DiD) method and hedonic pricing model for assessing the Transit Accessibility Premiums (TAP) of BRT stations. The results reveal that residential prices increased by 6.06% after the government announced a new BRT in Bandar Sunway. The variation in premium is highly associated with the proximity to BRT stations. These insights serve as crucial information for policymakers and urban planners in fostering urban development that maximises the benefits of transit-oriented enhancements.

Keywords: Bus Rapid Transit (BRT), Difference-in-Differences Method (DiD), Hedonic Pricing Model, Transit Accessibility Premium (TAP), Walkability

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INTRODUCTION

The Malaysian government has invested billions of ringgit in modern public rail projects such as LRT, MRT, KL Monorail, and KTM Komuter. Nonetheless, overall ridership has not shown significant improvement. As an effort to enhance the ridership, Transit-Oriented Development (TOD) has been suggested. TOD is a concept that integrates property development with public transportation infrastructure. It has gained popularity as an efficient planning in addressing urban mobility issues by reducing private vehicle usage as well as promoting sustainable travel behaviour (Yap et al., 2021). Cervero and Dai (2014) argued that adopting a bus-centric TOD approach, along with carefully planned infrastructure for pedestrians and cyclists, could guide many global cities toward sustainable development. In Malaysian context, Bandar Sunway stands out as the sole town equipped with a Bus Rapid Transit (BRT) system. The Sunway BRT was officially announced by Malaysian government on 9th June 2012, and commenced its operation on 1st June 2015. By examining both the pre- and post-construction stages, this study complements existing literature on transit-induced premiums, which has largely concentrated on post-construction effects.

LITERATURE REVIEW

Alonso-Muth-Mills model illustrates that households tend to favor living closer to city center to reduce commuting costs, leading to increased land prices around the Central Business District. As population and vehicle numbers are rising, high-density urban areas be Adam come unavoidable. Yet, traffic congestion hampers travel times and productivity, emphasising the need for congestion alleviation and transportation efficiency improvements. According to Nguyen-Phuoc et al. (2020), public transport is essential in easing traffic congestion. Fageda (2021) found that cities with new rail systems have an average 7% less congestion, 1% shorter travel times, and 3% less pollution compared.

Arum and Fukuda (2020) studied the impact of railway lines on property prices in Tokyo, Japan, using hedonic price modeling, found a 16% increase in property prices near railway lines. Similarly, Berawi et al. (2020) employed Geographically Weighted Regression to examine the effects of LRT stations, revealing property price increases ranging from 3.2% to 52.4% for properties near LRT stations. In the context of BRT, an average property price increase of 1.9% was found in Buenos Aires, Argentina (D'Elia et al., 2020) while a 13.2% to 13.9% increment in property price were found in Beijing, China (Deng et al., 2016). In Malaysia, Dziauddin (2019) and Dziauddin and Ridzuan (2022) found a 30% rise in property prices near LRT stations and a 9.5% increase near MRT stations. Nevertheless, the impacts associated with BRT is yet to be uncovered.

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According to Rosen (1974), property prices are determined by various factors, including land area, built-up area, location, quality of the neighborhood, and accessibility. The BRT system is viewed as a public transport option that can enhance accessibility. It is expected to have a positive impact on property prices.

However, Malaysia has paid less attention to the Transit Accessibility Premium (TAP) generated by the introduction of new BRT systems. Understanding the market's response to the new BRT system can enable both sellers and buyers to make more informed decisions when transacting properties. Thus, considering TAP is crucial for investors when assessing the risk and return trade-off in TOD. Moreover, it confirms the value of the BRT system within the community.

RESEARCH METHODOLOGY

This study uses manageable randomized sample to generalize the findings to larger populations. The range of data collected is 13 years starting from 2010 – 2022 which sited in Sunway area of Malaysia. The number of samples is 649 set of transaction data to reflect the price volatility of terrace houses.

The BRT system has seven stations, but only five of them—namely Sunway-Setiajaya, Mentari, Sunway-Lagoon, SunMed, and SunU-Monash—are included in this study. Proximity to the BRT stations is used as the measurement criteria. This study examines two sample periods: before (2012-2015) and after (2015-2022) the completion of the BRT system. The change in property prices relative to the distance from BRT stations is analysed during these periods to confirm the existence of a "BRT premium" in the community.

This study employs both the OLS hedonic model (global estimation) and the Geographically Weighted Regression (GWR) hedonic model to validate the study's hypothesis. The global estimation method assumes that the relationship between dependent and independent variables is consistent across all locations, whereas the GWR model posits that these relationships vary spatially. Additionally, this study uses the K-Nearest Neighbor (KNN) method to determine sub-segments of properties, taking into account various factors that can influence property prices. In addition to exploring the relationship between property prices and proximity to BRT stations, this study hypothesises that the residential market will react positively to any news about improvements in accessibility. Consequently, the Difference-in-Differences (DiD) method is used to examine the impact of new announcements regarding the BRT system on residential property prices.

Hedonic Regression Model

The TAP will be estimated with hedonic model via OLS regressions. This method has been frequently used to estimate static versions of the model, in which property values are the dependent variable and the independent variables are a

collection of qualities or traits expected to affect property prices (Garay et al., 2022). The hedonic technique was used to investigate the housing premium generated by the Sunway BRT. The hedonic model can be used to calculate the marginal impact of each variable on property prices.

A. Before the completion of BRT system:

$$\ln\text{Price}_{\text{it}} = \beta_0 + \delta_1\text{Distance_BRT}_{it} + \beta_k Z_{it} + \theta_k 2012Q1 - 2015Q1_{\ it} + \varphi_1\text{Segment}_{it} + \varepsilon_{\text{it}} \quad (1)$$

B. After the completion of BRT system:

$$\ln\text{Price}_{\text{it}} = \beta_0 + \delta_1\text{Distance_BRT}_{it} + \beta_k Z_{it} + \ \theta_k 2015Q2 - 2022Q2_{it} + \varphi_1\text{Segment}_{it} + \varepsilon_{\text{it}} \quad (2)$$

TAP can be identified from transacted properties before and after the completion of BRT system. Both equations have incorporated the distance to BRT stations as one of the variables (Distance_BRT_{it}), to examine the premium. This study hypothesises that the residential prices have an inverse relationship with the distance towards BRT stations. Z_{it} consists of the property attributes of each transacted properties. The transaction data will be assigned to two different periods which is before (2013 - 2015Q1) and after (2015Q2 – 2022) completion of BRT system. This study expects the impact of BRT stations proximity to be more significant after the completion of BRT system.

Geographical Weighted Regression (GWR) Model

GWR is a local type of spatial analysis that is based on statistical methodologies for curve-fitting and smoothing applications. The method works by estimating local models using subsets of observations centred on a focal point, which is a simple yet effective idea (Páez & Wheeler, 2009). GWR was originally developed in geography and other disciplines to analyse spatial point datasets and interpolate unsampled attribute values by assuming that contextual factors can change the strength and direction of the relationship between a dependent attribute and the independent attributes. GWR considers nonstationary qualities and models the local interactions between these independent attributes and the dependent variable of interest in this context (Wu et al., 2022).

$$\ln\text{Price}_{\text{it}} = \beta_0(u_i, v_i) + \sum_{k=1}^{p} \beta_k(u_i, v_i)\, x_k + \varepsilon_{\text{it}} \quad (3)$$

The GWR model is an extension of the classical linear regression model obtained by taking into account spatial relationships in the form of assigning weights to individual observations depending of the location. v_i and $u_{i,}$ represent the x and y coordinates of each transacted properties which accompanied with the

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property attributes x_k. This study will perform GWR analysis to evaluate the significance of transit accessibility premium at the local level. The estimation of the GWR model parameters is performed in a similar manner as in the classic models, but location-dependent weights of observations are taken into account:

$$\hat{\beta}(u_i, v_i) = (X^T W(u_i, v_i) X)^{-1} X^T W(u_i, v_i) y \quad (4)$$

K-Neighbours for Market Segmentation

The objective of K-means algorithm is to minimize the within-cluster variance where it is achieved by minimizing the sum of squared distances from each point to its assigned cluster centroid (Calka 2019). The algorithm aims to find the optimal values for the centroids. Mathematically, it can be expressed as:

$$\text{Minimise} \sum_{i=1}^{k} \sum_{x \in S_i} \| x - \mu_i \|^2 \quad (5)$$

Where K = the number of clusters; S = the set of clusters; $S_i = i^{th}$ cluster; x = represents a data point; μ_i = is the centroid of cluster S_i

Difference-in-Differences (DiD) Method for Hedonic Approach

The announcement of new BRT system in Bandar Sunway was made on 2012Q2. Property shared similar characteristics with other investment assets where the prices will react to the news released from the market. In term of assessing the TAP prior to the completion of BRT system, it is crucial to eliminate the macroeconomic factors that can influence the residential prices, such as inflation. Therefore, the DiD model has been referred to examine the causal effects for an event or scenario. This method requires one control group and one treatment group for pre and post event. This study identifies residential properties close to the BRT stations as the treatment group, while those located far away will serve as control group. Additionally, 2012Q2 act as the cut-off point to differentiate between pre and post announcement of new BRT system in Bandar Sunway. The property attributes such as land area, built-up area, and etc have been considered in the hedonic model for evaluating transit accessibility premium.

$$\ln \text{Price}_{it} = \beta_0 + \delta_1 \text{Post}_{it} + \delta_2 \text{Treat}_{it} + \delta_3 \text{Post} \, \alpha \, \text{Treat}_{it} + \beta_k Z_{it} + \theta_k Yearly_{it} + \varphi_1 \text{Segment}_{it} + \varepsilon_{it} \quad (6)$$

The dependent variable $\ln Price_{it}$ represents transacted housing sale price in logarithm form. Z_{it} and β_k represent housing characteristics and its coefficient respectively. Post_{it} referred as a dummy variable for the transaction happened between 2012Q2 until 2015Q2. Treat_{it} referred as a dummy variable for the properties situated close to the BRT stations. $\text{Post} \, \alpha \, \text{Treat}_{it}$ represents the dummy variable for transacted properties located in the vicinity of BRT stations starting 2012Q2 until 2015Q2. Z_{it} consists of the property attributes of each

transacted properties such as land area, built-up area and non-bumi lot. $Yearly_{it}$ referred as the dummy variable for the transaction period of properties happened between 2010 – 2015Q2. Segment_{it} represents the housing segments in addressing the spatial autocorrelation among the transacted properties.

Descriptive Statistics

The descriptive statistics of variables are reported in Table 1 to provide understanding on the characteristics of the sample before they can be incorporated in the model development.

Table 1: Descriptive Statistics of Residential Property Attributes in Bandar Sunway

No.	Attribute	COUNT	MEAN	STD	MIN	MAX
1.	Transacted Price (RM)	649	637,176	243,788	140,000	1,600,000
2.	Land Area (sq. m)	649	145.91	56.34	72.00	576.00
3.	Built-up Area (sq.m)	649	119.93	39.18	53.05	350.08
4.	Restriction of transfer	649	0.91	0.28	0.00	1.00
5.	Latitude	649	3.07	0.00	3.06	3.08
6.	Longitude	649	101.61	0.01	101.60	101.62
7.	Property type	649	0.13	0.34	0.00	1.00
8.	Number of storey	649	1.9	0.39	0	2.5
9.	Shortest distance to BRT statation (km)	649	0.61	0.31	0.05	1.37
10.	Year 2010	649	0.03	0.16	0.00	1.00
11.	Year 2011	649	0.00	0.00	0.00	0.00
12.	Year 2012	649	0.13	0.33	0.00	1.00
13.	Year 2013	649	0.08	0.28	0.00	1.00
14.	Year 2014	649	0.08	0.28	0.00	1.00
15.	Year 2015	649	0.09	0.28	0.00	1.00
16.	Year 2016	649	0.07	0.25	0.00	1.00
17.	Year 2017	649	0.07	0.26	0.00	1.00
18.	Year 2018	649	0.08	0.28	0.00	1.00
19.	Year 2019	649	0.06	0.24	0.00	1.00
20.	Year 2020	649	0.07	0.25	0.00	1.00
21.	Year 2021	649	0.07	0.25	0.00	1.00
22.	Year 2022	649	0.03	0.16	0.00	1.00
23.	Submarket A***	649	0.00	0.00	0.00	0.00
24.	Submarket B***	649	0.18	0.38	0.00	1.00
25.	Submarket C***	649	0.30	0.46	0.00	1.00

***submarket of property is determined by the K-means cluster of the residuals and the submarket A of properties serves as the comparative variable to submarket B and submarket C of properties.

DATA ANALYSIS

The "BRT premium" was uncovered via three perspectives. First, it examines the change in residential prices in Bandar Sunway before and after the announcement of the new BRT system using DiD method. Second, the relationship between property prices and their proximity to BRT stations is analyzed using OLS hedonic models. Lastly, findings are validated using the GWR method.

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Clustering Housing Market

Clustering techniques can enhance the effectiveness of hedonic price models by grouping similar properties based on various attributes such as location, size, and amenities. Clustering allows for the identification of distinct market segments with unique preferences. This segmentation enables hedonic price models to capture heterogeneity more effectively, leading to more accurate estimations of property prices. Moreover, clustering analysis facilitates the identification of relevant variables and interaction effects that may influence property values within specific market segments, thereby improving the model's explanatory power and predictive accuracy. The analysis is illustrated in Figure 3.

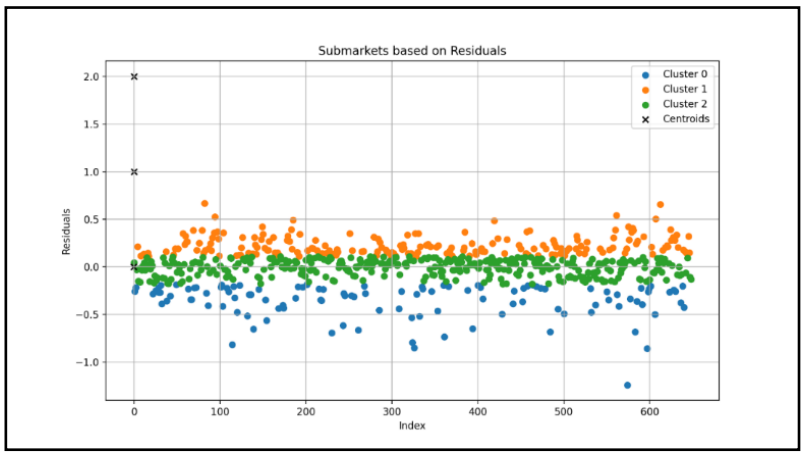


Figure 1: Submarkets based on Residuals

Figure 1 illustrates how housing prices are grouped into clusters based on their residual patterns. By examining cluster centers, spread, and size, it will identify common residual patterns and assess the overall performance of the regression model in predicting housing prices. This analysis aids in understanding areas where the model performs well and areas for potential improvement. Each cluster is separated from the others, indicating that the K-means algorithm effectively grouped the data points into relatively distinct clusters based on their residuals. The clusters 0, 1, and 2 are named submarkets as A, B, and C, respectively.

Examination on Control Variables of Hedonic Model for Bandar Sunway

As shown in Table 2, 6 control variables are found to be correlated with the price change of residential properties in Bandar Sunway – land area, built-up area, shortest distance to BRT station, submarket, and non-bumi lot. The coefficient signs are consistent with the expected sign.

Table 2: Reliability of Control Variables

Property Attributes	Coefficient (+)	Coefficient (-)	P<0.05	P>0.05	Reliability
Land Area	46	0	46	0	√
Built-up Area	46	0	43	3	√
Shortest distance to BRT station	0	46	46	0	√
Submarket B	0	46	46	0	√
Submarket C	45	0	45	0	√
Non-Bumi Lot	46	0	37	9	√
Property type	16	30	2	44	×
Number of storey	40	6	6	40	×

Impact of New BRT Announcement on Residential Property Prices

A hedonic model based on DiD method is constructed to validate the existence of TAP, following the announcement of the Sunway BRT stations in 2012Q2.

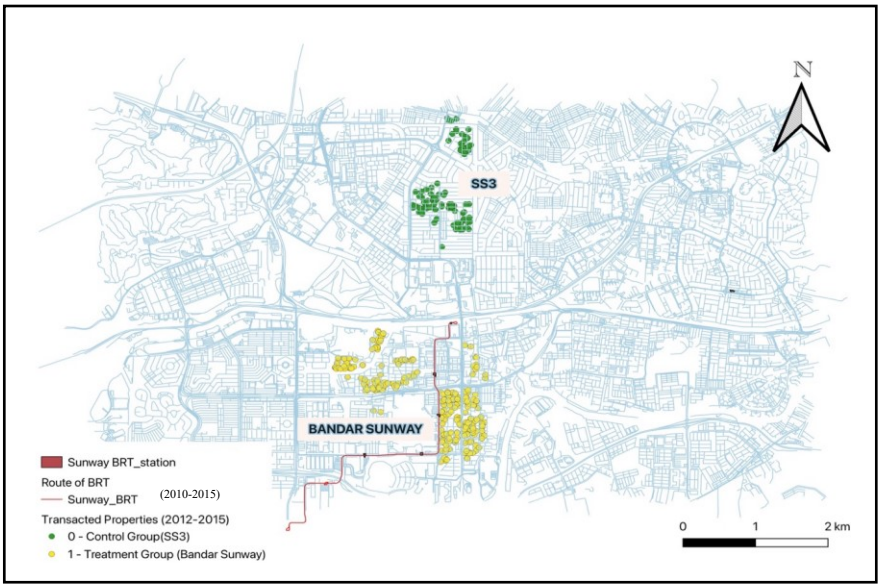


Figure 2: Location of Control Group and Treatment Group

This model necessitates the inclusion of a control group and a treatment group in the regression analysis. For this study, properties transacted in SS3 have been identified as the control group because they are located approximately 3 km from Sunway BRT station and are not close to any other forms of rail transit.

Figure 2 illustrates the locations of transacted properties. From 2010 to 2015, there were 147 property transactions in SS3 served as the control group. The remaining 310 transactions in Bandar Sunway, designated as treatment

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group. The period from 2012Q2 to 2015Q2 is identified as treated period, coinciding with the launch of the Sunway BRT stations. The regression analysis will assess the significance of the BRT effect on the TAP by comparing the treatment group (Bandar Sunway) to the control group (SS3). Results are presented in Table 3.

Table 3: Regression Output of Difference-In-Differences (DiD) Method

Dep. Variable: lnPrice
Adjusted R-squared: 0.934
N: 457

Attribute	Coef	t-value	p-value
Const	11.6379	378.047	0.00
Land Area	0.0024	23.086	0.00
Built-up Area	0.0042	28.428	0.00
Non-Bumi Lot	0.3400	18.366	0.00
2011**	0.1425	7.448	0.00
2012**	0.1579	5.448	0.00
2013**	0.2912	8.763	0.00
2014**	0.3730	11.210	0.00
2015Q2**	0.4086	9.271	0.00
Treat	-0.0308	-1.824	0.069
Post	0.0986	3.227	0.001
Treat_Post	0.0589	2.625	0.009
Submarket_B***	0.2496	22.386	0.000
Submarket_C***	-0.3627	-23.526	0.000

**year 2010 is the base period and it compares with the respective period for calculating the coefficients for time effects.
***submarket of property is determined by the K-means cluster of the residuals and the submarket A of properties serves as the comparative variable to submarket B and submarket C of properties.

Table 3 presents the regression results based on DiD method. The control variables adequately explain the price change of residential in Bandar Sunway, highlighting the importance of assessing the BRT effect through three specific variables listed in the table, namely "Treat," "Post," and "Treat_Post." The "Treat" variable has a negative coefficient, suggesting that the prices in the treatment group are slightly lower than the control group, although this effect is insignificant. Conversely, the "Post" variable shows a positive coefficient, suggesting a 10.36% increase in property prices following the launch of the Sunway BRT stations. Specifically, the significant positive effect of the Sunway BRT stations on the residential properties of the treatment group is demonstrated by an average price increase of 6.06% compared to the control group after launching Sunway BRT system.

Relationship Between Property Prices and Proximity to BRT Stations

There are two hedonic models constructed to justify the existence of BRT Premium. The study period for equation 1 is ranged from 2012Q1-2015Q1

whereas the equation 2 is ranged from 2015Q2-2022Q2. The Ordinary Least Square (OLS) regression method was conducted to examine the relationship for the distance between residential properties and Sunway BRT stations.

Table 4: Regression Output Before the Completion of BRT system

Dep. Variable: lnPrice
Adjusted R-squared: 0.943
N: 191

Attribute	**Coef**	**t-value**	**p-value**
Const	12.0464	302.361	0.000
Land Area	0.0027	13.466	0.000
Built-up Area	0.0046	19.073	0.000
Non-Bumi Lot	0.2492	8.575	0.000
2013	0.1606	8.908	0.000
2014	0.2515	13.593	0.000
Distance_BRT	-0.1641	-6.494	0.000
Submarket_B***	-0.3673	-17.839	0.000
Submarket_C***	0.1911	11.138	0.000

**year 2012 is the base period and it compares with the respective period for calculating the coefficients for time effects.
***submarket of property is determined by the K-means cluster of the residuals and the submarket A of properties serves as the comparative variable to submarket B and submarket C of properties.

Table 4 presents the regression results for Equation 1. The control variables adequately explain the price changes of residential properties in Bandar Sunway. Further examination of the BRT premium based on distance reveals that residential prices decrease by 15.13% for every kilometer further away from the BRT stations. The locally weighted BRT effects can be also illustrated based on Geographical Weighted Regression and it is presented in Figure 5.

Figure 3 shows the locally weighted BRT effects through GWR. The BRT effects appear to be more significant in the residential properties located further from the BRT stations which presented in the red box. The property prices are estimated to reduce from 4.00% - 5.30% for every kilometer away from the BRT stations. In contrast to the properties indicated in Blue Box, its effect is slightly weaker. The property prices are estimated to reduce from 1.46% - 4.01% for every kilometer away from the BRT stations.

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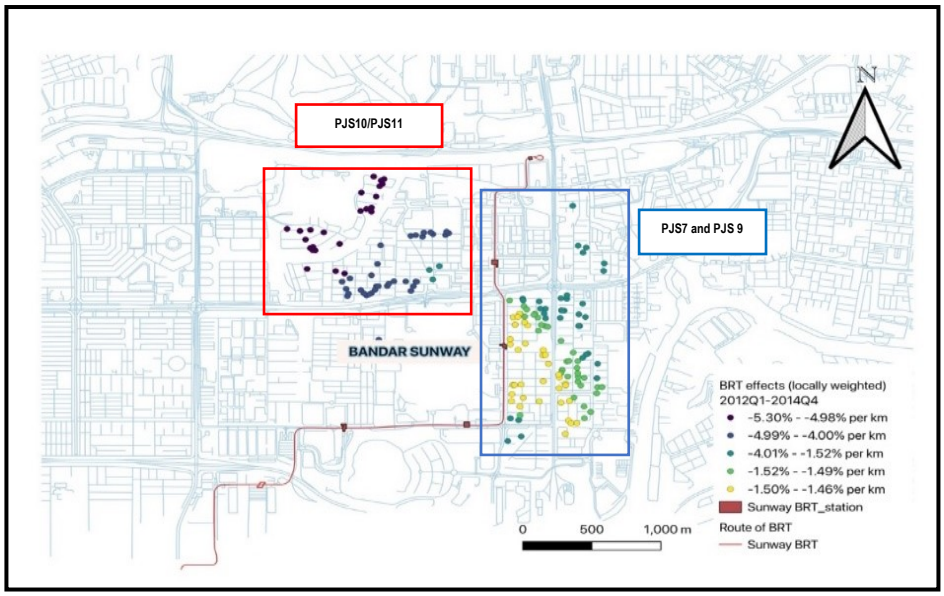


Figure 3: Locally Weighted BRT Effects Prior To The Operation of BRT Stations

Table 5: Regression Output After the Completion of BRT system

Dep. Variable: lnPrice
Adjusted R-squared: 0.898
N: 351

Attribute	Coef	t-value	p-value
Const	12.5325	302.361	0.000
Land Area	0.0026	22.017	0.000
Built-up Area	0.0035	20.247	0.000
Non-Bumi Lot	0.2006	9.234	0.000
2015	-0.0759	-2.307	0.022
2016	-0.0074	-0.259	0.796
2017	0.0104	0.376	0.707
2018	0.0167	0.598	0.551
2019	-0.0132	-0.458	0.647
2020	-0.0119	-0.416	0.677
2021	0.0282	0.970	0.333
2022	0.0002	0.005	0.996
Distance_BRT	-0.1826	-8.710	0.000
Submarket_B***	-0.3791	-20.072	0.000
Submarket_C***	0.2411	15.488	0.000

**Year 2014 is the base period and it compares with the respective period for calculating the coefficients for time effects.
***submarket of property is determined by the K-means cluster of the residuals and the submarket A of properties serves as the comparative variable to submarket B and submarket C of properties.

Table 5 depicts the regression results for equation 2. Generally, the control variables are reasonably explained the price change of residential in

Bandar iuSunway. Subsequently, the BRT premium is examined further based on the distance when the Sunway BRT station in operation since 2015. The empirical study shows that the residential prices decreased at 20.03% for every kilometer farther from the BRT stations.

The locally weighted BRT effects can be also illustrated based on Geographical Weighted Regression and it is presented in Figure 4.

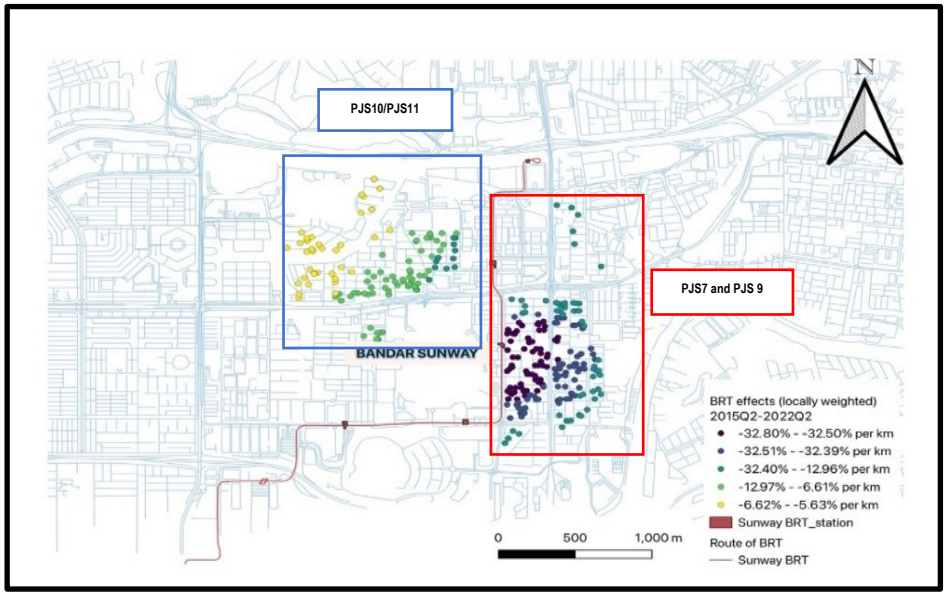


Figure 4: Locally Weighted BRT Effects After the Operation of BRT Stations

Figure 4 had shown the locally weighted BRT effects through Geographical Weighted Regression (GWR). The BRT effects appear to be more significant in the residential properties located close the BRT stations which presented in the red box. The property prices are estimated to reduce from 32.8% - 12.96% for every kilometer away from the BRT stations. In contrast to the properties indicated in blue box, its effect is much weaker. The property prices are estimated to reduce from 12.97% - 5.63% for every kilometer away from the BRT stations. In conclusion, the buyers are more optimistic to pay a higher price to purchase the property located near to the BRT stations. This effect is appeared to be more significant if these properties located closer to the BRT stations.

DISCUSSION AND POLICY IMPLICATION

This section highlights the policy implications for public transport in urban development. This study reveals the impact of BRT system on TAP from three aspects. First, it examines the response of residential prices to the announcement of new BRT system in Bandar Sunway. After the announcement of the new BRT

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system, average property prices in PJS7 and PJS9 were found to be 6.06% higher than in SS3. This could be due to anticipated improvements in accessibility and connectivity, making these areas more attractive to potential buyers and investors. Empirical studies that quantify the benefits of TAP provide valuable evidence for policymakers to develop and implement value capture policies aimed at funding BRT projects in the future. Land value capture can be achieved through various instruments such as land value tax, tax increment financing, special assessments, joint development, and transit-focused real estate fees (Mulley et al., 2016). By harnessing the potential of value capture mechanisms, cities can accelerate the implementation of sustainable transportation solutions and improve the overall liveability and accessibility of urban areas.

Second, findings show that a 'BRT premium' exists before and after the establishment of BRT stations. Residential prices decrease by 15.13% and 20.03% for every kilometer further from the BRT stations before and after the completion of BRT stations, respectively. This indicates that proximity to BRT stations is associated with higher residential property prices, and this effect had strengthened after the operational of BRT stations. BRT system benefits homeowners with an increase in house prices. It creates affordability for people who want to seek a place with better connectivity. Policymakers could implement inclusionary zoning policies to ensure a diverse range of housing options remains available near BRT stations, meanwhile, supporting the expansion of the BRT network as part of sustainability initiatives.

Thirdly, the significance of BRT effects is examined at the local level via GWR model. Prior to the completion of the BRT system, properties in PJS7 and PJS9, with an average proximity of 423 meters to BRT stations, exhibit a 'BRT premium' with property prices decreasing in the range of 1.46% - 4.01% for every kilometer away from the BRT stations. Similarly, residential properties of PJS10/PJS11with an average proximity to BRT stations of 824 meters, are estimated to decrease in price in the range of 4.98% - 5.30% for every kilometer away from the BRT stations. PJS7 and PJS9 shows a lower 'BRT premium' compared to PJS10/PJS11, most likely due to nuisance associated with the construction of BRT stations between 2012-2014. However, these effects were reversed in 2015-2022, with property prices in Bandar Sunway decreasing in the range of 12.96% - 32.8% for every kilometer away from the BRT stations. In terms of the properties in PJS10/PJS11, it experienced reduction in prices in the range of 5.63% – 12.97% for every kilometer away from the BRT stations. It shows that PJS7/PJS9 has a stronger demand for the BRT system compared to PJS10/PJS11 because of their closer proximity to BRT stations. This finding corroborates with Zhang and Yen (2020), which reported that land and property within 50 meters of a BRT station have notably higher value. Specifically, having a BRT station nearby yields a price premium of 13.0% compared to locations 1,200 meters away. Munoz-Raskin (2010) found that the people were actually

willing to pay more to be in the immediate walking proximity in exchange for travel time savings and public space improvement. Hence, policymakers should allocate funds towards enhancing pedestrian infrastructure.

CONCLUSION

The findings highlight that homeowners and investors place a significant value on enhanced accessibility and connectivity. The results also indicate that residential property prices respond positively to announcements enhancing accessibility which is particularly notable in high-density areas. However, this study focuses solely on the impact of the Bandar Sunway BRT system on landed houses. To obtain a more comprehensive understanding of the 'BRT premium', future studies could be extended to include high-rise residential and commercial properties.

DISCLOSURE STATEMENT

This research was supported by the Ministry of Higher Education under Fundamental Research Grant Scheme. (FRGS/1/2024/SS06/TARUMT/02/1). All transaction data were obtained from the Valuation and Property Services Department and were anonymized prior to analysis. This study utilized only secondary data and did not involve human participants.

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THE ASSESSED VALUE CONUNDRUM: A STUDY ON THE ACCURACY AND FAIRNESS OF PROPERTY TAXATION IN SOUTH TANGERANG CITY, INDONESIA

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Abstract

The Land and Building Tax for the Rural and Urban sector (PBB-P2) is a cornerstone of fiscal decentralization in Indonesia, yet many local governments experience suboptimal revenue performance since its administrative transfer in 2014, largely due to inaccurate property value assessments. Although national regulations mandate property reassessment every three years, limited resources have hindered compliance, causing growing disparities. This study examines the accuracy and fairness of property taxation in the high-growth context of South Tangerang City using quantitative ratio analysis recommended by the International Association of Assessing Officers (IAAO). Analysis of seven districts found a severe fiscal deficit, evidenced by an average Assessment-Sales Ratio (ASR) of 42%, indicating that assessed property values remain systematically undervalued. Assessment fairness, however, revealed a nuanced conundrum: the Price-Related Differential (PRD) (0.96–1.00) suggested neutral assessment behaviour with no significant evidence of regressivity. But the Coefficient of Variation (CoV) exceeded the ideal 14% in several sub-districts, notably Cilenggang, signalling localized administrative capacity failure and significant non-uniformity in high-growth zones. The findings provide a practical, data-driven framework for local governments to overcome assessment lag. By identifying specific CoV hotspots, this study enables targeted reassessment efforts to improve valuation accuracy and strengthen regional fiscal capacity. Policy implications stress the immediate importance of systematic data updates and equity-oriented, phased tax adjustments to achieve a fairer and more sustainable local taxation system in rapidly urbanizing Indonesian regions.

Keywords: Land and Building Tax; Assessment Accuracy; Mass Valuation

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INTRODUCTION

In the global context, fiscal decentralization has been widely recognized as a key instrument in public governance reform. Governments in many jurisdictions extend fiscal authority to regions with the aim of improving public service efficiency, strengthening accountability, and ensuring that policies are more responsive to the needs of local communities (Affroumou, 2025; Rodríguez-Pose & Vidal-Bover, 2024). While classical Fiscal Federalism argues that the proximity of local governments to citizens allows for more targeted fiscal decisions (Neyapti & Aslim, 2022), contemporary scholarship emphasizes that the success of this autonomy hinges on the region's capacity to manage own-source revenue (Likwelile & Assey, 2023). Within this framework, property tax serves as the backbone of local fiscal independence. However, its efficacy is strictly bound by the accuracy of property valuation; without accurate assessment, the tax becomes an instrument of inequity rather than a tool for development (Affroumou, 2025; Grote & Wen, 2024).

The theoretical imperative of property tax systems rests on two pillars of fairness: horizontal and vertical equity (Borg & Borg, 2023; Totanan et al., 2024). Horizontal equity mandates that properties of similar market value bear equivalent tax burdens (Durankev, 2019), while vertical equity requires a progressive structure where higher-value property owners contribute proportionally more (Totanan et al., 2024). Achieving both horizontal and vertical equity is a universal goal for property tax systems across the globe, yet it often presents significant challenges in practice (Borg et al., 2023; Chmielewska et al., 2025). Accurate valuation is fundamental to ensuring fair assessment of property owners, as inaccuracies can lead to discrepancies in tax burdens and even impact tax collection efficiency (Bidanset & Rakow, 2022).

Many countries utilize mass appraisal systems, where the responsibility for property valuation typically rests with ministries of finance, land administration authorities, or municipalities (Kim & Hong, 2024). Mass appraisal is the process of valuing a group of properties as of a given date and using common data, standardized methods, and statistical testing (IAAO, 2025b). Mass appraisal requires the integration of three core components: (1) accurate and current market data, (2) appropriate valuation models, and (3) consistent application across property classes to ensure accuracy, uniformity, equity, and reliability (IAAO, 2025b). The IAAO framework emphasizes that assessment quality should be evaluated through statistical indicators such as the Assessment–Sales Ratio (ASR), Price-Related Differential (PRD), Coefficient of Dispersion (COD), and Coefficient of Variation (CoV) (IAAO, 2025a). These metrics measure both accuracy (the ASR) and uniformity (COD and CoV) of assessments, as well as equity performance across property value ranges (PRD) (IAAO, 2025a). The adoption of these international standards is essential for

countries applying mass appraisal for property tax, where uniformity and equity in valuation practice becomes a precondition for both fiscal fairness and administrative efficiency (Borg et al., 2023; Totanan et al., 2024).

However, empirical evidence across numerous countries shows that assessment inaccuracies frequently undermine these principles, leading to systemic regressivity, distorted tax burdens, and weakened fiscal capacity (Amornsiripanitch, 2020; Rakow, 2023). The failure to perform regular revaluations is a common issue worldwide that compromises the accuracy and equity of assessments over time (Hou et al., 2021; Zulkifli et al., 2021). These valuation issues contribute to widespread problems, including what has been termed "pervasive regressivity" in assessments, where less expensive properties are often over-assessed relative to more valuable ones, leading to higher effective tax rates for their owners (Amornsiripanitch, 2020; Rakow, 2023).

Comparative analysis reveals that while this challenge is global, its manifestation varies by economic context. In mature markets like the United States, low-value properties are often assessed at disproportionately higher ratios than high-value properties, resulting in marked regressivity that burdening low-value property owners with effective tax rates nearly 50% higher than high-value property owners (Amornsiripanitch, 2020; Berry, 2024). Conversely, Asian economies face distinct structural hurdles. Taiwan struggles with market volatility and land speculation, forcing the government to implement complex progressive taxes to curb unaffordability (Galland & Stead, 2022; Tsai & Wang, 2022). Similarly, Malaysia, which shares a comparable developing context with Indonesia, grapples with assessment bias and intolerable disproportionality caused by delayed revaluations and arrears (Bin-Bustamin et al., 2023; Senawi & Osmadi, 2022). The international cases highlight the crucial fact that property tax systems can drift towards inequity without rigorous, regular, and accurate mass appraisal.

This global challenge finds a direct echo in the Indonesian context. Following the transition of the Land and Building Tax for the Rural and Urban sector (Pajak Bumi dan Bangunan Sektor Perdesaan dan Perkotaan or PBB-P2) from central to local administration, local governments gained full authority over tax revenues to strengthen regional fiscal capacity (Von Haldenwang, 2017). The PBB-P2 is one of the most important locally administered revenue sources and a key instrument supporting fiscal decentralization (Rosdiana & Irianto, 2018). The basis for this taxation is the Tax Object Sale Value (Nilai Jual Object Pajak or NJOP), which, by Law Number 1 of 2022, must reflect reasonable market transactions and be reassessed at least every three years. Yet, a significant gap exists between this legal mandate and administrative reality. Limited technical capacity, a scarcity of certified assessors, and inadequate data infrastructure have hindered many Indonesian regions from conducting these mandatory periodic

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revaluations (BKF, 2015; BPK, 2015; Hernandi et al., 2025; Wahyudi et al., 2022). Consequently, static NJOP values fail to capture dynamic market appreciation, leading to systematic undervaluation, contributes to inequitable tax burdens and potential revenue loss (Hernandi et al., 2025). From a theoretical standpoint, Indonesia's challenges can be linked to the broader literature on administrative capacity and valuation governance in developing economies. Slack and Bird (2014) emphasize that the quality of property tax administration is fundamentally shaped not only by technical valuation capacity but also by the political economy environment in which assessments occur. Their comparative analysis shows that jurisdictions with weak administrative systems, outdated cadastres, and limited data interoperability consistently struggle to implement regular and credible revaluations, leading to entrenched inequities and systematic undervaluation.

South Tangerang City provides a particularly compelling case for examining these issues. As a satellite city bordering the Special Region of Jakarta, South Tangerang experiences some of the highest regional growth in Indonesia, with the real estate sector contributing a dominant 17.47% to the Gross Regional Domestic Product (BPS South Tangerang City, 2023). Despite this booming property market, there is a paucity of empirical evidence evaluating whether the city's tax assessments have kept pace with market realities. This leads to an important research gap: in a satellite city with high-growth property market, to what extent does the lack of frequent reassessment distort tax equity?

To address this gap, this study applies ratio analysis based on the International Association of Assessing Officers (IAAO) standards to evaluate assessment accuracy and tax equity in South Tangerang City. Specifically, the study investigates: (1) the extent to which NJOPs approximate market values across districts; (2) whether assessment patterns indicate horizontal inequity or vertical inequity (regressivity); and (3) how the results can inform reassessment priorities and improvements in local fiscal capacity. This study contributes to the literature in three ways. First, it provides the first systematic, district-level assessment ratio analysis of PBB-P2 in a major Indonesian metropolitan area using internationally recognized IAAO metrics. Second, it advances the theoretical discourse on property tax fairness in developing countries by linking empirical evidence with the broader mass appraisal and fiscal decentralization literature. Third, it offers actionable policy insights for local governments seeking to improve valuation accuracy, equity, and revenue performance. The study presents South Tangerang City as an illustrative case of the valuation challenges faced by rapidly urbanizing regions under decentralization, and provides an analytical framework that can be replicated in other Indonesian cities.

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DATA DESCRIPTION AND RESEARCH METHODOLOGY

Study Area

The locus of this research is South Tangerang City, located in Banten Province, Indonesia. The city forms part of the Greater Jakarta metropolitan region and lies approximately 30 km west of Jakarta. The city encompasses a relatively flat topography covering a total area of about 147.19 km². Administratively, South Tangerang is divided into seven districts (kecamatan), with the central government administration located in the Ciputat District.

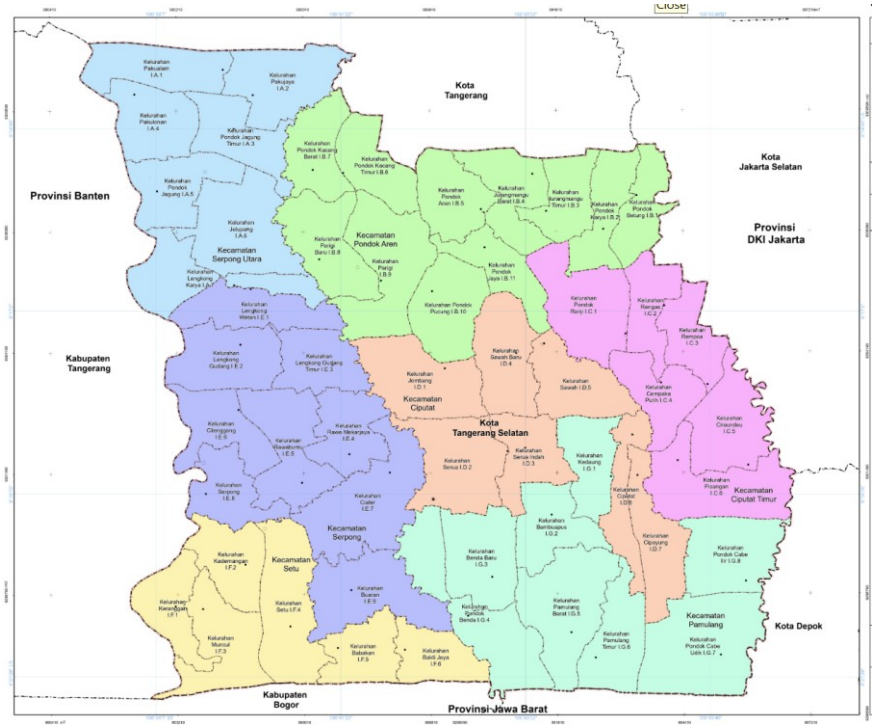


Figure 1. Study Area: Administrative Boundaries and District Divisions of South Tangerang City
Source: South Tangerang City Government (2023)

Data Description

This study utilizes a secondary dataset comprising Market Value and Assessed Value (NJOP) data obtained from the South Tangerang City Regional Revenue Agency (Bapenda). A unique characteristic of South Tangerang's urban landscape is the dualistic nature of its residential development, which is categorized by the local government as 'Kompleks' (Planned Estates) and 'Non-Kompleks' (Unplanned/Organic Settlements) zones. The term 'Kompleks' refers

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to residential areas developed by real estate developers, characterized by orderly spatial configurations, exclusivity, and uniformity, and equipped with comprehensive infrastructure such as high-quality water systems, worship facilities, electricity, and road networks. Conversely, 'non-Kompleks' comprise land zones outside developer-built estates, generally characterized by more organic development patterns and limited direct intervention from real estate developers.

Table 17 presents district-level details relevant to this classification.

Table 17: District Data of South Tangerang City

No.	District	Area (Km^2)	%	Number of Samples		
				Non-Kompleks	Kompleks	Total
1.	East Ciputat	15.43	10.5%	269	175	444
2.	Pamulang	26.82	18.2%	431	240	671
3.	Pondok Aren	29.88	20.3%	402	170	572
4.	Serpong	24.04	16.3%	224	115	339
5.	North Serpong	17.84	12.1%	138	91	229
6.	Setu	14.8	10.1%	153	68	221
7.	Ciputat	18.38	12.5%	274	117	391
	Total	**147.19**	**100%**	**1.891**	**976**	**2.867**

Source: South Tangerang City Government (2023)

The study population comprises approximately 497,075 land parcels in South Tangerang City (ATR/BPN, 2025), from which a sample of 2,867 properties was selected. A purposive sampling technique was employed to select cases most relevant to the research objectives, allowing for an in-depth examination of the specific phenomena under investigation (Andrade, 2021). This non-probability sampling method prioritizes the selection of cases based on their relevance rather than randomness. The rationale is to enhance the rigor and trustworthiness of outcomes by ensuring alignment between the sample and the research objectives (Campbell et al., 2020). Unlike probability sampling, purposive sampling does not require statistical formulas to determine sample size (Ahmed, 2024). Instead, adequacy is assessed based on the sample's ability to provide rich and detailed information relevant to the research questions (Campbell et al., 2020). For this study, the sample size of 2,867 properties is considered sufficient to enable a robust analysis of the accuracy and fairness of property taxation in South Tangerang City.

The primary dataset was obtained from Bapenda in 2023 and subsequently reverified by the researchers between June and July 2024 to ensure its accuracy and relevance. It is important to note that findings derived from purposive sampling are typically generalizable only to the specific sub-population represented by the sample (Andrade, 2021).

Analysis Method

To achieve the research objectives, a quantitative ratio analysis was conducted based on the standards set by the International Association of Assessing Officers (IAAO). The analysis proceeds in two stages:

1) **Analysis of Assessment-Sales Ratio**

According to the IAAO, mass appraisal accuracy is evaluated using ratio studies, which assess the accuracy of assessed values relative to market values (IAAO, 2025b). The Assessment–Sales Ratio (ASR) is calculated as:

$$\mathbf{ASR} = \frac{A_i}{S_i} \text{..... Formula 1}$$

where A_i is the assessed value (NJOP) and S_i is the market value of the subject property. ASR results were subsequently used to compute the Price-Related Differential (PRD), a measure of assessment equity. A regressive assessment occurs when high-value properties are underappraised relative to low-value properties, while progressive assessments occur when high-value properties are overappraised (IAAO, 2025a, 2025b). Regressive assessments are particularly problematic because they impose a disproportionately lower tax burden on owners of high-value properties (Prabu, 2021). PRD is calculated by dividing the mean of ASR by the weighted mean. The PRD formula is as follows:

$$\text{PRD} = \frac{\overline{ASR}}{\bar{A}_i/\bar{S}_i} \text{..... Formula 2}$$

A PRD above 1.00 indicates regressivity (high-value parcels underappraised), whereas a PRD below 1.00 indicates progressivity (high-value parcels overappraised). For consistency and accuracy, assessment levels should generally fall within the legally acceptable range of 0.90 to 1.10 (IAAO, 2025a).

2) **Analysis of Assessment Uniformity**

This stage evaluates the uniformity of land assessments used to calculate the property tax (the PBB-P2). Two indicators were employed: the Coefficient of Dispersion (CoD) and the Coefficient of Variation (CoV). Both measure variability as a percentage, facilitating comparisons across property groups (IAAO, 2025a). In ratio studies, the Coefficient of Dispersion (CoD) represents the most prevalent measure of uniformity, as suggested by IAAO (2025a). The CoD is calculated using the formula:

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$$\text{COD} = \frac{100\ (AAD)}{\widetilde{ASR}} \text{ …….. Formula 3}$$

where AAD is the average absolute deviation, and $\widetilde{ASR}$ is the median.

The Coefficient of Variation (CoV) is another widely used measure, based on the standard deviation of ASR (IAAO, 2025a). The CoV can be used as a tool to assess the degree of uniformity in the assessment of properties with similar characteristics. A lower CoV indicates better uniformity. Harjanto (2011) suggests an optimal CoV value below 14%. The CoV is computed using the formula:

$$\text{COV} = \frac{100.(s)}{\overline{ASR}} \text{ …….. Formula 4}$$

where $\overline{ASR}$ is the mean of ASR and *s* represents the standard deviation of the ratios

ANALYSIS AND DISCUSSION

Analysis of Assessment-Sales Ratio

The Assessment–Sales Ratio (ASR) was computed to examine the relationship between the assessed value (NJOP) per square metre and the market value per square metre. The results show that, at the district level, the average ASR is 0.42 (42%) with a standard deviation of 0.06. This finding underscores that NJOP—used as the basis for the property tax (PBB-P2) imposition—remains substantially below prevailing market prices. On average, the assessed values represent less than half of the actual property market values. This systematic undervaluation indicates a substantial fiscal capacity loss for the local government (Hernandi et al., 2025). Among districts, Serpong exhibits the highest ASR at 0.45 (45%), whereas North Serpong records the lowest ASR at 0.39 (39%). Detailed descriptive statistics are presented in Table 18 below.

Table 18: ASR Statistic Descriptives at the District Level

District	Total Sample	Mean	Standard Deviation	Min	Max
Ciputat	391	0.40	0.05	0.17	0.73
East Ciputat	444	0.44	0.05	0.21	0.79
Pamulang	671	0.42	0.04	0.23	0.59
Pondok Aren	572	0.40	0.06	0.23	0.88
Serpong	339	0.45	0.09	0.21	0.89
North Serpong	229	0.39	0.07	0.19	0.72
Setu	221	0.42	0.09	0.23	0.69
	2,867	**0.42**	**0.06**	**0.17**	**0.89**

Source: ASR Data Analysis (2024)

At the subdistrict level, the lowest ASR is observed in Pakulonan (0.35 or 35%). This result aligns with the district-level analysis, where North Serpong—of which Pakulonan is a part—also records the lowest district-level ASR. The highest ASR at the subdistrict level is found in Babakan (0.48 or 48%). However, this does not correspond with district-level results, as Setu District (which includes Babakan) is not the district with the highest ASR.

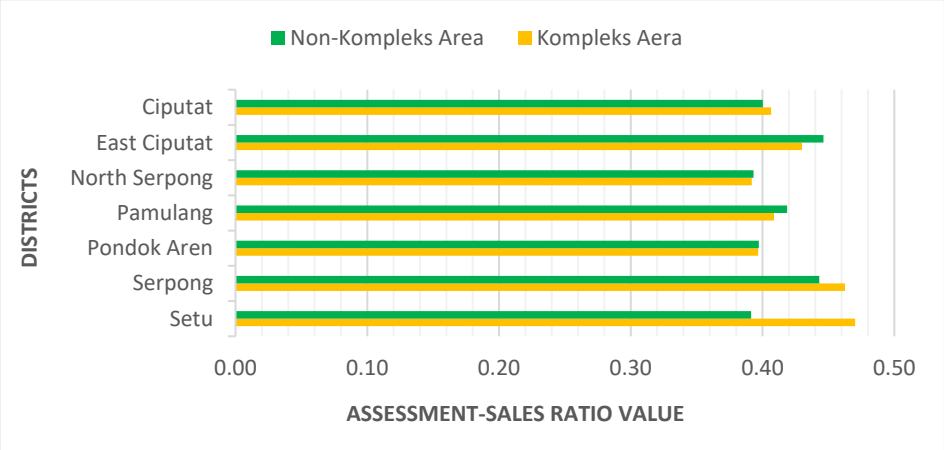


Figure 1: ASR Comparison between 'Kompleks' and 'Non-Kompleks' Area of Each District in South Tangerang City
Source: ASR Data Analysis (2024)

Figure 1 illustrates the comparative ASR values between 'Kompleks' (Planned Estates) and 'Non-Kompleks' (Organic Settlements) areas. The study found wide variability in ASR discrepancies between 'Kompleks' and 'Non-Kompleks' across districts. In Serpong, Setu, and Ciputat, 'Kompleks' areas show higher ASR values, while in East Ciputat, Pamulang, Pondok Aren, and North Serpong, 'Non-Kompleks' areas have slightly higher ratios. The discrepancy in the ASR between the two areas within each district is relatively insignificant except for Setu district, where the ASR of 'Kompleks' areas is considerably higher than in 'Non-Kompleks' areas, indicating a clear lack of uniformity in the NJOP determination between the two development types. Non-uniformity is a common indicator of assessment biasinequity (Bin-Bustamin et al., 2023), which is precisely what periodic reassessment processes aim to mitigate to maintain fairness (Senawi et al., 2022). The lack of timely revaluations, as seen in many contexts (Bin-Bustamin et al., 2023; Senawi et al., 2022), can lead to "stale assessed values" and systematic valuation errors, which are known contributors to assessment regressivity, where lower-value properties

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end up over-assessed relative to higher-value properties (Amornsiripanitch, 2020).

Setu is the smallest in terms of both area and population in South Tangerang City (BPS South Tangerang City, 2023). Located on the southwestern edge of the city, it borders Bogor Regency to the south and Tangerang Regency to the west. Two plausible explanations account for the stark ASR disparity between 'Kompleks' and 'Non-Kompleks' areas in this district. First, Setu is located far from the city's main economic activity centers. This reduces developers' incentives to invest in the area. With limited development and fewer reliable transaction records in 'Non-Kompleks' areas, re-assessments are less likely to occur, resulting in persistently low ASR values. Second, the 'Kompleks' areas that do exist in Setu have been developed by real estate firms whose transaction prices are more easily captured by the government. This enables NJOP adjustments that more accurately reflect market changes, leading to higher ASRs in 'Kompleks' areas.

Figure 2 below highlights the ten subdistricts with the widest ASR disparities between 'Kompleks' and 'Non-Kompleks' areas. The sub-district of Babakan in Setu district stands out as the one exhibiting the most pronounced divergence in ASR between the two groups, reaching nearly 20%.

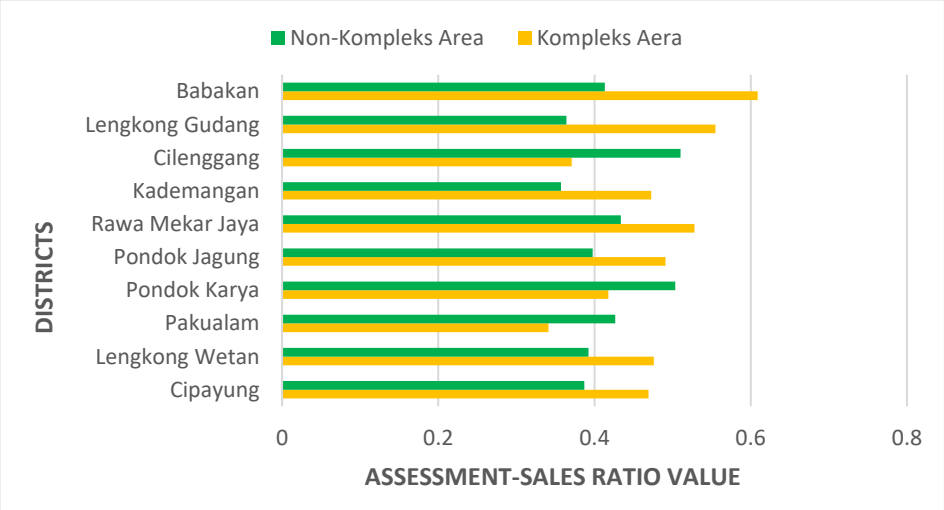


Figure 2: Top Ten Sub-District with The Highest ASR Disparities Between Groups in South Tangerang City
Source: ASR Data Analysis (2024)

Although 'Kompleks' areas generally yield higher ASR values, three subdistricts—Cilenggang, Pondok Karya, and Pakualam—display the opposite

pattern. The anomalies in these neighbourhoods can be attributed to two factors. First, the 'Kompleks' areas in these three neighbourhoods are small and limited area housing that were not developed by major real estate developers. Second, property sales in these areas occur primarily in the opaque second-hand market, where market prices are more difficult to ascertain than in newer developer-led projects. In such cases, the lack of transparent and timely transaction data constrains the ability of local governments to adjust NJOP in line with market dynamics, resulting in lower ASR values.

This study applies Price-Related Differential (PRD) analysis to assess horizontal and vertical equity and evaluate the presence of regressivity in the imposition of the property tax (PBB-P2). According to Eckert et al. (1990) and (IAAO, 2025a), a fair assessment system for property tax should produce PRD values within the acceptable range of 0.90 to 1.10.

Table 19: PRD Analysis at District Level

District	Mean	Weighted Mean	PRD
Ciputat	0.40	0.41	0.99
East Ciputat	0.44	0.44	1.00
Pamulang	0.42	0.42	0.99
Pondok Aren	0.40	0.40	0.98
Serpong	0.45	0.47	0.96
North Serpong	0.39	0.40	0.99
Setu	0.42	0.43	0.96

Source: ASR Data Analysis (2024)

The PRD values across all districts range from 0.96 to 1.00 (**Table 3**). The highest PRD is observed in East Ciputat (1.00), while Setu and Serpong record the lowest PRD values (0.96). These results indicate no evidence of regressivity or progressivity in property tax (PBB-P2) imposition in South Tangerang City. This finding creates a nuanced "conundrum" for the local government. Although the ASR demonstrates a profound fiscal potential loss (average undervaluation of 58%), the near-neutral PRD suggests that this administrative failure is being applied uniformly across all value tiers; thus, the system achieves proportional equity in its undervaluation. This uniformity is a positive technical outcome, contrasting with studies in other developing contexts like Malaysia, which often find regressive assessment biases (Bin-Bustamin et al., 2023). The challenge for South Tangerang is not equity distribution, but rather

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raising the entire assessment level (ASR) and cutting down on non-uniformity assessments.

Analysis of Assessment Uniformity

To assess the uniformity of property assessments, this study employs the Coefficient of Dispersion (CoD). A low CoD value (below 15.0) generally indicates satisfactory uniformity in assessments. In addition to CoD, CoV is also used as a complementary indicator of uniformity (IAAO, 2025b). **Table 4** below presents a comparison of the CoV and the CoD among districts.

Table 20: Comparison of Uniformity at the District Level

District	Sample Number	CoD	CoV
Ciputat	391	3.82	13.46
East Ciputat	444	3.28	10.63
Pamulang	671	3.28	10.12
Pondok Aren	572	3.77	14.20
Serpong	339	6.73	20.04
North Serpong	229	5.43	17.94
Setu	221	7.48	21.15

Source: Assessment Uniformity Analysis (2024)

The district-level CoD analysis shows that all districts in South Tangerang City exhibit a high degree of uniformity, with CoD values below 15.0. However, based on CoV values, three districts— Serpong (20.04), North Serpong (17.94), and Setu (21.15) —display relatively poor uniformity compared to the others. A more granular analysis at the subdistrict level reveals additional variation that warrants attention. **Table 21** highlights selected subdistricts where CoD and CoV values are relatively high and thus merit closer scrutiny.

Table 21: Uniformity Comparison of Selected Neighbourhoods

District	Sub-District	Sampel Number	CoD	CoV
East Ciputat	Cempaka Putih	57	5.84	15.88
Pamulang	Bambu Apus	39	9.45	21.48
Pamulang	Pondok Cabe Ilir	43	12.31	17.56
Pondok Aren	Jurangmangu Barat	75	11.13	16.28
Pondok Aren	Pondok Jaya	31	15.29	15.49
Serpong	Cilenggang	17	8.38	16.38
Serpong	Lengkong Wetan	24	29.49	31.76
Serpong	Rawabuntu	37	10.88	26.82
Serpong	Serpong	35	8.97	21.39
North Serpong	Jelupang	36	6.61	27.21
North Serpong	Lengkong Karya	20	13.12	25.99

District	Sub-District	Sampel Number	CoD	CoV
North Serpong	Pakualam	29	13.09	17.42
North Serpong	Pakulonan	16	17.05	27.87
North Serpong	Pondok Jagung	44	7.88	20.76
North Serpong	Pondok Jagung Timur	37	8.76	22.82
Setu	Karanggan	28	16.04	30.41
Setu	Setu	20	15.44	27.13
Ciputat	Serua Indah	49	9.75	23.97
Ciputat	Sawah Baru	49	7.22	20.43
Ciputat	Sawah	69	8.14	21.30

Source: Assessment Uniformity Analysis (2024)

The analysis of sub-district data confirms that localized administrative failures are masked by the broad district averages. Notably, Lengkong Wetan (Serpong) exhibits an extremely high CoD of 29.49 and CoV of 31.76, figures dramatically exceeding the maximum recommended threshold of 15.0.

Table 22 further disaggregates the subdistricts that do not meet the desired uniformity criteria by distinguishing between 'Kompleks' and 'Non-Kompleks' zones. These results can help the South Tangerang City Government identify priority areas for reassessment. Rapid urban expansion has generated sharp fluctuations in market prices that are not always accompanied by timely updates to the assessed value (NJOP). In several subdistricts, accelerated development has occurred alongside persistent pockets of slower growth, which exacerbates disparities and reduces assessment uniformity. This reflects the theoretical concept of assessment lag, where rapid market value changes are not immediately reflected in the property tax base due to administrative constraints. This challenge is frequently linked to factors common in developing contexts, such as limited capacity, outdated cadastres, and political resistance to regular revaluations (Almy, 2014; Grote et al., 2024; Slack and Bird, 2014).

Table 22: Recommendation for Re-Assessment Priority

District	Sub-District	Zone	PRD	CoD	CoV
Ciputat	Cipayung	Kompleks	1.00	9.6	16.08
Ciputat	Cipayung	Non-Kompleks	1.01	10.8	15.94
Ciputat	Ciputat	Non-Kompleks	0.97	11.24	15.06
Ciputat	Sawah	Non-Kompleks	0.99	13.43	19.38
Ciputat	Serua Indah	Non-Kompleks	1.01	11.69	17.27
East Ciputat	Pondok Ranji	Kompleks	1.01	8.29	19.08
Pondok Aren	Perigi	Kompleks	0.97	14.22	18.06
Pondok Aren	Pondok Jaya	Non-Kompleks	0.95	10.23	17.46
Pondok Aren	Pondok Kacang Barat	Kompleks	0.97	19.45	20.87
Pondok Aren	Pondok Karya	Non-Kompleks	1.04	10.81	17.38

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District	Sub-District	Zone	PRD	CoD	CoV
Serpong	Buaran	Kompleks	0.98	20.43	25.65
Serpong	Ciater	Kompleks	0.98	12.09	17.58
Serpong	Ciater	Non-Kompleks	0.96	18.18	24.57
Serpong	Cilenggang	Kompleks	0.94	45.18	44.1
Serpong	Cilenggang	Non-Kompleks	1.02	22.89	33.13
Serpong	East Lengkong Gudang	Non-Kompleks	0.97	10.43	16.68
Serpong	Rawabuntu	Non-Kompleks	0.95	18.35	24.74
Serpong	Serpong	Non-Kompleks	0.97	13.55	18.84
North Serpong	Pakualam	Kompleks	0.97	18.01	23.27
North Serpong	Pakujaya	Kompleks	0.99	10.84	16.32
North Serpong	Pakujaya	Non-Kompleks	0.98	15.77	22.99
North Serpong	Pakulonan	Kompleks	1.00	16.3	20.19
North Serpong	Pondok Jagung	Non-Kompleks	0.94	10.21	16.77
Setu	Babakan	Non-Kompleks	0.98	11.7	18.61
Setu	Bukti Jaya	Kompleks	0.98	10.63	16.37
Setu	Bukti Jaya	Non-Kompleks	0.95	14.09	19.63

Source: Data Analysis (2024)

Table 23 outlines several areas that go above the CoD and CoV values threshold. Eckert et al. (1990) or (IAAO, 2025b) recommended a maximum of 15.0 for uniformity indicator. There are 8 sub-districts that have CoD above the tresshold, such as Pondok Kacang Barat, Buaran, Ciater, Cilenggang, Rawabuntu, Pakualam, Pakujaya, and Pakulonan sub-districts.

Table 23: Sub-districts with the Highest CoD and CoV

No.	Sub-district	Zone	CoD	CoV
1	Cilenggang	Komplek	45.18	44.10
2	Cilenggang	Non-Komplek	22.89	33.13
3	Buaran	Komplek	20.43	25.65
4	Rawabuntu	Non-Komplek	18.35	24.74
5	Ciater	Non-Komplek	18.18	24.57
6	Kademangan	Non-Komplek	14.10	23.6
7	Pakualam	Komplek	18.01	23.27
8	Pakujaya	Non-Komplek	15.77	22.99
9	Pondok Kacang Barat	Komplek	19.45	20.87
10	Pakulonan	Komplek	16.30	20.19

Source: Data Analysis (2024)

CoD and CoV values can serve as practical benchmarks for prioritising reassessment efforts. This study identifies Cilenggang as a critical area requiring urgent attention, as both ‘Kompleks’ and ‘Non-kompleks’ zones exhibit the

highest CoD and CoV values. Considering the rapid expansion observed in parts of Cilenggang, a comprehensive re-assessment should be conducted in a timely manner. Upon field observation, the sporadic land value growth that fractures uniformity in these high-priority zones can be directly linked to specific local development factors, consistent with trends in rapidly urbanizing regions globally:

(1) **Infrastructure Shock.** The variability in Cilenggang is primarily driven by the opening of the Serpong-Balaraja toll gates and economic activity surrounding the Rawa Buntu Electric Train Station. Similarly, the Serpong Kuciran Toll Road has influenced land value fluctuations in Pakujaya, Pakualam, Pakulonan, and Pondok Kacang Barat.
(2) **Commercial Conversion.** The growth of Buaran is catalyzed by the presence of the Pamulang University campus, which rapidly shifts residential zones into commercial areas (rental housing, boarding houses, businesses).
(3) **Administrative Lag.** This rapid, localized expansion, coupled with administrative limitations (lack of competent personnel, limited budgets, and slow approval processes), prevents the South Tangerang City government from promptly adjusting NJOPs, creating localized "inequity hotspots" (Slack and Bird, 2014).

The rapid urban expansion and resulting significant fluctuations in market prices observed here are consistent with challenges faced by many rapidly urbanizing regions globally, where property tax systems struggle to keep pace with dynamic land value changes (Chmielewska et al., 2025). The CoD and CoV values presented here provide a practical, evidence-based framework for the South Tangerang government to prioritize resource allocation for immediate reassessment efforts.

CONCLUSION

The core finding of this study is the Assessed Value Conundrum in South Tangerang City: the property tax system is characterized by a significant fiscal deficit combined with a high degree of proportional equity.

The analysis revealed a profound level of systematic undervaluation, with an average Assessment-to-Sales Ratio (ASR) of 42%, demonstrating that the assessed tax base captures less than half of the prevailing market values. This indicates persistent undervaluation and suggests that existing assessment practices do not accurately capture real property values and substantially limits the local government's own-source revenue capacity.

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However, Equity and uniformity indicators present a mixed picture. Price-Related Differential (PRD) ranges from 0.96 to 1.00, falling within the standard acceptable limits and indicating that the undervaluation is applied proportionally across different value tiers. This suggests neutral assessment behavior concerning vertical equity (not systematically regressive or progressive). While the Coefficient of Dispersion (CoD) meets the recommended threshold, the Coefficient of Variation (CoV) exceeds the ideal 14% in several districts, signalling substantial inconsistencies in value representation. Cilenggang sub-district shows the highest variability (CoV 44.10) in both Planned and Unplanned zones, demonstrating severe localized non-uniformity driven by uncaptured infrastructure-led market spikes.

Overall, these results highlight the urgent need for a shift from passive assessment to systematic and targeted revaluation to correct undervaluation patterns and ensure fairer tax burdens. By applying the IAAO ratio analysis as a diagnostic tool, this study provides a practical framework for local governments to correct valuation discrepancies and support stronger, more sustainable fiscal performance. Prioritizing equity-oriented adjustments based on CoV hotspots and regular valuation updates will be crucial in advancing a more reliable, transparent, and sustainable property taxation framework for South Tangerang and other rapidly urbanizing regions in Indonesia.

POLICY IMPLICATION

Addressing the challenges of property tax administration and ensuring fiscal equity are critical aspects of effective urban governance, a theme widely explored in academic literature (Chmielewska et al., 2025). While legal mandates, such as Law Number 1 of 2022, require local governments to update and re-assess property data regularly (at a maximum interval of three years), many Indonesian regions (e.g., as noted by BKF (2015), BPK (2015), or Wahyudi et al. (2022)), struggle to comply due to limitations in budget, personnel, and technical competencies. This issue mirrors international observations regarding the failure to conduct regular revaluations, which compromises the accuracy and equity of assessments over time (Hou et al., 2021; Grote et al., 2024; Slack and Bird, 2014; Zulkifli et al., 2021).

The OECD and UN-Habitat similarly emphasize that regular, data-driven revaluations are essential for ensuring the fairness, transparency, and revenue potential of property taxation systems, particularly in rapidly urbanizing contexts(Grote et al., 2024; Kelly et al., 2020). When revaluations lag, systematic biases often emerge, including assessment regressivity, whereby lower-priced properties are over-assessed relative to higher-priced ones (Amornsiripanitch, 2020; Berry, 2024).

The findings from South Tangerang City illustrate a profound fiscal deficit (ASR of 42%), but demonstrate a unique situation where equity is achieved in principle (PRD near 1.00) but lost in practice due to administrative capacity failure (high CoV in localized zones). This validates the theoretical link between administrative capacity and the health of the fiscal decentralization architecture (Slack and Bird, 2014).

In addition, political economy factors often discourage local governments from adjusting ASR values to reflect market dynamics, as concerns about public backlash may outweigh considerations of fiscal equity. In this context, the South Tangerang City Government may consider several policy strategies to strengthen assessment practices in a gradual, data-driven, and socially responsive manner:

1. **Prioritized and Phased Reassessment**. Given limited resources, reassessment efforts must be strategically prioritized based on assessment quality indicators. The simultaneous analysis of Price-Related Differential (PRD), Coefficient of Variation (CoV), and Coefficient of Dispersion (CoD) provides a data-driven framework to target areas of maximum administrative failure. The study strongly recommends that reassessment be initiated immediately in the nine sub-districts with the highest CoV values, including Cilenggang, Buaran, Rawabuntu, Ciater, Kademangan, Pakualam, Pakujaya, Pondok Kacang Barat, and Pakulonan. This approach maximizes the efficiency of resource allocation by focusing only on proven inequity hotspots.

2. **Mitigating Political Fallout via Targeted Adjustments.** The political economy of property tax reform dictates that increasing assessed values (ASR) to reflect market reality can cause voter backlash. To minimize potential social disruption, the government should adopt a gradual, phased approach to tax increases. The initial burden of the ASR adjustment should primarily target commercial property and upper middle-class residential areas, typically in the 'Kompleks' zones, where the government has the highest data reliability. This strategy leverages the social perception that higher property values correspond to a greater ability to pay, while providing transitional relief or income-related credits in suburban or lower-middle-class residential areas (Slack and Bird, 2014).

3. **Institutionalizing Technical Capacity and Data Capture.** The pervasive lack of uniformity in some areas highlights the administrative struggle to capture fluid market data outside of developer transactions. To overcome this, the government must:

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a. **Modernize Assessment Systems.** Implement computerized mass appraisal (CMA) systems and utilize geospatial technology to regularly monitor rapid, sporadic changes in land use (e.g., near toll roads or university developments) and ensure that these market shocks are integrated into the tax base swiftly.
b. **Strengthen Data Integrity.** Establish mandatory protocols for property transfer reporting to capture second-hand market values accurately, thereby reducing the reliance on older, static NJOP data.
c. **Enhance Transparency.** Clearly communicate the link between property tax revenue and specific local service improvements to increase taxpayer acceptance of higher ASR values.

4. **Addressing Assessment Lag:** The overall low ASR is a symptom of chronic **assessment lag**. To maintain the fiscal integrity of the PBB-P2 system, the government must adhere strictly to the 3-year reassessment mandate. Failure to do so not only weaken revenue collection but structurally undermines the goals of fiscal decentralization.

COMPETING INTEREST STATEMENT

The authors declare that there are no known competing interests that could have appeared to influence the work reported in this paper.

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AUTHOR CONTRIBUTION STATEMENT

All authors contributed significantly to the development of this research. The first author was responsible for the conceptualization of the study, research design, data collection, and primary data analysis. The co-author contributed to the refinement of the methodology, validation of results, and critical revision of the manuscript. All authors participated in interpreting the findings, drafting the manuscript, and approving the final version for publication. All authors agree to be accountable for all aspects of the work.

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A BIBLIOMETRIC ANALYSIS ON GREEN BUILDINGS ISSUES IN ASIA: 20 YEARS REVIEW

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Abstract

This article presents a comprehensive 20-year bibliometric analysis focused on the trends and patterns of research addressing green building issues in Asia. The problem statement arises from the increasing importance of green buildings in mitigating environmental impacts, coupled with the rapid urbanization witnessed in Asia. This study aims (1) to identify the publication trends in green buildings issues in Asia for the past 20 years; (2) to investigate the evolving trends of research priorities between the last two decades; (3) to study the field's intellectual and geographical evolution from the structures of collaboration and co-occurrence networks. This research used the Scopus database served as the primary source for collecting relevant publications spanning the period from 2004 to 2024. A systematic search using specific keywords related to green building issues in Asia was conducted. The bibliometric software VOSviewer was employed to visualize co-occurrence networks mapping, analyze publication trends, and others analysis. The analysis shows a steady increase in publications, reflecting growing interest in green building research across Asia. Leading contributors form a competitive and diverse research community, with Environmental Science, Social Sciences, and Engineering as the main subject areas, highlighting the field's multidisciplinary nature. Over the past two decades, research has evolved from broad discussions on sustainability to more focused, evidence-based, and interdisciplinary studies emphasizing technology, certification, and human-centered design. The co-authorship network further reveals that countries with stronger institutions and policies dominate research output, while regional gaps remain, underscoring the need for greater collaboration, knowledge sharing, and policy support to promote a more balanced and sustainable research ecosystem in Asia.

Keywords: Green Buildings, Green Issues, Bibliometric Analysis

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INTRODUCTION

In the dynamic landscape of sustainable development, green buildings have emerged as a linchpin, catalyzing a paradigm shift towards environmentally conscious urbanization. Over the past two decades, the Asian continent has been at the forefront of this transformative journey, navigating the intricate intersection of innovation, policy, and societal change. As the study embarks on a bibliometric analysis spanning the last 20 years, this article delves into the wealth of scholarly literature to unravel the intricate tapestry of green building issues in Asia. The exponential growth of research on green buildings in Asia underscores the urgency and global significance of sustainable urban development. Scholars, policymakers, and industry experts have engaged in a rich tapestry of discourse, addressing the multifaceted challenges and opportunities that define the region's commitment to eco-friendly construction practices.

This study seeks to provide a comprehensive and nuanced understanding of the evolving scholarly discourse on green building issues in Asia. It identifies key intellectual contributors and maps collaborative networks to reveal intersections of knowledge production and clusters of expertise that have influenced the field's development. The findings offer both a retrospective view of the past two decades and guidance for future research and policy directions in sustainable development. In addressing the growing academic focus on this topic, the study is guided by three main research questions:

(1) What are the publication trends in green building research in Asia over the past 20 years?
(2) How have thematic focuses and research priorities evolved, as reflected through keyword co-occurrence patterns? and
(3) How do collaboration and co-occurrence networks among authors, institutions, keywords, and countries shape the intellectual and geographical landscape of green building research in the region?

LITERATURE REVIEW

In the past two decades, green buildings in Asia have focused mostly on environmental benefits such as energy conservation, emission reduction, and ecological sustainability (Chen & Luo, 2020; Leong et al., 2023; Zhao et al., 2023). Green building initiatives aim to preserve the climate and urban environment through innovations in building design, construction methods, and materials (Wardhana et al., 2023), particularly in densely populated Asian cities (Thakur, 2023).

However, despite the green benefits there are various key economic issues arise include high initial costs, long-term cost recovery, and barriers to implementation over the past two decades in the Asia countries. High initial costs are a major challenge in the design and construction stages, particularly due to

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the higher costs of green materials and features (Hussain Ahram & Syed Zakaria, 2023; W. Shen et al., 2018; Taherkhani, 2023; Zhang et al., 2018). Long-term cost recovery is also a concern in the operational stage (Hussain Ahram & Syed Zakaria, 2023). Barriers to implementation include financial pressure, technical limitations, inadequate promotion, and difficulty in obtaining green materials (W. Shen et al., 2018; Susanto & Sujana, 2023; Taherkhani, 2023; Tam, 2014).

Despite the potential long-term benefits, economic viability remains unclear due to information, behavior, and policy factors (Zhang et al., 2018). Green finance can help bridge the investment gap, with Asia contributing significantly to this area (Debrah et al., 2022). Market demand, technological advancement, and government support are crucial for the adoption of green buildings in developing countries like Thailand, where financial pressure, technical limitations, and inadequate promotion are identified as barriers (W. Shen et al., 2018; Taherkhani, 2023). The existing literatures shows that the China's government has played a significant role through a mix of regulatory, market-based instruments (Y. Shen & Faure, 2021) and evolution of policies and tools over the past two decades (He et al., 2023). Meanwhile, the implementation of green building policies in Indonesia faces challenges related to effectiveness, legal level, and social momentum, suggesting the involvement of various sectors and stakeholders for effective implementation (Maramis & Lumunon, 2022; Sahid et al., 2021). Similarly, the challenges faced by Vietnam include the need for comprehensive regulations, slow adoption, and lack of governmental support (Nguyen & Gray, 2016). Contrarily, the key success factors in Singapore's green building implementation with over 30% of buildings being Green Mark certified, provides valuable lessons emphasizing the importance of government policy, incentives, legislation and industry strong support (Hatmoko et al., 2017). In the past two decades, the adoption of green building technologies in Asia has been hindered by a lack of technical capabilities and various challenges. For instance, in Thailand, "skilled in energy systems" was identified as one of the top two most important green technical capabilities, while in Indonesia and Malaysia, lack of awareness, expertise, and budget were identified as barriers to green building adoption (Hatmoko et al., 2017; Sahid et al., 2021; W. Shen et al., 2018; Yee Sin et al., 2021).

In conclusion of the literature, the last two decades have marked a significant period of evolution, challenges, and achievements in the domain of green building implementation across Asia. The comprehensive reviews from various scholars and studies provide a rich tapestry of insights that underline the multifaceted nature of green building issues in the region, encapsulating environmental benefits, economic hurdles, policy and regulatory frameworks and technological advancements. This conclusion synthesizes these insights, acknowledging the progress made while highlighting the persistent and emerging

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challenges that need addressing to foster the broader adoption of green buildings in Asia.

RESEARCH METHODOLOGY

Bibliometrics is the process of organising, coordinating and analysing bibliographic data from scientific publications (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). In addition to standard descriptive data like publication year, major author categorization, and publishing journals, it also includes sophisticated methods like document co-citation analysis (Wu & Wu, 2017). In order to produce a full bibliography and reliable results, a successful literature review requires an iterative process that includes the discovery of appropriate keywords, literature search, and careful analysis (Fahimnia et al., 2015). Considering this, the study aimed to concentrate on high-caliber publications since they provide insightful information about the theoretical stances influencing the development of the field of study. The study used the SCOPUS database for data gathering in order to guarantee data fidelity (Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017). Furthermore, only papers published in carefully peer-reviewed academic journals were taken into consideration, with books and lecture notes purposefully left out in order to guarantee the inclusion of high-quality publications (Gu et al., 2019). Notably, papers from 2004 to February 2024 were collected for further research thanks to Elsevier's Scopus, which is renowned for its broad coverage.

Data search strategy

The data search terms for article retrieval were determined by the study using a screening sequence. The study was started by putting together 2,786 articles by querying the Scopus database with the online TITLE ("Green building") AND issues. Subsequently, the query string was changed to emphasise by adding the search phrases "Green building" AND (topics OR problems OR challenges). 1,241 articles that were included after the refinement were included in the bibliometric study. All papers pertaining to green building issues in Asia included in the Scopus database as of February 2024 were included in the analysis as criterion in Table 1 and 2.

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Table 24: The search strings

Scopus	TITLE-ABS-KEY ("green buildings" AND (issues OR problems OR challenges)) AND (EXCLUDE (PUBYEAR , 1992) OR EXCLUDE (PUBYEAR , 1996) OR EXCLUDE (PUBYEAR , 1998) OR EXCLUDE (PUBYEAR , 1999) OR EXCLUDE (PUBYEAR , 2000) OR EXCLUDE (PUBYEAR , 2001) OR EXCLUDE (PUBYEAR , 2002) OR EXCLUDE (PUBYEAR , 2003)) AND (EXCLUDE (DOCTYPE , "re") OR EXCLUDE (DOCTYPE , "ch") OR EXCLUDE (DOCTYPE , "cr") OR EXCLUDE (DOCTYPE , "bk") OR EXCLUDE (DOCTYPE , "sh") OR EXCLUDE (DOCTYPE , "ed") OR EXCLUDE (DOCTYPE , "tb") OR EXCLUDE (DOCTYPE , "no") OR EXCLUDE (DOCTYPE , "er") OR EXCLUDE (DOCTYPE , "cp")) AND (EXCLUDE (LANGUAGE , "Chinese") OR EXCLUDE (LANGUAGE , "Spanish") OR EXCLUDE (LANGUAGE , "Korean") OR EXCLUDE (LANGUAGE , "French") OR EXCLUDE (LANGUAGE , "German") OR EXCLUDE (LANGUAGE , "Italian") OR EXCLUDE (LANGUAGE , "Persian")) AND (EXCLUDE (SRCTYPE , "d") OR EXCLUDE (SRCTYPE , "p") OR EXCLUDE (SRCTYPE , "k"))

Table 1: The selection criterion is searching

Criterion	Inclusion	Exclusion
Timeline	2004 – 2024 (Feb)	< 2004
Literature type	Article	Non-Article
Source type	Journal	Non-Journal
Language	English	Non-English

Source: Author's Analysis (2024)

Data analysis

The study used VOSviewer, a widely used bibliometric software used to analyze and visualize scientific literature (Van Eck and Waltman, 2010). VOSviewer enables mapping of co-authorship, co-citation, and keyword co-occurrence networks through intuitive visualizations, clustering related items, and generating density maps. Its interactive interface and compatibility with major bibliometric databases allow efficient exploration of large datasets. The software also supports metric computation and customizable visualizations. By translating complex bibliometric data into clear visual maps and charts, VOSviewer helps identify research trends, thematic clusters, and collaboration networks, providing valuable insights into the intellectual structure and development of a research field.

The bibliometric analysis process in this research involved datasets containing information on publication year, title, author name, journal, citation, and keywords. The data were export in PlainText format obtained from the Scopus database, covering the period from 2004 to February 2024. These datasets were analyzed using VOSviewer software version 1.6.20, employing VOS clustering and mapping techniques to examine and generate maps. Unlike the Multidimensional Scaling (MDS) approach, VOSViewer focuses on situating items within low-dimensional spaces, ensuring that the proximity between any two items accurately reflects their relatedness and similarity. While sharing similarities with the MDS approach, VOSViewer diverges by employing a more

appropriate method for normalizing co-occurrence frequencies, such as the association strength (ASij) calculated as:

$$ASij = \frac{Cij}{Wiwj}$$

According to Van Eck and Waltman (2010), the index used in VOSviewer measures the observed co-occurrences of items relative to their expected co-occurrences under statistical independence. Based on this index, the software positions items on a map by minimizing the weighted sum of squared distances between pairs, often applying LinLog/ modularity normalization to improve clustering (Appio et al., 2016). Visualization techniques in VOSviewer reveal patterns grounded in these mathematical relationships, enabling analyses such as keyword co-occurrence, citation analysis, and document co-citation analysis. Keyword co-occurrence analysis allows tracking the evolution of research topics over time and identifying prominent themes (Li et al., 2016). Citation analysis helps uncover key research trends, techniques, and historical significance, while co-citation analysis maps the intellectual structure of a field through network-based approaches (Appio et al., 2016; Fahimnia et al., 2015; Liu et al., 2015).

RESULTS AND FINDINGS

RQ 1: What are the publication trends in green building issues in Asia for the last 20 years?

The Figure 1 show the number of journal articles published on green building issues in Asia that were indexed by Scopus over a 20-year period (2004 to 2024 (Feb)). There seems to be a steady increase in the number of publications over the timeframe, indicating a growing interest in "Green Building Issues in Asia". This could be due to a number of factors, including rising awareness of environmental impact of buildings, growing interest in green building practices, rapid urbanisation in Asia that need for more sustainable construction methods to reduce the environmental impact of new buildings as well as many Asian governments have implemented policies to promote green building practices, such as tax breaks and subsidies. The figure also shows that the highest publications recorded were from 2021 to 2023. During these three years, there are 109 up to 175 publications recorded per year. By considering these trends, patterns, and potential influences, it can be concluded from the bibliometric analysis that recently green buildings issues are seriously discussed in high impact articles from various perspectives.

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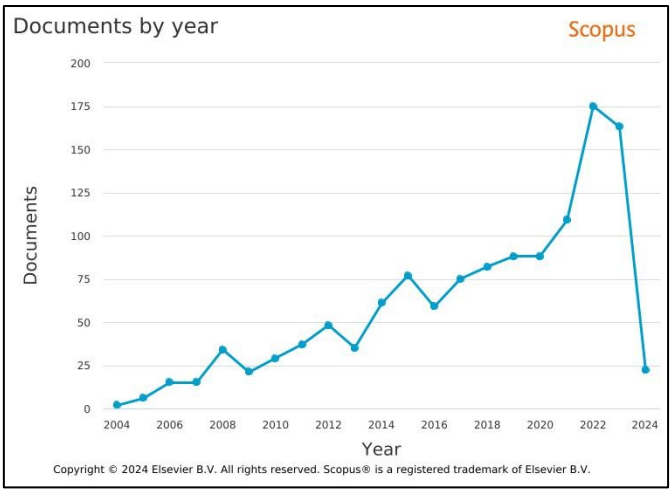


Figure 1: Plotting document publication by years.
Source: Scopus's Analysis (2024)

In line with the literature synthesis, this trend reflects the regional shift from conventional construction paradigms toward more environmentally conscious and resource-efficient building practices. It also signals a maturation of the research domain, transitioning from descriptive explorations of "green" principles to data-driven, policy-oriented, and performance-based analyses. Hence, the consistent growth over two decades underscores not only the enduring relevance of green building research in Asia but also the region's role as a critical contributor to global sustainability discourse.

Who are the most influential researchers and countries contributing to the advancement of green building studies within the region?

The Figure 2 and Table 3 shows the top 10 authors based on the number of publications in green building issues in Asia indexed by Scopus. The most prolific researcher in the field is Guo Z. with the highest number of publications (7 journal articles) accounting for 0.56 percent of the total publications. The rest of the authors in Figure 2 shows 5 publications each, contributing 0.40 percent to the total publications. The top 10 authors have made significant contributions to the research on green building issues in Asia, collectively accounting for more than half (56%) of the total publications in the dataset. The remaining

publications are distributed among a larger number of authors, with 430 unique authors listed.

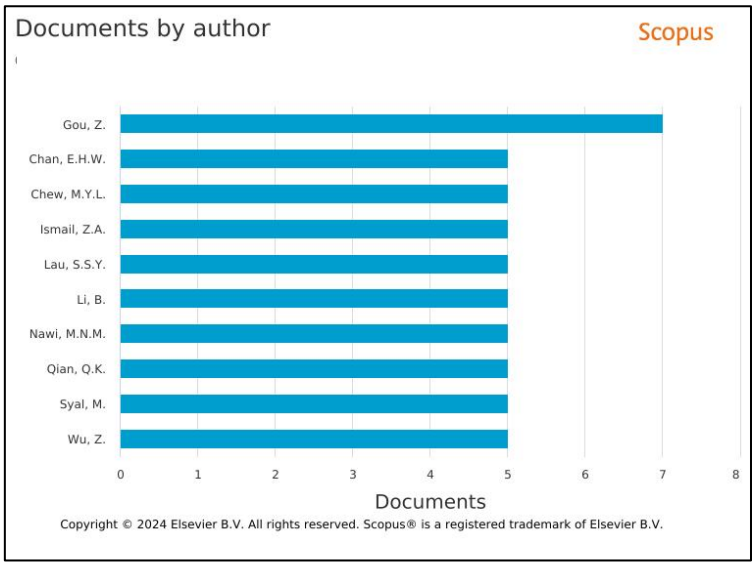


Figure 2: 10 Top Authors in publication of green buildings issues in Asia
Source: Scopus's Analysis (2024)

Table 3: Number of Publications for Top Researchers

Author Name	Number of Publication	Percentages
Gou, Z.	7	0.56
Chan, E.H.W.	5	0.40
Chew, M.Y.L.	5	0.40
Ismail, Z.A.	5	0.40
Lau, S.S.Y.	5	0.40
Li, B.	5	0.40
Nawi, M.N.M.	5	0.40
Qian, Q.K.	5	0.40
Syal, M.	5	0.40
Wu, Z.	5	0.40

Source: Scopus's Analysis (2024)

Based on the author names analysis, it appears that researchers from various countries in Asia are contributing to this field. The institutional affiliations and author backgrounds suggest strong representation from China, Malaysia, and Singapore, countries that have established institutionalized research programs and policy frameworks supporting sustainable construction. The clustering of co-authored works also points to active research networks and

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collaborative initiatives, which are instrumental in advancing cross-border knowledge exchange on sustainability issues.

This finding reinforces the earlier literature synthesis, which emphasized China's regulatory leadership, Singapore's Green Mark policy success, and Malaysia's growing focus on sustainable construction technologies as catalysts for regional transformation. Nevertheless, the relatively limited contributions from emerging economies such as Indonesia, Vietnam, and the Philippines highlight a research disparity that warrants future attention to ensure equitable and regionally representative advancements in sustainable building practices.

What are the dominant research themes or subject areas and keyword clusters that define the intellectual structure of this field?

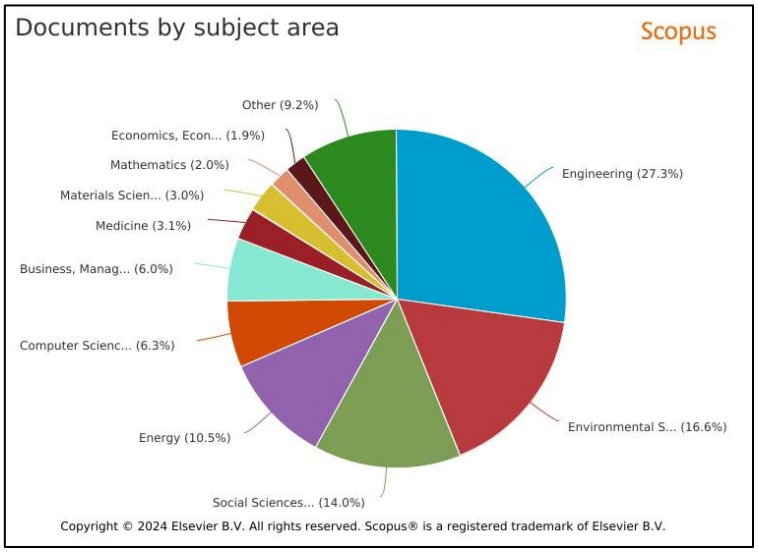


Figure 3: Type of document by subject of research
Source: Scopus's Analysis (2024)

The Figure 3 shows the research themes or subject areas covered in a collection of Scopus documents related to green building issues in Asia. The breakdown of the information recorded the largest slices were dominated by Engineering (27.3%), Environmental science (16.6%) and Social Sciences (14.0%). This suggests that research on green building in Asia tends to focus on the environmental and social impacts of green buildings, as well as the engineering challenges of designing and constructing them. There is also some

research on the economic and business aspects of green buildings, as well as on the use of computers and data in green building design and construction.

Engineering research has primarily focused on energy-efficient design, building performance optimization, and technological innovation in materials and systems, resonating with the literature on technological limitations and the need for green construction codes. Meanwhile, studies in Environmental Science have concentrated on emission reduction, resource efficiency, and life-cycle assessment, aligning with the identified environmental benefits of green buildings in the region. Social Science contributions, in contrast, reflect a growing recognition of human well-being, behavioral adaptation, and governance frameworks, emphasizing the role of stakeholder engagement, education, and regulatory policy in advancing green building adoption.

RQ 2:How the thematic focuses and research priorities in green building studies in Asia evolved over the past two decades based on keyword co-occurrence patterns?

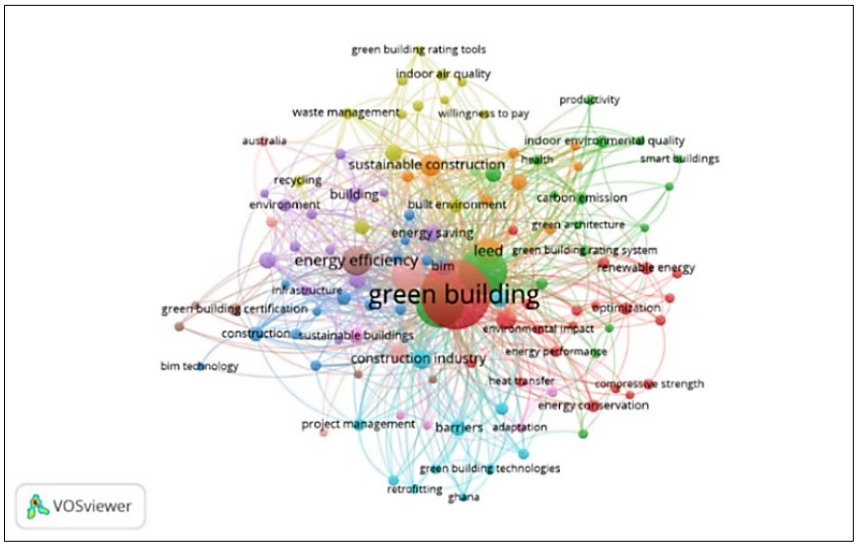


Figure 4: Network visualization map of keywords' co-occurrence (2004-2024: 2 decades)
Source: VOS viewer's Analysis (2024)

The map in Figure 4 visually represents the relationships and prominence of various keywords within the green building issues in ASIA in two decades (2004 – 2024). The term "green building" is highly frequent, appearing 294 occurrences, indicating its central importance in the literature. The total link strength of 323 suggests strong connections with other terms, reinforcing its

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significance in the context of green building issues in Asia. "Energy efficiency" is another highly emphasized concept, appearing 55 occurrences. The total link strength of 81 indicates a strong association with various related terms, highlighting the focus on energy-efficient solutions in green building discussions. "Sustainability" is a key theme, occurring 140 times, and has a substantial total link strength of 240. This indicates a broad and interconnected network of topics related to sustainability in the context of green buildings in Asia.

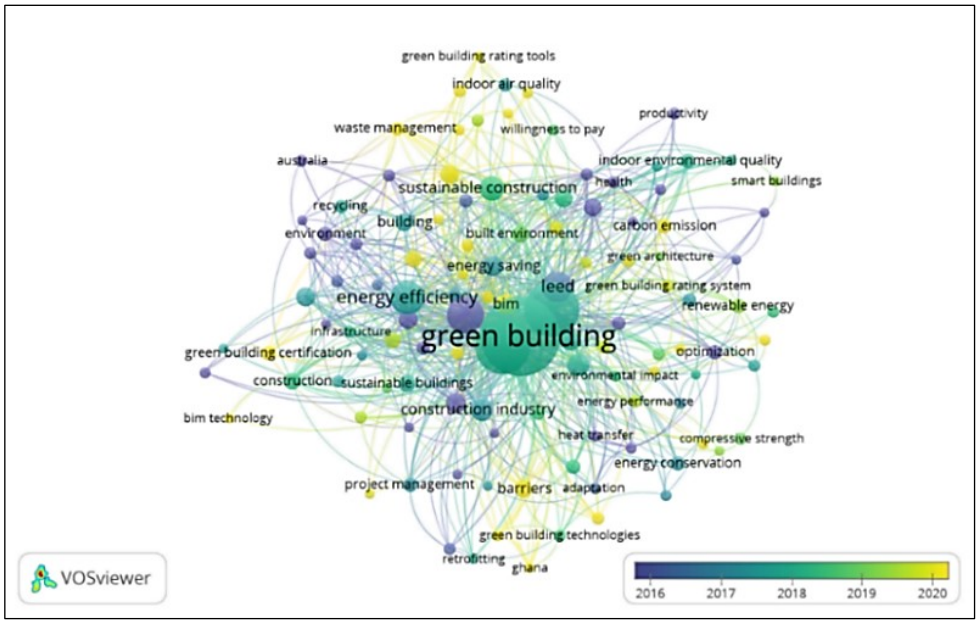


Figure 5: Network Visualization Map of Keywords' Co-Occurrence
(2014 – 2024: Recent decade)
Source: VOS viewer's Analysis (2024)

Meanwhile, the visual mapping in Figure 5 is a network visualization map of keywords co-occurrence that representing the recent decade from 2014 up to 2024 (February) on green buildings issues in Asia. The result shows the relationship on keywords on "Green building" that refers to rating system which is a central term with strong links to other keywords such as LEED, BIM, green building certification, and sustainable construction. This suggests that green building rating systems are a major issue on green building research in Asia. The next keywords is "Energy" related keywords like energy saving, energy efficiency, and renewable energy are also prominent and interconnected. This reflects the importance of energy efficiency in green buildings. There is a cluster of keywords around "indoor environment" including indoor air quality, health, and productivity. This suggests a focus on creating healthy and productive indoor

spaces in green buildings. There are also several other prominent keywords like "waste management", "recycling" and "sustainable construction" form another cluster, indicating a concern for sustainable building practices throughout a building's life cycle. Overall, the network visualization map shows that recently green building research in Asia is focused more on attributes in developing green buildings that create energy-efficient, healthy, and environmentally friendly buildings.

A comparative analysis of the keyword co-occurrence maps in Figure 4 and Figure 5 reveals a significant evolution in the thematic focus of green building research in Asia over the past twenty years. During the earlier period (2004–2023), the keyword network was dominated by broad conceptual terms. These patterns suggest that the earlier body of literature was largely conceptual, focusing on defining the scope, importance, and environmental implications of sustainable construction in the Asian context. In contrast, the recent decade (2014–2024) exhibits a noticeable shift toward application-oriented and technology-driven themes. This reflects the field's maturation from conceptual discussions to the integration of practical assessment tools, digital technologies, and standardized rating systems. The emergence of interconnected keywords indicates a growing concentration on optimizing building performance and reducing carbon footprints through technological innovation.

Moreover, new clusters have emerged around the theme of indoor environmental quality, encompassing keywords such as indoor environment, air quality, health, and productivity. This thematic evolution suggests that research has broadened to include human well-being and occupant comfort as critical dimensions of sustainability, aligning with the global paradigm shift toward healthy and livable buildings. Another emerging cluster includes waste management, recycling, and life-cycle assessment, signifying a holistic concern for sustainability across the entire building lifecycle from material selection to post-occupancy waste reduction.

Overall, the comparison between the two periods indicates a transition from general sustainability discourse to specialized, interdisciplinary, and performance-based research orientations. While earlier studies established the conceptual foundation of green building in Asia, the recent decade has been characterized by empirical investigations that emphasize technological integration, certification mechanisms, and human-centered design. This progression reflects the growing maturity of the field and the region's

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commitment to aligning built environment practices with both global sustainability frameworks and localized environmental priorities.

RQ 3: How do collaboration and co-occurrence networks among authors, keywords and countries shape the field's intellectual and geographical development?

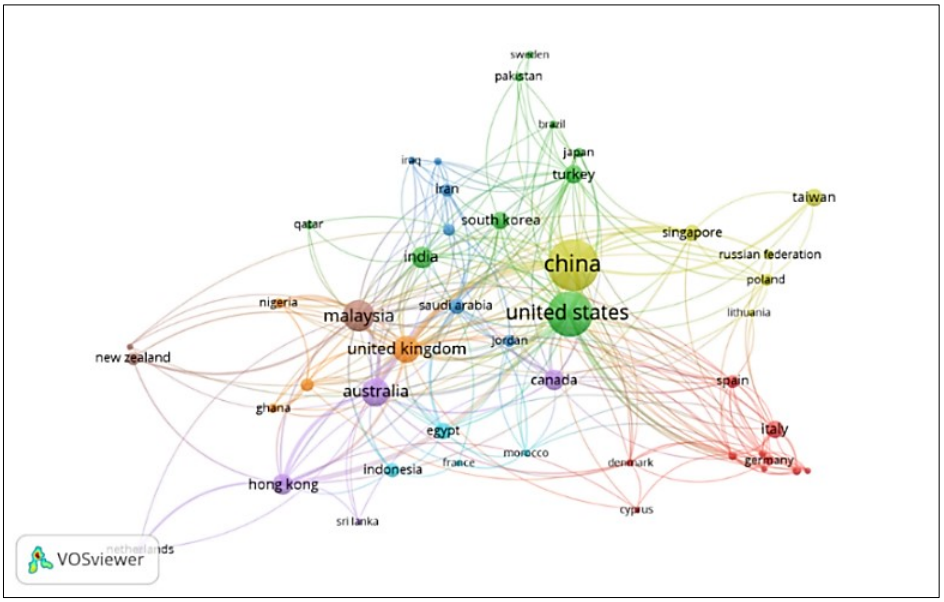


Figure 6: The Co-Authorship Collaboration Countries
Source: VOS viewer's Analysis (2024)

Figure 6 presents the VOSviewer map illustrating co-authorship collaborations among countries based on citations in green building research in Asia. The visualization reveals the formation of distinct regional clusters, notably the China–Singapore–Malaysia–South Korea–Taiwan nexus and the Japan–Australia–United States cluster. These clusters represent intellectual sub-communities, or epistemic networks, that generate specialized knowledge on sustainable construction, energy-efficient design, and life-cycle assessment (Appio et al., 2016; Liu et al., 2015).

The observed collaboration patterns empirically support the literature on green building evolution in Asia. Dominant clusters, particularly China–Singapore–Malaysia–South Korea–Taiwan, reflect concentrated research efforts in countries with advanced institutional frameworks, strong policy support, and robust funding mechanisms (Hatmoko et al., 2017; Shen & Faure, 2021; He et al., 2023). Circle size in the map indicates citation volume, with China leading, followed by Singapore, Malaysia, and the United States, while line thickness

represents the strength of collaborative ties, highlighting the strong partnership between China and Singapore.

Geographically, China and Singapore serve as central nodes, steering the intellectual development of the field and influencing both regional and global research directions. Environmentally, clusters align with thematic priorities such as energy efficiency, emission reduction, sustainable materials, and urban ecological sustainability (Chen & Luo, 2020; Leong et al., 2023; Zhao et al., 2023; Wardhana et al., 2023). Economically and technologically, the network reveals structural disparities: countries with lower research participation, such as Indonesia, Vietnam, and the Philippines, are positioned peripherally, reflecting constraints in technical expertise, policy enforcement, and financial resources (Hussain Ahram & Syed Zakaria, 2023; Maramis & Lumunon, 2022; Nguyen & Gray, 2016; Taherkhani, 2023).

Policy factors are evident in the network, with Singapore's dense collaborations reflecting proactive Green Mark initiatives and cross-sector engagement, while China's centrality corresponds to extensive regulatory support and sustained research funding (Hatmoko et al., 2017; Shen & Faure, 2021; He et al., 2023). Overall, the co-authorship network confirms that countries with strong institutional and policy frameworks dominate knowledge creation and dissemination in Asian green building research. The patterns highlight persistent regional disparities, underscoring the need for inclusive collaboration, capacity building, and policy harmonization to establish a more balanced and sustainable research ecosystem across Asia.

DISCUSSION AND CONCLUSION

Over the past two decades, this study concludes that green building research in Asia has demonstrated sustained growth, reflecting increasing scholarly engagement, rapid urbanization, and supportive institutional and policy frameworks. China, Singapore, and Malaysia have consistently emerged as central contributors, serving as epistemic hubs where academic research, technological innovation, and policy implementation intersect. These countries define the epistemological contours of green building discourse in the region, while smaller or less-resourced nations, such as Vietnam, Indonesia, and the Philippines, remain peripheral, highlighting persistent asymmetries in knowledge production and circulation.

Keyword co-occurrence analyses indicate a thematic shift from broad sustainability discussions toward specialized, application-oriented, and technology-driven research, including energy efficiency, digital design tools (BIM), life-cycle assessment, indoor environmental quality, and circular economy practices. This evolution reflects the maturation of the field, signaling a transition from conceptual policy frameworks to operationalized technological and human-centered practices, consistent with urban transition theory (Hodson &

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Marvin, 2010). Co-authorship and co-occurrence networks further demonstrate that countries with strong institutional and policy capacity function as central knowledge hubs, forming epistemic communities, such as China–Singapore–Malaysia–South Korea–Taiwan and Japan–Australia–USA, while peripheral nations experience limited integration into these networks.

The observed collaboration patterns and regional clustering also highlight processes of policy diffusion, exemplified by the circulation of green building rating systems, including Singapore's Green Mark, Malaysia's GBI, and China's Three-Star System. Adoption and influence are mediated by institutional strength, regulatory coherence, and developmental capacity, emphasizing that effective policy transfer requires structural alignment and targeted capacity-building support rather than mere emulation (Hatmoko et al., 2017; Shen & Faure, 2021). From a political ecology perspective, the concentration of research power mirrors broader resource and institutional asymmetries, underscoring the importance of multi-scalar governance approaches and epistemic justice to ensure that localized knowledge from emerging economies informs regional sustainability agendas (Swyngedouw & Heynen, 2003). These insights have several practical implications for urban planning and policy: integrating green buildings into broader urban infrastructure strategies; fostering co-production of knowledge between researchers, policymakers, and industry; providing targeted support for underrepresented Southeast Asian nations to democratize sustainability knowledge; and using bibliometric intelligence to monitor and align research output with regional sustainability priorities.

Overall, green building research in Asia serves as both a mirror and a driver of sustainable urban transitions. It reflects regional inequalities and institutional strengths while simultaneously catalyzing technological innovation, policy development, and evidence-informed planning. Strengthening collaboration, capacity, and equitable knowledge dissemination will be essential to advance inclusive, low-carbon, resource-efficient, and resilient urban development, ensuring that Asia's green building agenda aligns with both global sustainability frameworks and local environmental and socio-economic priorities.

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THE ENERGY EFFICIENCY ASPECTS OF SUSTAINABLE HOTEL AND TOURISM INDUSTRY IN JOHOR, MALAYSIA

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Abstract

Energy efficiency plays a vital role and significantly contributes to reduce energy consumption and environmental impact. This research addresses the need for sustainability in Malaysia's hotel and tourism sector, focusing on the adoption and application of green building elements, particularly in the context of energy efficiency. Amidst the challenges posed by the Covid-19, this research investigates the level of acceptance of green building elements among hoteliers in Johor as the case study. Besides, the research objective is to identify the obstacles faced by hotel operators in applying aspects of energy efficiency. The research methodology adopted quantitative approach through questionnaire among 104 of hoteliers in Johor. The findings emphasize the importance of energy efficiency in promoting sustainability, offering recommendations on the efficient use of technology, personnel training programs, and sustainable practices to improve operational efficiency and meet the growing demand for environmentally responsible tourism. This research provides valuable insights to position Johor hotels as leaders in the global movement towards a more sustainable and high resilience of hotel and tourism sector.

Keywords: Energy Efficiency, Energy Consumption, Hotel and Tourism Industry, Johor and Malaysia

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INTRODUCTION

Tourism plays a crucial role in Malaysia's economy, contributing significantly to the national Gross Domestic Product (GDP) and employment rates. In recent years, the hotel and tourism industry has grown rapidly, making Malaysia one of the most popular tourist destinations in Southeast Asia. Johor, strategically positioned as a gateway between Singapore and Malaysia, holds an essential role within the national hotel and tourism industry. This state boasts diverse attractions ranging from the Legoland Malaysia Resort to beautiful beaches and national parks. It remains a primary hub for domestic and international tourists seeking various experiences from leisure to business travel. Johor's strategic location, coupled with its well established infrastructure, has fostered significant investments in tourism, resulting in a booming hospitality sector.

The impact of the previous COVID-19 pandemic, however, brought unprecedented disruption to the tourism and hospitality sectors worldwide. Malaysia was no exception. The sudden closure of borders, travel restrictions, and a general decline in consumer confidence led to massive financial losses for hotels and resorts, airlines, tour operators, and related service providers. According to data from the Malaysian Association of Hotels, the industry experienced revenue losses exceeding RM7 billion in 2021, following an earlier loss of RM6.5 billion in 2020. Hotels and other accommodations had to reduce their workforce, suspend operations, or even close permanently due to the drastic decline in revenue. This crisis revealed the fragility of the industry and the urgent need to implement more resilient and sustainable practices to better cope with future uncertainties. Energy efficiency is one of the key strategies that can help the industry recover and revitalize. In addition to reduce the operational costs through lower usage of utility bills, energy efficient measures align with global sustainability standards and consumer expectations. Travelers are seeking eco friendly accommodations and are willing to pay a premium for services that adhere to green practices. The adoption of energy efficient strategies thus serves a dual purpose which it aligns with environmental and sustainability goals (Siti Nor Fazillah et al., 2024) and provides a pathway toward economic recovery (Cottam, 2022).

In Malaysia, the Green Building Index (GBI) has been instrumental in promoting the adoption of energy efficient and sustainable practices. This certification system measures the environmental performance of buildings, providing clear guidelines for architects, developers, and property managers to design and maintain structures that minimize their environmental impact. As the tourism and hospitality sector seeks to align with global standards, incorporating energy efficient elements such as LED lighting, optimized HVAC systems, and renewable energy sources like solar panels is imperative (Azhgaliyeva, 2022). However, implementing these practices has proven challenging. Financial

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constraints, especially in the wake of COVID-19, remain a primary concern for many hoteliers. Additionally, a lack of technical knowledge, resistance to change, and concerns about upfront costs have slowed the transition toward greener operations. Despite these challenges, studies show that long term savings from energy efficient measures often outweigh the initial investment, providing both economic and environmental benefits (Glass, 2020).

This research aims to explore the extent to which energy efficient practices are currently being adopted by Johor's hoteliers and to identify the primary barriers hindering their implementation. By understanding these challenges, this research further investigates the practical solutions that will enable the hospitality sector in Johor to recover, adapt, and eventually lead in sustainable tourism practices. A focus on energy efficiency will not only assist Johor in remaining a top tourist destination but also set a precedent for the rest of Malaysia's hospitality industry to follow.

LITERATURE REVIEW

The concept of green elements forms the cornerstone of sustainable practices in construction and infrastructure management. The term 'green building' encompasses a range of practices and design principles aimed at reducing the environmental impact of structures throughout their lifecycle. This means minimizing resource consumption during construction, operation, and demolition phases while ensuring occupant health and comfort. By integrating environmentally responsible and resource efficient practices into the built environment, green buildings are designed to address energy consumption, water usage, indoor air quality, and waste generation. In Malaysia, the Green Building Index (GBI) provides a comprehensive certification system to recognize and reward buildings that adhere to high standards of sustainability. The GBI is the country's primary rating tool for green buildings and focuses on six criteria: energy efficiency, water efficiency (WE), indoor environmental quality (EQ), sustainable site planning and management (SM), material and resources (MR), and innovation (IN).

Sustainable Tourism

Sustainable tourism is a holistic approach that seeks to balance the economic, environmental, and socio cultural aspects (Abakumov and Beresten, 2023) of tourism development. It minimizes negative environmental and socio cultural impacts while maximizing economic benefits for host communities and stakeholders. In this context, sustainable tourism encourages responsible and ethical travel behaviour, ensuring that tourism activities contribute positively to destinations and local populations. The United Nations Environment Programme (UNEP) identifies energy efficiency as a critical element of sustainable tourism.

As the tourism sector grows, so does its environmental footprint. The hospitality industry, which includes hotels, resorts, and other accommodations, accounts for a significant portion of global carbon emissions. This impact stems from energy intensive activities like heating, cooling, lighting, and transportation. As tourists increasingly prioritize eco friendly travel options, adopting sustainable practices, particularly energy efficiency, has become crucial for the hospitality sector.

Environmental Benefits

Sustainable tourism practices help minimize negative environmental impacts. By reducing energy consumption through measures like efficient lighting, HVAC systems, and renewable energy sources, the sector can significantly cut its carbon emissions (López-Bernabé et al., 2021). Furthermore, water conservation, waste management, and habitat preservation also contribute to sustainable development. Hotels that implement these measures help protect natural resources and biodiversity, which often serve as key attractions.

Socio Cultural Benefits

Sustainable tourism aims to preserve and celebrate local culture and heritage. This includes promoting authentic cultural experiences, respecting indigenous customs, and ensuring that tourism does not commodify or exploit local traditions. Sustainable practices can lead to inclusive and community focused tourism development, where local businesses and artisans directly benefit from increased visitor spending.

Economic Benefits

While sustainable tourism emphasizes environmental and cultural preservation, it also drives significant economic benefits. It supports local businesses, creates employment opportunities, and fosters a stable source of income for host communities. Sustainable practices like energy efficiency reduce operating costs for hoteliers, translating into higher profit margins over time. Additionally, tourists are often willing to pay a premium for environmentally friendly accommodations, creating a competitive advantage for those who prioritize sustainable operations.

The tourism industry's transition to sustainable practices requires cooperation between stakeholders, governments, and local communities. Governments can play a pivotal role by setting clear regulations, providing incentives for sustainable initiatives, and raising awareness about responsible tourism. Moreover, organizations like the Global Sustainable Tourism Council (GSTC) provide comprehensive standards that help guide destinations and businesses in implementing best practices. Ultimately, sustainable tourism is not a temporary trend but a critical strategy for ensuring the long term viability of the

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tourism sector. Energy efficient and environmentally conscious practices are not only desirable from an ethical standpoint but also offer practical benefits that enhance the competitiveness and resilience of businesses in the evolving tourism landscape.

Energy Efficiency in Hotel and Tourism Industry

Energy efficiency in hotel and tourism industry is crucial due to the industry's high energy consumption, which directly affects both the environment and operational costs. Hotels, often operating 24/7, rely on energy intensive systems for heating, cooling, lighting, and other guest services. This presents a significant opportunity to reduce energy use and operational costs while simultaneously improving profitability and environmental sustainability.

Efficient Lighting

Lighting systems in hotels can account for a substantial portion of total energy use. Replacing traditional incandescent bulbs with LED lighting can significantly reduce energy consumption. LEDs are more efficient, longer lasting, and can produce better illumination, thereby improving both energy savings and guest experience (Shamri et al., 2022).

HVAC Systems

Heating, ventilation, and air conditioning (HVAC) systems are the largest energy consumers in many hotels. Upgrading to energy efficient HVAC systems, such as those equipped with smart thermostats and motion sensors, can significantly optimize performance. These systems automatically adjust to guest presence or absence, ensuring minimal energy wastage. Regular maintenance and cleaning also improve efficiency (López-Bernabé et al., 2021).

Renewable Energy Sources

Incorporating renewable energy sources, such as solar panels or wind turbines, allows hotels to generate their own electricity. Solar water heating can significantly reduce energy used for hot water production. While the initial investment may be high, the long term savings and potential government incentives make renewable energy an attractive option (Said et al., 2017).

Water Management

Efforts to implement energy efficiency often intersect with water management strategies.

Operational Benefits

Energy efficient practices reduce utility costs, allowing hoteliers to reinvest savings in improving guest services, staff training, or marketing. Reduced consumption also aligns with global sustainability goals and can enhance a hotel's brand reputation, attracting environmentally conscious travelers willing to pay a premium for eco friendly services.

Overall, energy efficiency initiatives are fundamental for modern hospitality businesses. By adopting efficient lighting, HVAC systems, and renewable energy sources, hotels can significantly reduce their environmental footprint and operating costs while strengthening their competitive edge in a rapidly evolving industry (Said et al., 2017).

Barriers to Implement Energy Efficiency Practices

Financial Constraints

The most pervasive barrier cited was the high upfront cost of investing in energy efficient technologies. Hotels, especially smaller ones, often operate on thin margins and cannot justify these costs, particularly in the context of a post COVID-19 financial recovery. The pandemic has exacerbated existing financial challenges, leaving many hoteliers struggling to break even or repay loans incurred during the industry's downturn. Although investments in LED lighting, HVAC upgrades, and renewable energy sources like solar panels promise long-term savings, the initial capital required remains prohibitive for many establishments (López-Bernabé et al., 2021). As a result, hoteliers are hesitant to invest in technologies that, while environmentally beneficial, could strain their short-term finances.

Technical Knowledge

Another significant barrier identified is the lack of technical expertise regarding energy efficient technologies and their integration into existing systems. Many hoteliers are unfamiliar with the nuances of these advanced systems, such as smart thermostats, energy management software, or renewable energy integration. Without clear technical guidance or expertise, hoteliers face challenges in selecting appropriate solutions that align with their specific infrastructure and operational needs. This often leads to hesitation in implementing new technologies due to concerns about compatibility, maintenance requirements, or the fear of making costly mistakes. In some cases, existing systems are outdated, and hoteliers are unsure how to incorporate new energy efficient measures without substantial retrofitting.

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Resistance to Change

Resistance to change is another barrier that prevents some hoteliers from adopting energy efficient practices. This resistance is rooted in skepticism about the return on investment (ROI) of such measures. Many decision makers believe that the savings are either exaggerated or would take too long to materialize (Muszaffarsham et al., 2022). They are also wary of disrupting established operational practices or inconveniencing guests during the transition to new systems. For instance, shifting to energy efficient lighting or modifying HVAC systems may require temporary closures, further impacting revenues and customer satisfaction. Additionally, a lack of staff awareness or support for these changes can lead to internal resistance, slowing the adoption process.

Operational Challenges

The survey also highlighted operational challenges such as insufficient staff training and a lack of internal processes for monitoring and managing energy consumption. Some hotels lack dedicated personnel responsible for energy management, making it challenging to implement and sustain energy saving initiatives effectively. Furthermore, older hotels often have aging infrastructure, which complicates the integration of newer, energy efficient systems.

External Factors

External factors, such as inconsistent government incentives or unclear regulations, also affect the adoption of energy efficient practices. While some incentives exist, many hoteliers believe they are insufficient or too complex to apply for. Additionally, a lack of clear regulatory requirements or industry standards regarding energy efficiency means there is no immediate pressure to adopt such measures.

Addressing these barriers requires a multifaceted approach involving financial, technical, and educational support (Muszaffarsham et al., 2022). Overall, while the barriers are significant, the survey data indicates that overcoming them is possible with coordinated efforts from hoteliers, government agencies, and industry associations. Implementing a supportive framework will help reduce costs, provide technical guidance, and foster a culture of sustainability, ultimately encouraging wider adoption of energy efficient practices in Johor's hospitality industry.

Theoretical Framework of Energy Efficiency towards Sustainable Hotel and Tourism Industry

Throughout the literature of sustainability tourism including the environmental, socio cultural and economic benefits, it reflects to energy efficiency in hotel and

tourism industry. The following theoretical framework is developed to strengthen the structure of this research.

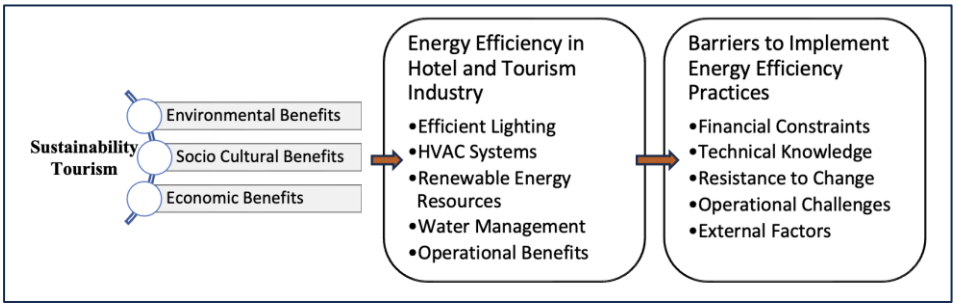


Figure 25 Theoretical Framework of Energy Efficiency towards Sustainable Hotel and Tourism Industry

Figure 1 presents the conceptual relationship between sustainable tourism, energy efficiency in the hotel and tourism industry, and the barriers to implementing energy efficient practices. Sustainable tourism is framed around three core dimensions environmental, socio-cultural, and economic benefits which collectively emphasize the need for tourism development that minimizes environmental degradation, promotes cultural integrity, and ensures long-term economic viability. Energy efficiency serves as a key component of sustainable tourism, focusing on operational improvements that reduce resource consumption while enhancing performance and profitability. Practices such as efficient lighting, HVAC system upgrades, renewable energy utilization, water management, and other operational innovations are essential strategies that contribute to environmental conservation and cost reduction.

The figure also highlights that despite these recognized benefits, several barriers hinder the widespread adoption of energy efficient measures in the tourism sector. Among the most significant obstacles are financial constraints, particularly the high upfront costs of new technologies, and a lack of technical knowledge that limits effective implementation. Additionally, resistance to change, operational challenges, and external factors such as inadequate policies or market conditions further impede progress. Overall, the framework underscores that achieving sustainability in tourism requires not only technological and operational advancements but also institutional support, financial incentives, and continuous capacity building to overcome these implementation barriers.

RESEARCH METHODOLOGY

This study adopts a quantitative, cross sectional survey design to investigate the acceptance and implementation of energy efficient practices among hoteliers in

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Johor, Malaysia. The research aims to assess current energy management practices and identify barriers that hinder efficiency improvements within the hospitality sector. The target population comprises hotel managers and decision makers from 3 star to 5 star hotels, as these establishments possess more complex infrastructure and higher energy demands, making energy efficiency crucial for both profitability and sustainability. A purposive sampling method is employed to ensure that only respondents with relevant expertise and authority participate, thereby enhancing the reliability and applicability of the findings. The list of participating hotels was compiled using publicly available tourism directories and industry association databases, ensuring a representative overview of Johor's hospitality industry.

Data Collection

The data is collected through a structured survey distributed to hotel managers and decision makers via email. The survey contained a combination of close ended and open ended questions to capture the idea and insights from the respondents. A total of 104 respondents are involved and this methodology ensures a balanced approach to understanding both the numerical and narrative aspects of the hoteliers' experiences with energy efficiency. The survey structure are as follows:

1. Demographic Information: This section includes questions about the participant's position, hotel size, and star rating to contextualize responses.
2. Current Practices: Participants were asked to indicate their hotel's current energy efficient practices, such as using LED lighting, upgrading HVAC systems, or installing renewable energy sources. They also ranked these practices based on their perceived effectiveness.
3. Barriers to Implementation: This section aims to identify the primary barriers to implementing energy efficient practices, including financial constraints, lack of technical expertise, and resistance to change. A Likert scale was used to measure the severity of each barrier.
4. Solutions and Recommendations: Open ended questions allowed respondents to suggest potential solutions for overcoming the barriers. Suggestions could include staff training programs, technological advancements, or governmental support.

DATA ANALYSIS

Ethical standards are maintained throughout the research process. Participation is voluntary, and respondents are assured of their anonymity and confidentiality. They are informed about the study's objectives and had the opportunity to withdraw at any point. The data is securely stored, and only aggregated findings

are reported. The collected data is analyzed using a combination of statistical and thematic analysis.

Statistical Analysis
The demographic data and responses to closed ended questions were summarized using descriptive statistics, including frequencies, percentages, and measures of central tendency. In analysing the objective 2 of the research, the barriers faced by hotel operators in implementing energy aspects are analysed using Relative Importance Index (RII). RII is used to rank the barriers in implementing energy efficiency practices. Through RII, further actions can be strategized as a solution to overcome the barriers.

Thematic Analysis
Open ended responses are analyzed through thematic coding to identify recurring themes related to barriers and potential solutions. These insights are used to supplement the quantitative findings and provide richer context. While this methodology provides valuable insights into energy efficiency practices among Johor hoteliers, several limitations are noted.

RESEARCH FINDINGS

Positive Acceptance of Energy Efficiency

Survey data reveal that there is 85% significant acceptance of energy efficient practices among hoteliers in Johor. Despite varying operational scales and strategies, most respondents recognize the environmental and economic benefits of incorporating energy efficient elements into their establishments. This research involves 3 stars hotel (27%), 4 stars hotel (49%) and 5 stars hotel (24%). The survey data reveal that there is significant acceptance of energy efficient practices among hoteliers in Johor.

Despite varying operational scales and strategies, most respondents recognize the environmental and economic benefits of incorporating energy efficient elements into their establishments. For instance, LED lighting and HVAC upgrades are reported to be among the most adopted measures, influenced by the potential for reduced energy consumption and maintenance costs (Cottam, 2022). Thus, the acceptance of energy efficiency are detailed according to the energy efficiency elements as in Table 1.

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Table 1: Research Finding 2: The implementation of energy efficiency elements in practices.

Ranking	Energy Efficiency Elements	Descriptive Analysis
1.	Energy efficiency hardware	52.4%
2.	Smart building management system	42.7%
3.	Energy audit and monitoring	37.5%
4.	Insulation and windows	34%
5.	Certification and green standards	30.1%
6.	Heat, Ventilation and Air Conditioning (HVAC) systems	30.1%
7.	Energy efficient lighting	29.1%
8.	Water heating efficiency	27.2%

Source: Fieldwork Researcher (2024)

Besides, upgrading HVAC (heating, ventilation, and air conditioning) systems emerged as another popular strategy. Many hotels have invested in more efficient HVAC units that automatically adjust based on room occupancy or external climate conditions. The use of smart thermostats and sensors has enabled many establishments to optimize their energy consumption without compromising guest comfort. Several hoteliers reported significant reductions in energy bills following these upgrades, validating the cost effectiveness of this approach. Renewable energy sources like solar panels into hotel operations has gained traction, particularly among larger 4 star and 5 star hotels. Solar panels have been used for electricity generation and heating water, reducing reliance on non renewable energy. Hoteliers highlighted that while the initial investment was considerable, the long term savings combined with potential government incentives made solar panels a financially and environmentally viable solution. Efforts to implement energy efficiency often intersect with water management strategies. Many respondents mentioned the installation of low-flow showerheads, faucets, and efficient irrigation systems as ways to reduce energy usage. By minimizing water consumption, the demand on energy intensive water heating systems is significantly lowered.

Some hoteliers also noted operational changes as a part of their energy efficiency efforts. This includes training staff to be mindful of energy consumption and implementing practices like switching off unused appliances, optimizing laundry schedules, and encouraging guests to reuse towels and linens. These operational changes contribute significantly to overall energy savings and sustainability goals (Cottam, 2022). Overall, hoteliers are not only aware of the long term financial benefits of energy efficient practices but also understand the importance of contributing to global environmental goals. The positive acceptance of these elements indicates a willingness to invest in energy efficiency, paving the way for future advancements and policy support. However, this acceptance is not without challenges, which include high initial costs,

technical knowledge gaps, and the need for more comprehensive staff training programs.

Barriers to Implement Energy Efficiency Practices

Despite the positive acceptance of energy efficient elements among Johor's hoteliers, the survey data reveals several significant barriers preventing broader adoption of these practices. These challenges, primarily financial constraints, technical knowledge gaps, and resistance to change, highlight the complexities of transitioning toward sustainable operations. Table 2 shows the research findings:

Table 2: Mean analysis for barriers to implement energy efficiency practices.

No.	Barriers to Implement Energy Efficiency Practices	Mean
1	Financial constraints	3.80
2	Technical Knowledge	3.74
3	Resistance to Change	3.77
4	OPERATIONAL CHALLENGES	3.69
5	External Factors	4.01

Source: Fieldwork Researcher (2024)

Based on the research findings as presented in Table 2, the most agreed barriers to implement energy efficiency practices among hoteliers is external factors with mean 4.01. While the least agreed barriers to implement energy efficiency practices is technical knowledge with mean 3.74. Financial constraints could be alleviated by offering targeted government grants or low interest loans to hotels investing in energy efficiency. Technical challenges could be mitigated through partnerships with technology providers, creating advisory programs, or organizing training workshops to educate hoteliers on integrating energy efficient systems. Building awareness and demonstrating tangible ROI examples can help reduce resistance to change, as can involving staff in decision making processes and developing comprehensive training programs. The following detailed analysis extract the external factors included as the barriers to implement energy efficiency practices.

Table 3: Research Finding 3: Relative Importance Index (RII) analysis for barriers to implement energy efficiency practices.

No.	Barriers to Implement Energy Efficiency Practices	RII
1	Lack of customer support	0.8777
2	Difficulty in managing and training the staff	0.8233
3	Lack of government regulation and enforcement	0.8019
4	Lack of resources (time, energy and equipment)	0.7864

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No.	Barriers to Implement Energy Efficiency Practices	RII
5	Hard to find green suppliers	0.7670
6	High implementation and maintenance costs	0.7592
7	Difficulties and balancing service quality with environmental performance	0.7534
8	Lack of information and knowledge about green buildings	0.7476
9	Lack of support from the owner and management	0.7379
10	Lack of infrastructure to support sustainable tourism	0.7359

Source: Fieldwork Researcher (2024)

Table 3 summarizes the key barriers to implementing energy efficiency practices in the hotel and tourism industry, ranked according to their Relative Importance Index (RII). The results indicate that the most critical barrier is the lack of customer support (RII = 0.8777), suggesting that guest attitudes and preferences significantly influence the adoption of sustainable practices. This is followed by difficulty in managing and training staff (RII = 0.8233) and lack of government regulation and enforcement (RII = 0.8019), both of which highlight organizational and policy-related challenges. Other notable barriers include limited resources, scarcity of green suppliers, and high implementation and maintenance costs, reflecting the operational and financial constraints faced by hoteliers. Lower-ranked but still significant barriers include balancing service quality with environmental performance, insufficient knowledge about green buildings, lack of management support, and inadequate infrastructure for sustainable tourism. Overall, the findings reveal that both internal organizational limitations and external systemic factors hinder the effective implementation of energy efficient practices in the sector.

DISCUSSION

The research findings align closely with global trends in sustainable tourism, emphasizing energy efficiency as a fundamental aspect of environmental conservation. In Johor, the hotel and tourism industry increasingly recognizes the importance of adopting sustainable measures that balance resource efficiency and profitability. The use of LED lighting, upgraded HVAC systems, and renewable energy technologies such as solar panels demonstrates the industry's commitment to reducing carbon emissions and improving operational sustainability. These practices mirror the recommendations of international bodies such as the World Tourism Organization (UNWTO) and the United Nations Environment Programme (UNEP), which identify energy efficiency as a key driver of sustainability in hospitality. Overall, the findings indicate a growing environmental and financial awareness among Johor's hoteliers, consistent with global movements toward greener tourism operations.

Despite this growing awareness, several barriers continue to impede the widespread adoption of energy efficient technologies. Chief among these are financial constraints, particularly the high initial investment costs associated with renewable energy systems and HVAC upgrades. The lingering economic effects of the COVID-19 pandemic have further limited hoteliers' financial capacity, leading to hesitation in pursuing costly sustainability initiatives. This challenge is compounded by managerial resistance to change, often resulting from a lack of technical expertise and skepticism about the long-term benefits of energy efficient investments. Similar patterns have been observed in Europe and North America, where uncertainty regarding return on investment (ROI) and potential operational disruptions have slowed adoption. Consequently, the tension between immediate financial recovery and long term sustainability remains a central obstacle for Johor's hotel sector.

The study also underscores the critical role of government intervention and strategic collaboration in promoting energy efficiency within the hospitality industry. Respondents emphasized the need for clearer policies, financial incentives, and technical support to facilitate the transition toward sustainable operations. International examples from countries such as Australia, the United Kingdom, and the United States highlight the effectiveness of government subsidies, low interest loans, and regulatory frameworks in advancing energy efficient practices. Similarly, Johor's hoteliers can benefit from greater institutional support, staff training, and partnerships with technology providers and industry associations to foster a culture of sustainability. By integrating technological innovation, financial assistance, and long-term strategic planning within a cohesive policy framework, Johor can position itself as a leader in sustainable hospitality balancing environmental stewardship with economic competitiveness in the global tourism landscape.

CONCLUSION

Energy efficiency has become a key driver in revitalizing Malaysia's hotel and tourism sector after the COVID-19 pandemic, offering both economic and environmental benefits. The adoption of sustainable practices such as LED lighting, upgraded HVAC systems, and renewable energy technologies like solar panels helps reduce operational costs, improve efficiency, and enhance brand reputation among environmentally conscious guests. However, the transition faces challenges that require a comprehensive, collaborative approach involving technological innovation, staff training, and strong government support through financial incentives and policy frameworks. Partnerships between hoteliers, technology providers, and industry associations are also essential to promote knowledge sharing and best practices. Overall, integrating advanced technologies, human capital development, and supportive governance can

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strengthen Johor's hospitality industry, positioning it as a leader in sustainable tourism and a model of resilience, profitability, and environmental stewardship within Malaysia.

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THE DEVELOPMENT OF HOUSING MISMATCH MODEL FOR AFFORDABLE HOUSING IN MALAYSIA USING FACTOR ANALYSIS

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Abstract

The Malaysian government's dedication to achieving sustainable development goals and ensuring adequate shelter for all Malaysians has placed significant emphasis on the development of affordable housing. However, housing demand among low- and middle-income earners earners are confronted with a multitude of factors that hinder this effort toward achieving this goal. These issues collectively represent a housing mismatch. This multidimensional and unstructured set of categories need to be narrowed down and organised into distinct components factors of housing demand. This study aims to identify key housing demand factors and dimensions to assess gaps faced by low- and middle-income earners. Exploratory Factor Analysis (EFA) was applied, using total variance, scree plot, pattern matrix, and reliability testing to determine latent constructs influencing housing demand. A survey was conducted among 200 potential buyers who were eligible to purchase affordable housing and had experience applying for such housing. The results revealed that remaining 31 attributes producing a four-factor solution comprising product factors, private financial requirements, government regulation, and location, all demonstrating acceptable reliability based on Cronbach's alpha values. The results have prompted discussions on the government's potential role in addressing housing demand needs and wants, emphasizing its crucial contribution to advancing sustainable development within Malaysia's affordable housing sector.

Keywords: Housing mismatch, Housing Demand, Factor Analysis

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INTRODUCTION

Around 75.1% of Malaysia's approximately 32 million residents reside in urban regions (DOSM, 2020), where the need for affordable housing is most pressing. Even though the supply of affordable housing is not taken lightly by the government, issues of overhang and unsold residential properties in Malaysia have brought attention to the complex interplay of economic, social, and market dynamics that influence the country's housing sector. According to Malaysia's National Property Information Centre (NAPIC), unsold and overhang properties are defined as those that are already completed or ready for occupancy but remain unsold for nine months. In Malaysia, the property market serves as an indicator of economic stability and growth. The alignment between housing demand and supply plays a pivotal role in ensuring balanced development. The most recent comprehensive report by NAPIC (2023) indicates that Malaysia recorded 25,816 housing units in overhang during the year, with a total value of RM17.68 billion. Surprisingly, compared to 2022, this represents a significant improvement in both the value and volume of overhang units. In 2022, overhang units in Malaysia were recorded at 27,746, with a total value of RM18.41 billion.

Despite proactive efforts by the government, exemplified by the recent announcement of the Madani Inclusive Housing Concept aimed at building more houses for low to middle-income groups, which targets the provision of 500,000 affordable housing units under the 12th Malaysia Plan (RMK12) and extended. A crucial aspect often overlooked is the issue of housing mismatch. According to Rahim and Kamaruddin (2023), private developers tend to build affordable housing outside urban areas, which is the opposite of what is required by housing demand. The mismatch between the type of housing provided under government programs and the specific needs and limitations of the intended demographic can lead to underutilized developments and an artificial oversupply (Saleh et al., 2024).

Although the supply of affordable housing is on the rise, a disconnect remains between what is built and what is needed by the local populace. While the government intends to increase homeownership and improve living conditions for its citizens through this specific program, there appears to be a research problem: the potential for an oversupply in the market, ironically planned for those it seeks to aid. It begs the question: should the focus shift towards a more nuanced perspective on housing demand mismatch issues? What are the sequential components for measuring housing mismatch? This demand-side perspective considers variations in regulatory requirements, spatial location, internal and external physical aspects of housing, and the financial constraints of potential buyers (Majid et al., 2023). Therefore, the research insists on addressing the proper components of barriers that influence housing demand for affordable housing. Spatial issues such as regulatory sensitivity, financing challenges, housing features, and the spatial location of development were taken into

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consideration, rather than simply increasing the supply of affordable units. Therefore, by prioritizing a thorough understanding of local requirements and refining policies to reflect this, the government and developers can work towards the development of affordable housing where supply is thoughtfully adjusted to housing demand, ultimately preventing the inefficiencies of oversupply and generating more meaningful social and economic outcomes for the populace.

LITERATURE REVIEW

Affordable Housing

Affordable housing was defined as housing deemed affordable to those with a median household income or below, as rated by the national government or a local government using a recognized housing affordability index. Saleh et al. (2025) expand affordable housing refer to housing intended for households or individuals with income below the median household income level. The enforcement of making affordable housing for the low and middle-income class may enhance the quality of life of this social group. It encompassed a range of housing types and programs, from emergency shelters to provisional housing, non-market rental, formal and informal rental, indigenous housing, and finally to affordable homeownership.

As per the Malaysian government's classification, affordable housing encompasses residences priced between RM42,000 and RM300,000, with factors like location, size, and property type considered. To tackle the affordable housing challenge in Malaysia, the government has introduced various initiatives, such as the People's Housing Programme (PPR), the Rumah Mampu Milik (RMM) scheme, Perumahan Rakyat 1 Malaysia (PR1MA), Perumahan Penjawat Awam 1Malaysia (PPA1M) scheme, and the MyHome scheme (Mohammad et al., 2018). Other than that, Residensi Wilayah, that previously known as RUMAWIP has offered prices between RM 250,000 to RM 300,000, with a focus on locations primarily in Kuala lumpur, Putrajaya and Labuan.

Variation of Housing Mismatch

The determinants for identifying the existence of housing mismatch in the affordable housing market include homeownership rates and living status. The Khazanah Research Institute (KRI) conducted measurements using homeownership rates to identify imbalances in housing demand. Meanwhile, Ozanne and Thibodeau (1983) initially assessed variations in housing demand by analyzing renter characteristics and rental property prices. Past scholars have long debated housing mismatch from the demand perspective, and the most common measurement framework derives from the Hedonic Pricing Model (HPM). Typically, in this model, housing attribute indicators are classified into locational traits (L), structural traits (S), and neighbourhood traits (N) (Thalmann, 2003). From the Malaysian point of view, Gapor et al. (2011) also adopted this theory in

their research on urban housing in Malaysia. They outlined six attributes to identify the mismatch faced by respondents regarding housing, namely home location, house price, home design, distance from work, housing compound, and ethnic composition. Subsequently, they conducted the study by comparing demographic profiles with the housing problems reported by respondents. However, the present researcher holds a contrasting opinion on the housing attributes documented by Gapor et al. (2011), particularly concerning the distinction between home location and distance from work, based on the definitions provided by the authors. Meanwhile, as specified in Faizul et al. (2019), the research addressed housing issues related to perception and satisfaction by considering indicators such as management, safety, facilities, and location. Although the study focused on ownership issues for low-cost housing, with greater emphasis on facilities and management, it still referred to housing mismatch as experienced by the occupants.

Following the research frameworks of Majid et al. (2023) and Saleh et al. (2024, 2025), this study adopts a variation of the housing mismatch concept from the housing demand perspective by examining patterns of homeownership in specific areas. Even when individuals meet the minimum income requirements set by the government to qualify for affordable housing, some still choose not to purchase such properties. Understanding this behaviour requires identifying the full range of housing mismatch indicators from the demand side, as regulated and influenced by both federal and state governments.

Initial Factors of Housing Mismatch for Housing Demand

Housing demand refers to the desire for housing combined with the capacity to pay for it. The level of housing demand is influenced by several factors, including income levels, trends and preferences, and external factors counting economics and regulation. When these factors contribute high contradiction between another, it can widen the gaps of housing mismatch for housing demand (Saleh et al., 2025).

Empirical research has further identified multiple determinants of housing mismatch. Majid et al. (2023) and Saleh et al. (2022) outlined eight key factors that significantly influence housing demand. These include internal and external product factors, private financial requirements, government regulations and requirements, spatial and geographic considerations (such as strategic, environmental, and established locations), and other associated costs. Understanding housing mismatch also requires examining demographic characteristics, such as living status and monthly income levels, which often determine affordability and access to suitable housing options.

Product factors impact stakeholders' decisions regarding the quality of the product. Individuals are highly discerning when it comes to recognizing housing products (Ariff et al., 2016). Meanwhile, housing demand may be

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hindered by developers' limited ability to provide social housing due to profit orientation (Zainul and Idris, 2017). Additionally, past research has shown that product-related factors affecting demand involve internal and external product factors which include tenure, house design, built-up areas, number of rooms, allocation of site plan and layout plan, restrictions of interest, allowable density, external view, topography, and open spaces (Zainon et al., 2017; Majid et al., 2023; Mukhtar et al., 2025; Saleh et al., 2024).

Location remains a crucial determinant of housing demand and satisfaction. Rosli et al. (2024) emphasize the need for balanced planning between housing, workplaces, and city centers, while accessibility to business districts, education, and leisure facilities also shapes housing preferences (McCluskey et al., 2000). Rising urban populations have intensified demand, often leading to mismatched housing supply. Literature highlights three key locational categories—strategic, environmental, and established—as essential for meeting demand and ensuring satisfaction (Abdullah, 1992, 2008; Saleh et al., 2024). The desirability of a location may also depend on both known and latent factors such as popularity and functional specialization.

Another prevalent attribute is the factors related to financial requirement and accessibility. Financial requirements set by banking institutions for end-finance may contribute to housing mismatch. Low-income households are chosen as they are more likely to be financially excluded (Mahdzan et al., 2023). Some financial institutions do not lend to low-income customers due to a lack of proper income documentation. Additionally, the difficulty in providing a 10% down payment and cash for other hidden charges such as legal fees is challenging for low- to middle-income individuals According to the Malaysian real estate industry survey (2022) by REHDA Malaysia, 86 per cent of reported finance issues for end financing.

Furthermore, eligibility and qualification criteria remain key attributes influencing buyers' decisions in affordable housing. Government regulations at both federal and state levels play a crucial role, as eligibility requirements—such as income level, age, and first-time ownership—significantly shape market participation and housing choices (Majid et al., 2012; Jewkes & Delgadillo, 2010; Gabriel et al., 2005; Stone, 2006). However, many applicants fall outside prescribed income brackets or fail to meet other criteria (Cagamas, 2013)

Similarly, procedural complexity in affordable housing applications—such as the multi-stage approval process under PR1MA (2023)—creates administrative burdens that affect buyers' access and satisfaction. Prior studies have highlighted how lengthy and rigid procedures exacerbate inequalities in housing demand and supply (Pugh, 1992; Agarwal & Prasad, 1998; Ādmīdiņš & Zvanītājs, 2011).

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Lastly, final attributes that could be counted as a part of factors contributed to housing mismatch was availability of types for affordable housing. In which most of the affordable housing has referred to strata building. The types of houses offered should possess a stable physical setting that aligns with social life and allows for shared cultural experiences. Figure 1 show the compilation and initial reviews from other past authors that could lead to the existence of a housing demand mismatch for affordable housing.

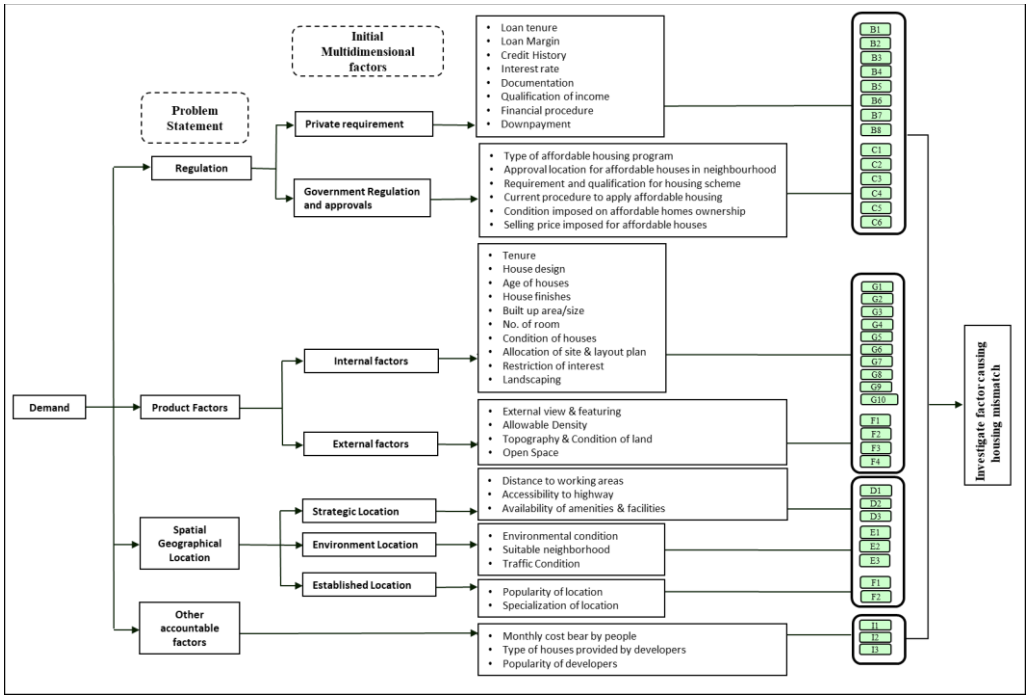


Figure 1: Conceptual Framework (*Author Self-Compilation*)

Fundamentally, based on Figure 1, compilation of eight factors with 39 attributes and segregation of dimension was performed based on Saleh et al. (2017;2024; 2025), and was supported by Masri et al. (2017) and Majid et al. (2023).

As highlighted in the literature review above, Hedonic Pricing Model (Thalmann, 2003) and multidimensional frameworks (Gapor et al., 2011) have identified diverse housing attributes, reflecting the complexity of housing demand. Thus, it is essential to capture all relevant factors to represent housing mismatch within the local context. Factor analysis was applied to consolidate these attributes into meaningful constructs, reducing data complexity and revealing key determinants of housing demand (Hair et al., 2019; Yong & Pearce, 2013; Williams et al., 2010).

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RESEARCH METHODOLOGY

A sample size of 200 respondents was used for the Exploratory Factor Analysis (EFA), aligning with the sample minimum adequacy threshold suggested by Yamane (1967) at a precision of ±10% with a 90% confidence level. For applications of EFA, the sample adequacy was further supported by satisfactory results on the Kaiser–Meyer–Olkin (KMO) and communalities values (Hair et al., 2010; MacCallum et al., 1999). The respondents were drawn from key urban regions known for high housing transaction volumes, namely Klang Valley, Johor, and Perak (NAPIC 2025), thereby representing Malaysia's major affordable housing markets and the diversity of the low- and middle-income groups. Thus, the sample size is sufficient to produce a reliable and valid factor structure for assessing housing demand factors in Malaysia.

The study employed stratified sampling to ensure balanced representation across demographic and regional groups. Respondents were assessed on eight main factors with 39 attributes related to housing demand, using a five-point Likert scale to capture key perceptions such as affordability, location, and facilities. Factor Analysis was then conducted to reduce the multidimensional data into interpretable components. Sampling adequacy and factor reliability were confirmed through KMO, communalities, eigenvalues, and scree plot analyses, with communalities above 0.3 considered acceptable in sample size (MacCallum et al., 1999; Pallant, 2013; Shrestha, 2021). Following this, any new components identified were grouped accordingly through pattern matrix. Subsequently, the interpretation of underlying factors and validation of internal consistency through reliability analysis aimed to validate the framework and strengthen the study's conceptual framework for the next research of Confirmatory Factor Analysis (CFA).

ANALYSIS AND DISCUSSION

Table 1 below illustrates the respondents' homeownership status alongside their net monthly income and living status. Surprisingly, 67.8% of respondents were tenants, and among them, 78.5% did not own any property, choosing to rent instead of purchasing a home. Out of this 78.5%, 37.3% were tenants predominantly earning a net monthly income between RM3,501 and RM4,000, followed by those earning between RM3,001 and RM3,500. Nevertheless, this raises the question of why individuals who meet the eligibility criteria have not yet acquired homes.

Table 1: Cross tabulation between demographic profiles

Monthly Salary (net) * Status of living * Homeownership Cross-tabulation					
			Status of living (%)		**Total**
Homeownership			Owner	Tenant	**(%)**
No houses	Monthly Salary	RM 1501-2000	0.0	6.7	6.7
		RM 2001-2500	0.0	4.3	4.3
		RM 2501-3000	0.0	6.7	6.7
		RM 3001-3500	0.0	23.3	23.3
		RM 3501-4000	0.0	37.3	37.3
		RM 4001-5000	0.0	13.4	13.4
78.5% - 157 people	Total		0.0	100.0	100.0
First House	Monthly Salary	RM 1501-2000	0.0	16.0	16.0
		RM 2001-2500	0.0	20.5	20.5
		RM 2501-3000	3.8	24.9	28.6
		RM 3001-3500	8.0	9.4	17.4
		RM 3501-4000	2.8	0.9	3.8
		RM 4001-5000	2.3	10.0	12.3
12.5% - 25 people	Total		18.3	81.7	100.0
Second Houses	Monthly Salary	1500 and below	0.0	2.3	2.3
		RM 1501-2000	0.0	0.8	0.8
		RM 2001-2500	0.8	3.1	3.8
		RM 2501-3000	11.5	16.0	27.5
		RM 3001-3500	13.7	7.6	21.4
		RM 3501-4000	7.6	3.8	11.5
		RM 4001-5000	3.8	0.0	3.8
		RM 5001-6000	7.6	0.0	7.6
6.5% - 13 people	Total		61.8	38.2	100.0
Extra Houses	Monthly Salary	RM 2001-2500	0.0	4.9	4.9
		RM 3001-3500	2.4	4.9	7.3
		RM 3501-4000	2.4	12.2	14.6
		RM 4001-5000	2.4	7.3	9.8
		RM 5001-6000	9.8	2.4	12.2
		RM 6001 -700	14.6	0.0	14.6
		RM 7001 and above	36.6	0.0	36.6
2.5% - 5 people	Total		68.3	31.7	100.0
	Total		32.2	**67.8**	100.0

Following this, respondents owning their first homes accounted for 12.5%, of which 81.7% were tenants, mainly earning RM2,501–RM3,000 (24.9%). Meanwhile, 6.5% owned second homes, with 38.2% being tenants earning similar income levels (16.0%). Overall, the findings indicate that most respondents were tenants, reflecting a housing mismatch in urban areas.

Data Screening Execution and Sampling Adequacy

The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.941, and Bartlett's test of sphericity was significant ($p < 0.001$), confirming the dataset's

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suitability for factor analysis. The correlation matrix of 39 items showed acceptable inter-item relationships, with most correlations exceeding 0.3. According to Pallant (2013), a KMO value above 0.5 is the minimum threshold, while values above 0.9 indicate excellent sampling adequacy. Hence, the KMO result and the determinant value of 4.365E-16 (> 0.00001) suggest that multicollinearity was not a concern and that the sample size of 200 respondents was statistically sufficient for conducting Exploratory Factor Analysis (EFA).

Factor Extraction: Scree Plot

Initial steps for Factor analysis identified seven components with eigenvalues exceeding 1, which collectively explained 41%, 10.4%, 5%, 3.8%, 3%, 2.4%, and 1.7% of the variance, respectively. These seven components accounted for a total of 67.3% of the variance and met the criterion for information.

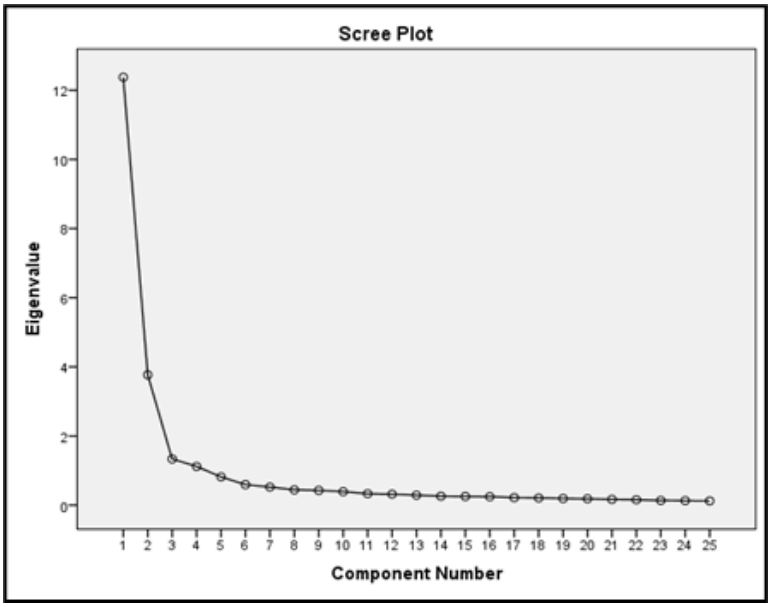


Figure 2: Scree Plot

Figure 2 highlights that components 1 and 2 captured a significant amount of variance. However, components 3 and 4 also showed potential, as there was a noticeable break after the fourth component. Based on this observation, the researchers opted to retain only four components.

Factor Before Extraction: Initial Pattern Matrix, Total Variance Explained, Communalities

The initial pattern matrix revealed a seven-factor solution with most items loading above .30, though some showed weak or cross-loadings. Items such as location popularity, allowable density, and built-up area were excluded due to low or inconsistent loadings. To improve construct validity and achieve a clearer factor structure, eight items with loadings below .40 (F2, G10, H3, H4, I1, I2, I3, G5) were removed. Factor rotation was then performed to refine and confirm the final underlying structure.

Factor Rotation: Final Pattern Matrix

Finally, after screening and extracting the initial pattern, the final factor analysis was conducted on the remaining 31 attributes, resulting in a four-factor solution outlined in the pattern matrix. These findings are summarized in Table 2 as the final results for the housing mismatch attributes.

Table 2: Final Pattern Matrix

Attributes	**Factors**			
	1	**2**	**3**	**4**
Product factors				
House Design (G2)	.860			
Allocation of Site Layout Plan (G8)	.815			
No. of Room (G6)	.815			
Restriction of Interest (G9)	.802			
External view & Featuring (H1)	.764			
Houses Finishes (G4)	.730			
Tenure (G1)	.689			
Topography & Condition of Land (H2)	.659			
Age of Houses (G3)	.563			
Condition of Houses (G7)	.421			
Private financial requirement and regulation				
Loan Margin (B2)		-.881		
Credit History (B3)		-.877		
Documentation Requirement (B5)		-.877		
Loan Tenure (B1)		-.848		
Qualification of Income (B6)		-.698		
Interest Rate (B4)		-.696		
Down Payment (B8)		-.552		
Financial Procedure (B7)		-.518		
Government approvals and regulation				
Requirement and qualification for affordable housing scheme (C3)			-.740	
Current procedure to apply for affordable houses (C4)			-.721	
Condition imposed on affordable homes ownership (C5)			-.671	
Approval location for affordable houses in the neighbourhood (C2)			-.669	

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Selling price imposed for affordable houses (C6)			-.667	
Type of affordable housing program by government (C1)			-.529	
Location factors				
Availability of amenities and facilities (D3)				.766
Accessibility to highways (D2)				.720
Distance to working areas (D1)				.632
Suitable Neighbourhood (E2)				.564
Traffic condition (E3)				.561
Popularity of location (F1)				.559
Environment condition (E1)				.550
Eigenvalue	15.118	3.899	1.756	1.364
% Total Value	47.753	11.590	4.682	3.382
Total Variance				67.407

According to Table 2, attributes G and H were grouped together, revealing a strong correlation among product factors (G and H) compared to other groups of items. Additionally, component two, comprising items of B2, B3, B5, B1, B6, B4, B8, and B7, was associated with groups of private financial requirements, implying that regulations could vary significantly. Next, items from component three were indicative under factors of government regulation. Furthermore, items from component four were most aptly defined as spatial geographical location variables. The analysis also indicates that product factors (G and H) serve as main variables influencing other aspects, such as private regulation, government regulation, and location factors. Notably, location factors were grouped in component number 4, displaying positive loadings ranging from .550 to .766.

Despite the positive questioning in the questionnaire's design, items from category B (Private Regulation) exhibited negative loadings within the range of .518 to .881, along with corresponding factor loadings from group C (Government Approval and Regulation) showing negative loadings ranging between .529 and .740. This suggests a negative perception among the public respondents towards these regulatory aspects. In summary, although regulatory factors show a negative influence on house buyer reactions, product factors and location appear to be less affected, presenting non-issues once regulations are implemented. This finding is consistent with Majid et al. (2023), who also highlighted that regulatory constraints tend to shape buyer sentiment more strongly than product or locational attributes in the affordable housing market. However, this contrasts with findings by previous authors such as Gibb and Whitehead (2007) and Mulliner et al. (2013), who argued that in mature housing markets, regulatory measures often enhance transparency and market confidence rather than deter potential buyers. Therefore, after all multidimensional attributes were finalized, the results indicate that approximately 67% of the total variance

is explained by 31 variables grouped into four key factors influencing housing demand for affordable housing ownership.

Reliability of new component

The reliability and consistency of the components were assessed by calculating Cronbach's Alpha to evaluate their accuracy. The significance value for Cronbach's Alpha should exceed 0.

Table 3: Reliability test

Summary Item Statistics				
Attributes	**Cronbach's Alpha**	**Cronbach's Alpha Based on Standardize Items**	**Mean**	**Number of Items**
Product factors	.932	.934	3.483	10
Private Financial Requirement	.939	.941	3.767	8
Government Regulation	.942	.943	3.722	6
Location	.923	.924	3.618	7
TOTAL				31

In Table 3, the components of product factors, private financial requirements, government regulation, and location have demonstrated Cronbach's Alpha values of 0.93, 0.94, 0.94, and 0.92 respectively, confirming the reliability of the survey instrument. This indicates a strong correlation between the variables and their respective components, demonstrating internal consistency. Additionally, the government regulation and private financial requirements components exhibit high levels of agreement, with both displaying mean scores above 3.0. Following this, location (Mean = 3.61) and product factors (Mean = 3.48) components demonstrate lower levels of agreement. This aligns with findings from previous studies, which demonstrated that housing demand is shaped by a combination of product, financial, regulatory, and locational dimensions (Saleh et al., 2024; 2025)

CONCLUSION

The findings have led to the conclusion that a more streamlined dataset with proper component grouping consists of 31 attributes with four key factors, effectively capturing maximum variability within the study's scope.

This study concludes that government regulatory and private financial requirement factors negatively influence housing demand, reflecting a mismatch between policy implementation and market realities. These findings reinforce the notion that housing mismatch in Malaysia arises not solely from supply constraints but from private institution and government policy inefficiencies with affordability barriers that hinder ownership among eligible groups (Saleh et al., 2025; Jamaludin et al., 2018). In contrast, financial accessibility and government regulation remain crucial determinants that shape buyers' preferences for

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affordable housing. Financial inclusion, particularly for low- and middle-income households, plays a vital role in bridging this gap through improved access and utilization of formal financial services (Mela, 2024).

Conversely, product and locational factors demonstrated a positive influence on housing demand. This suggests that while stringent government regulations may contribute to housing mismatches, aspects related to product quality and spatial accessibility remain less problematic in shaping buyers' preferences. These findings align with Jamaludin et al. (2018), who emphasized that improving housing policies and planning mechanisms is crucial for achieving sustainable urban living. Meanwhile, well-designed housing products and strategic locations can mitigate mismatch issues and enhance satisfaction among potential homeowners (Mukhtar et al., 2025). Hence, policymakers and financial regulators must focus on recalibrating affordable housing frameworks to reduce procedural barriers, streamline eligibility criteria, and ensure better alignment between public policy and market needs. Therefore, a more holistic and demand-responsive approach addressing regulatory, financial, product, and locational dimensions is essential to strengthen affordable housing delivery and reduce mismatches among low- and middle-income earners. However, before arriving at conclusive decisions regarding the impact on housing demand, further research is necessary to validate the conceptual framework. Therefore, additional research such as Confirmatory Factor Analysis (CFA) will be essential to ensure that final framework of sustainable development and the resilience of future development projects are considered within the context of affordable housing in Malaysia.

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