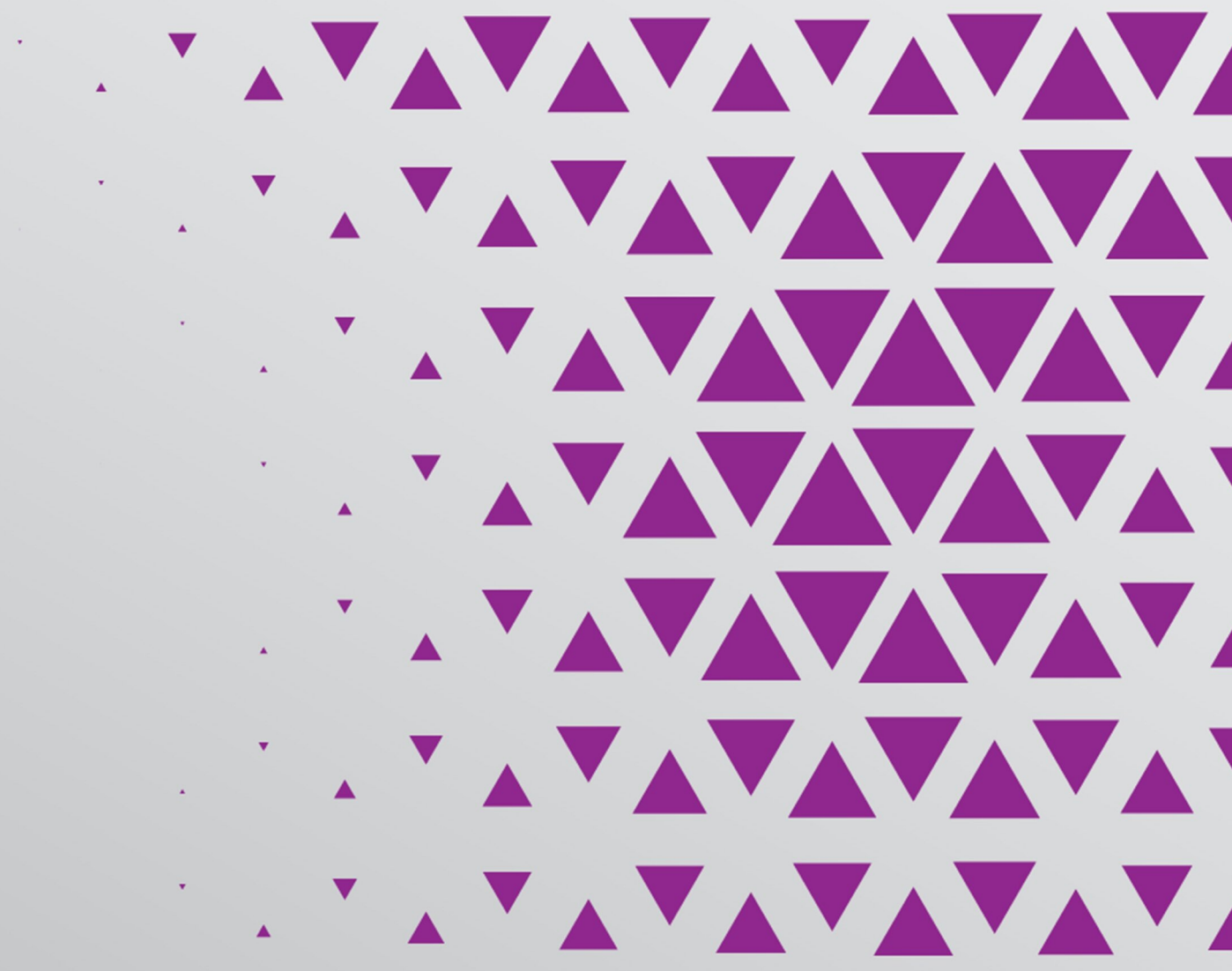


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ENHANCING THE CONTRACTUAL PROVISION FOR SUSPENSION OF WORK IN MALAYSIA: A COMPARATIVE ANALYSIS WITH EMPHASIS ON A CASE STUDY OF GOVERNMENT CONTRACT FORM PWD203A

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Abstract

The government possesses the authority to halt or delay work on-site, either partially or entirely, through the suspension of works as outlined in Clause 50 of the Public Work Department's PWD203A contract form. However, the global outbreak of the COVID-19 pandemic has revealed the lack of attention towards the proper implementation of work suspension. This study proposes for the improvement of contractual procedures and provisions on the suspension of works of government projects. It addresses the issues pertaining to work suspension in construction projects, examines the existing contract provision in the contract forms, and suggests enhancements of government project contracts. Through a comparative analysis and case study approach focusing on PWD203A, this study identifies the need for establishing clear suspension of work activities, and a fair time restriction mechanism as crucial enhancements to be incorporated into contractual provisions of work suspension. Subsequently, an expert validation process validates the proposed enhancement of the contractual provisions. These findings offer stakeholders valuable insights into practical solutions for more effective management of work suspension of government projects.

Keywords: government, contract, suspension, enhancement, provision

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INTRODUCTION

The issue of work suspension has been much discussed due to the outbreak of the COVID-19 pandemic that hit the whole world. During that time, in Malaysia, many construction projects that did not fall within the definition of “critical work” had to be suspended due to the government issuance of the Movement Control Order (MCO). The pandemic was an unforeseen event that brought about various forms of losses to all parties involved in a project. Various perspectives are thoroughly considered when preparing and asserting claims to mitigate losses in accordance with the available contract clauses. Therefore, it is imperative that the provisions and procedures for work suspension outlined in the contract are thorough and comprehensive to effectively address the given circumstances.

Typically, issues regarding the suspension of construction work are addressed either by granting an extension of time, and/or terminating the contractor's work. However, the efficacy of these measures in resolving such problems is questionable. For instance, with numerous construction projects halted during the MCO period, the implications on the contract itself become significant. Several authors have argued that contractors may seek for the extension of time (EOT) to complete the work, but may not be eligible to claim for the loss and expenses (L&E) incurred during this period (Lee, 2020; Naveen Sri Kanth, 2020). Generally, contractors have the right to seek for the compensation of any losses and expenses resulting from project delays if they are not attributable to the contractors' own fault. Nevertheless, the contractors' entitlement for the EOT and/or L&E claim is contingent upon the terms of the contract agreed upon by the parties. Standard forms of the contracts typically specify the rights, obligations, and remedies of each party concerning the suspension and termination of work under specific circumstances (Surahyo, 2018).

The Malaysian Public Works Department standard form of contract to be used where the bills of quantities form part of the contract or commonly known as PWD203A (Rev.1/2010) or in short PWD203A, include the provisions for the suspension of work. The suspension of work is a prerogative of the government, as stipulated in Clause 50 of the PWD203A form. This clause grants the authority to the government to instruct for the suspension of work, either entirely or partially. Nevertheless, the contract frequently lacks clarity regarding the specific circumstances that would trigger for the suspension of work under this clause. Hence, it is crucial to exercise caution when contemplating the suspension of contractors' on-site work. Francisco (2016) emphasized that inadequate administration increases the risk of incurring additional expenses and budgetary increase. This risk is attributed to factors such as the potential of damage to assets in projects of industrial nature, which often constitute a significant portion of the

overall cost, as well as the absence of adequate planning and control during the suspension, resulting in the loss of time and/or financial resources.

Considerations when deciding to suspend work of a project include extending insurance, maintaining bond performance, potential price increase of goods, addressing current client needs, assessing contractors' ability to resume work, ensuring safety of construction site assets, and estimating costs for taking care of the completed work on-site. It is important to note that in contracts allowing for work suspension, the contractors cannot unilaterally terminate the contract upon receiving suspension instructions; they must continue work upon project reinstatement (Wittbrodt & Eaton, 2009). Clause 50 of the PWD203A form empowers the Superintending Officer (S.O.) to instruct for work suspension at any time. Additionally, under Clause 43.1(c) of the same form, the S.O. can grant an Extension of Time (EOT) due to work suspension. However, failure to issue an EOT as per this clause may result in the contract being considered 'time at large'.

Thus, neglecting the proper procedure for suspending work in government projects can result in significant losses for the government in terms of energy, cost, and time. Any delay, suspension, or termination of the contractors' employment is likely to lead to additional expenses. Establishing a clear framework is thus essential to provide certainty regarding the rights and obligations of the contracting parties regarding work suspension instructions. For instance, the COVID-19 pandemic has ignited debates regarding its possibility to qualify as a force majeure event under the existing construction contract. The enforcement of the Movement Control Order (MCO) by the Malaysian government, which mandated for the immediate suspension of all construction activities to curb the spread of COVID-19 infection, has resulted in considerable uncertainty on this issue. Hence, this study proposes for the improvement of the contractual procedures and provisions concerning the suspension of work, particularly in government projects.

LESSONS LEARNT FROM COVID-19

During the COVID-19 outbreak, many construction projects have been instructed to temporarily suspend work due to different reasons, ranging from government orders, COVID-19 preventive measures, and economic issues. It is therefore essential to examine the contract provisions related to the term "pandemic", "epidemic", "endemic" and "force majeure" to ascertain the applicable clauses and subsequent actions due to the suspension of work.

Pandemic, epidemic, and endemic

To achieve this, reference is made to standard forms of contract, such as PWD203A, PAM2018 (a contract form published by the Malaysian Institute of

Architects (*Pertubuhan Akitek Malaysia*), CIDB2000 (a contract form published by the Construction Industry Development Board of Malaysia), and FIDIC Red Book 2017, which shall be subsequently referred to as FIDIC RB2017 in this paper (a contract form published by the International Federation of Consulting Engineers). According to the World Health Organization (2010), a pandemic refers to the global outbreak of a new epidemic, characterized by the widespread occurrence of an infectious disease affecting a significant portion of the population. The declaration of COVID-19 as a pandemic by the World Health Organization (WHO) was made when the disease exhibited critical severity and rapid spread across a wide geographical area. Unlike seasonal epidemics such as influenza, pandemics involve a broader scope and impact. Robinson (2020) defines a pandemic as a contagious disease or illness that manifests unexpectedly in large numbers, spreads rapidly beyond anticipated levels, and traverses multiple countries or continents, resulting in significant fatalities. Thus, a pandemic can be understood as an exceptionally severe and widespread form of epidemic that extends globally. Initially, none of the standard forms of contract included the provisions that specifically address the pandemic. Nevertheless, the pandemic has recently been incorporated as a force majeure event under Clause 58 of PWD203A. This underscores the recognition of the pandemic as a significant event necessitating for contract amendments to address its impact on the contract. The amendment to the contract conditions was made through KPKR Instruction Letter No. 26/2021 on 30 September 2021, which now stipulates the following:

58.0 EFFECT OF FORCE MAJEURE

58.1 Events of Force Majeure

Neither the Government nor the Contractor shall be in breach of its obligations under this Contract if it is unable to perform or fulfil any of its obligations under this Contract (or any part of them) as a result of the occurrence of an Event of Force Majeure. An event of “force majeure” shall mean an event, not within the control of the Party affected, which that party is unable to prevent, avoid or remove and shall mean –

- (a)....
- (f) pandemic or epidemic; or
- (g).....

On the other hand, an epidemic is defined as an infection that occurs more frequently and spreads more rapidly than usual, leading to an unexpected surge in the number of cases within a specific community or region where it is not typically prevalent (World Health Organization, 2019; Porta, 2014). Unlike a pandemic, an epidemic occurs when a disease rapidly spreads within a community or region, whereas a pandemic occurs when an epidemic spreads

across continents or globally, affecting a significantly larger population. Presently, the PWD203A, PAM2018, and FIDIC RB2017 forms include provisions for epidemics. For instance, Clause 77 of PWD203A includes provisions for epidemics and medical attendance, requiring the contractors to maintain site cleanliness and adhere to all regulations, orders, and requirements issued by the government or local medical or health authorities to address any outbreak of the epidemic. The requirements of this clause align with the implementation of the SOPs for construction projects in response to the COVID-19 outbreak.

In contrast, an endemic refers to the persistent occurrence of a disease over time, typically confined to a specific geographical area or population, with a predictable rate of spread (Porta, 2014; Cambridge Dictionary, 2021; Columbia University Mailman School of Public Health, 2021). It has been observed that epidemics can transition into the endemic state when a community develops immunity to the disease through either vaccination or prior infection (Medley & Vassall, 2017). Additionally, while an endemic does not necessarily indicate a mild outbreak, it does imply that the disease is less severe and results in fewer cases of infection. Many experts speculate that COVID-19 may never be completely eradicated, but could potentially transition from a "pandemic" to an "endemic" phase.

Presently, none of the established standard contract forms have included a specific provision in addressing endemics. However, the inclusion of such provision should be considered due to the potential risk of a resurgence in COVID-19 cases in the event of the emergence of new variants of the virus, despite current preventive measures such as vaccination, booster shots, and continued use of face masks. This consideration is particularly crucial if the execution of a project is hindered by a significant number of project workers testing positive for COVID-19. Numerous studies on the ramifications of sudden outbreaks have underscored the importance of taking requisite precautions during the planning phase of a construction project to mitigate against worst-case scenarios (Gamil & Alhagar, 2020; Muniandy & Mydin, 2022; Hatoum et al., 2021; Ogunnusi et al, 2021)

Force Majeure

The definition and extent of force majeure vary globally as different legal systems and jurisdictions employ diverse approaches in determining its occurrence (Augenblick & Rousseau, 2012). Generally, force majeure is understood as an unforeseen event or circumstance beyond the control of the contract parties. This was exemplified in the case of *Magenta Resources (S) Pte. Ltd. v China Resources (S) Pte. Ltd.* [1996] 3 SLR 62, where Rajendran J. remarked:

What is referred to as force majeure in our law (as opposed to French law from which that term originates) is no more than a convenient way of referring to contractual terms that the parties have agreed upon to deal with situations that might arise, over which the parties have little or no control, that might impede or obstruct performance of the contract. There can therefore be no general rule as to what constitutes a situation of force majeure. Whether such a (force majeure) situation arises, and, where it does arise, the rights and obligations that follow, would all depend on what the parties, in their contract, have provided for.

Under a force majeure clause, one or both parties in the contract may be excused from fulfilling their obligations. The specific entitlements under force majeure are determined by the contract provision for such events, as outlined in the agreed-upon standard form of contract, which may include requirements such as providing written notice of the event to the S.O. Typically, the contractor is granted an extension of time, but is not eligible to claim for the compensation of expenses incurred due to the force majeure event. A prerequisite for invoking a force majeure provision is that the contractor has taken all necessary measures to prevent and mitigate the effects of the force majeure situation.

The contractor must demonstrate that the performance of the contract has become physically or legally impossible due to the force majeure event (Moore, 2020). According to Clause 43.1(a) of the PWD203A form, the contractor is eligible to seek for an extension of time if the delay is attributable to a force majeure event. However, Clause 43.1(a) does not encompass the provision for claiming loss and expenses under Clause 44.1. The definition of a force majeure event in PWD203A was recently refined through KPKR Instruction Letter No. 26/2021 dated 30 September 2021, as specified in Clause 58.1, which explicitly includes the pandemics and MCO within its scope. Nevertheless, the contractors' ability to claim under various circumstances warrants consideration. In cases where there is written instruction from the S.O. to suspend or halt all work during the MCO, contractors may be entitled to claim for loss and expenses under Clauses 43.1(c) & (e), Clause 44.2, and Clause 50.

In the PAM2018 form, while Clause 23.8(a) does not explicitly define force majeure, Article 7(ad) offers the definition of a force majeure event as, "Any circumstances beyond the Contractor's control caused by terrorist acts, governmental/regulatory action, epidemics, and natural disasters". Therefore, the pandemic and MCO are likely to be classified as force majeure events under the PAM2018 contract. Just like in the PWD203A form, Clause 23.8(a) of the PAM2018 form allows the contractors to request for an extension of time, but it does not encompass claims for the loss of expenses. Additionally, the entitlement to claim for loss and expenses arises when there is a written instruction to suspend or stop work.

In the CIDB2000 form, force majeure is mentioned under Clause 24.1 that allows the contractors to claim for an extension of time due to a force majeure event. However, similar to the other standard form of contracts discussed earlier, contractors are not entitled to claim for the loss of expenses. Unlike PAM2018, CIDB2000 form does not define the scope of a force majeure event. While in FIDIC RB2017 form, a force majeure event could be addressed under Clause 18 as within the scope of exceptional events. Clause 18 defines exceptional events as an event or circumstance that:

- (i) is beyond a Party's control;
- (ii) the Party could not reasonably have provided against before entering into the Contract;
- (iii) having arisen, such Party could not reasonably have avoided or overcome; and
- (iv) is not substantially attributable to the other Party.

Hence, under the FIDIC RB2017 form, the pandemic and MCO may possibly fit as an exceptional event although they are not part of the examples listed under Clause 18.1. Nevertheless, the contracting parties must determine the obligations that are affected by this exceptional event and issue a notice according to Clause 18.2. The contractors may only be entitled to an EOT for any consequent delay and/or claims for payment once the contract requirements for the exceptional event are met as per Clause 18.4.

METHODOLOGY

Case study research serves as a suitable method for elucidating phenomena or situations within the construction field (Yin, 1994, 2009; Fellow & Liu, 2008). Case study offers descriptive insights into specific topics and often yield rich information compared to other research designs. Moreover, document review proves to be a valuable technique for data collection in case study research, involving the examination of existing documents such as policies, reports, and written materials (Creswell & Poth, 1997). Chynoweth (2008) has advocated for the use of qualitative research, specifically through a case study approach, to complement legal research, particularly in the realm of interdisciplinary methodology. For this study, a case study is conducted focusing on the PWD203A standard form of contracts, with data collection carried out through document review to analyze contract provisions related to the suspension of work, current procedures, and legal precedents concerning work suspension, in comparison to other contract forms.

Subsequently, expert validation is conducted through focus group discussion sessions via in-depth interviews with experts in the field of

government agency, particularly those with more than 10 years of experience in contract administration (Saeb, 2018; Mohd-Danuri, 2015). The objective of the focus group discussion is to look into the suggestions, namely the proposed enhancement to the PWD203A contract form. Purposive or convenience sampling was employed for the focus group discussion as it enables the researcher to choose suitable participants for the research in obtaining vital data that might otherwise be unavailable (Maxwell, 1996).

RESULTS AND DISCUSSION

A standard contract form proves beneficial when it not only delineates the parties' responsibilities, but also offers clarity and certainty for the avoidance of disputes (Che Haron & Arazmi, 2020; Yan, et al., 2023; Mohd-Danuri et al., 2015). To improve the contractual procedures and provisions related to the suspension of work, this study seeks to identify the key issues through a thorough examination of the relevant provisions. Table 1 summarises the findings and illustrates the two (2) suggestions that emerged from the findings which necessitate the enhancement to the PWD 203A form, i.e., to identify the potential events that could lead to the suspension of work and to incorporate them into the suspension of work provision, and to provide a fair time restriction procedure for the suspension of work. The findings are specifically related to the provision of the suspension of work, and the prolonged suspension that is commonly available in the contract. This involves anticipating various circumstances or events that could arise during a project that might necessitate for the suspension of work. The provision should clearly outline the type of events or circumstances that could trigger a suspension, the responsibilities of each party (e.g., client, contractor, subcontractors), notification procedures, and any other relevant details. The goal is to ensure that all parties involved in the project understand their rights and obligations in the event of a suspension, and to establish a framework for managing such situations efficiently and fairly. Providing a fair time restriction procedure for the suspension of work involves establishing guidelines on the duration that the work can be suspended before it must resume or be terminated.

Table 1: Summary of Contract Provisions Related to Suspension

Key Provisions related to Work Suspension	PWD203A Clause 50.0 Clause 43.0 Clause 44.0 Clause 50.0	PAM2018 Clause 21.4 Clause 23.8 Clause 24.3 Clause 30.7 Clause 30.8	CIDB2000 Clause 17.3 Clause 19.0 Clause 24.0 Clause 32.0	FIDIC RB2017 Clause 8.9 Clause 8.10 Clause 8.11 Clause 8.12 Clause 16.1
Suspension of work	S.O. can instruct suspension	- Architect can instruct suspension - Contractor suspends his obligations under Clauses 30.7 and 30.8 - Suspension by order of the appropriate authority	- Suspension due to failure to give site possession - S.O. can instruct suspension - A list of relevant events that led to the suspension of work is provided under Clause 19.2	- Engineer can instruct suspension (employer's suspension) - A list of events that may have led to suspension by contractor under Clause 16.1
Extension of time	Contractor may be entitled for EOT	Contractor may be entitled for EOT	Contractor may be entitled for EOT	Contractor may be entitled for EOT
Loss & expenses	Only costs that arise from protecting and securing the work under Clause 50.1 (b), as well as any repairs under Clause 50.1 (d).	Only costs that arise in complying with suspension instructions.	Only costs that arise in complying with suspension instructions subject to Clauses 19.2 32 and 42.	Only costs that arise from protecting and securing the work under Clause 8.9, as well as any repairs under Clause 8.12.
Prolonged suspension	If suspension exceeds 12 months, mutual termination may be considered.	The contractor may determine his own employment if the work is suspended for a continuous period exceeding the period of delay in the appendix. If none is stated in the appendix, the period of delay is for a continuous period of three (3) months.	If it exceeds the suspension period specified in the appendix (3 months if none is stated), the contractor may determine his own employment, or, treat such suspended part as an omission.	If suspension exceeds 84 days, the contractor may issue a notice requesting permission to resume work. If the engineer does not give a notice for work to be resumed, the contractor may either:

Key Provisions related to Work Suspension	PWD203A Clause 50.0 Clause 43.0 Clause 44.0 Clause 50.0	PAM2018 Clause 21.4 Clause 23.8 Clause 24.3 Clause 30.7 Clause 30.8	CIDB2000 Clause 17.3 Clause 19.0 Clause 24.0 Clause 32.0	FIDIC RB2017 Clause 8.9 Clause 8.10 Clause 8.11 Clause 8.12 Clause 16.1
				1) agree to a further suspension, or 2) give a second notice to omit the affected part of the work, or to terminate if the suspension involves the whole project.
Findings	- Relevant events to trigger suspension are not provided. - Allowable prolonged suspension is considered too long, i.e., 12 months	- Relevant events to trigger suspension are provided. - Allowable prolonged suspension is considered as fair, i.e., 3 months	- Relevant events to trigger suspension are provided. - Allowable prolonged suspension is considered as fair, i.e., 3 months	- Relevant events to trigger suspension are provided. - Allowable prolonged suspension is considered as fair, i.e., 84 days

Expert Validation

Table 2 shows the details of the focus group participants. Expert validation seeks to further improve the research findings and enhance the provisions related to the suspension of work in the PWD203A contract form by analyzing the views and comments from the experts.

Table 2: Details of Focus Group Participants

Code	Designation	Department	Years of work experience	Number of Projects Involved	Experience with Suspension of Work
E1	Senior Quantity Surveyor	Contract	17	>100 projects	Yes
E2	Senior Quantity Surveyor	Project Team	20	>100 projects	Yes

Code	Designation	Department	Years of work experience	Number of Projects Involved	Experience with Suspension of Work
E3	Senior Quantity Surveyor	Contract	14	>100 projects	Yes
E4	Senior Quantity Surveyor	Project Team	17	>100 projects	Yes
E5	Senior Quantity Surveyor	Contract	18	>100 projects	Yes
E6	Senior Quantity Surveyor	Contract	21	>100 projects	Yes

Events of Suspension of Work

All experts concurred that revising and updating the current provision for work suspension within the PWD203A form is imperative to address complications arising from past experiences and lessons learnt. While there was varied feedback from the experts regarding the inclusion of a list of events for work suspension in the contract, it was unanimously agreed that the availability of a criteria serves as a valuable guideline for the government to predefine the events. The consensus among the experts was that having such a list would facilitate the identification of suspension events by the S.O., therefore enabling prompt and appropriate action. The primary concerns associated with work suspension also extend beyond mere extensions of time (EOT) and loss and expense (L&E) to include the possibility of mutual termination.

Recommendations put forth by the experts intersect with various clauses within the PWD203A form. For instance, Expert E5 emphasized that despite the presence of a predefined list, the S.O. retains the authority to identify and declare “any other events” warranting the suspension of work. The expert recommended that events leading to the suspension of work include circumstances related to national interest and technical issues, as directed by the S.O. Additionally, Expert E2 proposed replacing the term “special event” with “any other events” to mitigate potential misinterpretations. Among the contentious issues discussed by the experts were events related to force majeure and the government’s failure to provide site possession. The consensus achieved is that these events should not fall under the suspension clause, as the contractor should only be entitled to an EOT in such cases.

Prolonged Suspension

In general, the experts have unanimously advocated for the improvement of the clause concerning prolonged suspension in PWD203A. They emphasized the

necessity of establishing a specific time frame for work suspension and providing additional guidance in the case of prolonged suspension, considering the current 12-month period stated under Clause 50.2 is excessively lengthy. Expert E4 highlighted the importance of proactive involvement from both the government and the contractors to address issues leading to the prolonged suspension promptly. The consensus among the experts is that prolonged suspension leads to significant losses for both parties, necessitating a provision to mitigate these losses by compelling the contractual parties to take necessary action at the soonest possible, i.e., after 90 days of suspension. Expert E6 recommended enhancing the time limit for submitting comprehensive details of the L&E claims in the case of prolonged suspension. These details, together with the supporting documentation, should be submitted within 3 months after the project resumes to prevent administrative complications arising from the change in personnel. Overall, the proposed enhancements to the contractual procedures and provisions are outlined in Figure 1.

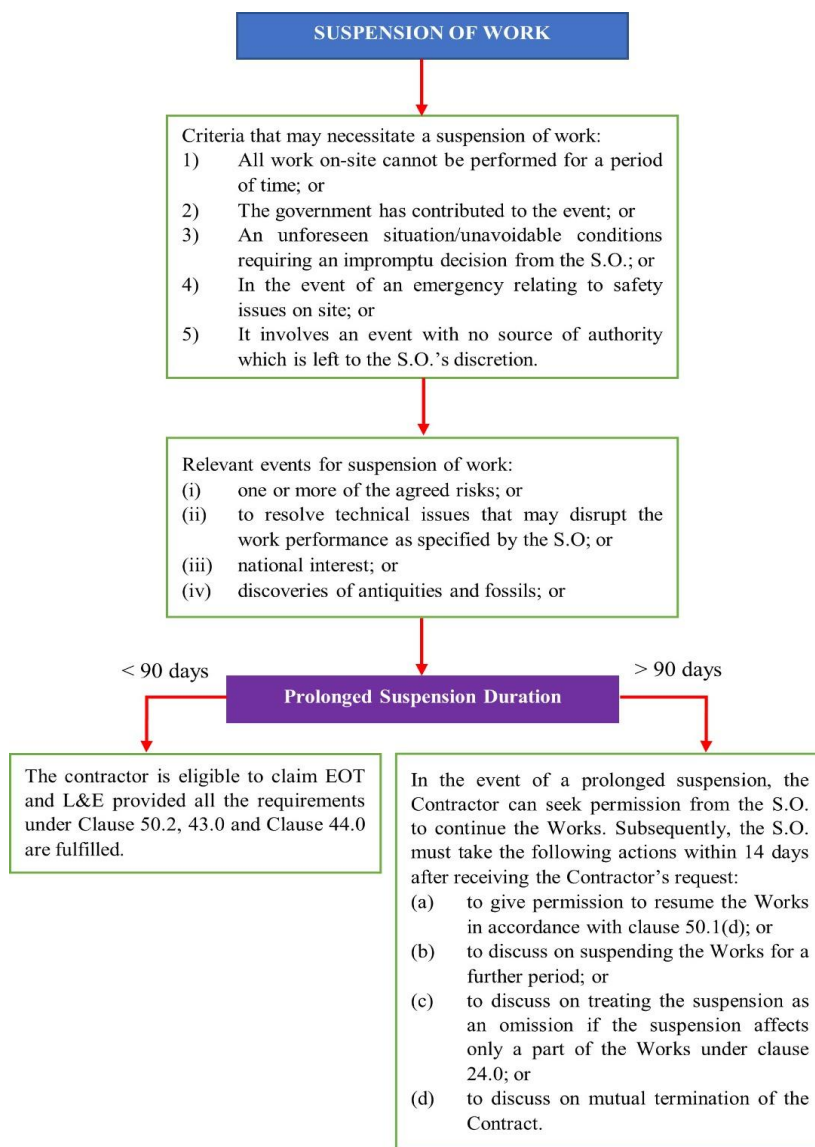


Figure 1: Proposed Enhancement of the Contractual Procedures and Provisions for the Suspension of Work

The findings from the expert validation consistently indicate that the process of identifying the potential events leading to the suspension of work and incorporating them into the suspension of work provision involves a thorough risk assessment process, clear documentation of procedures and responsibilities,

and the establishment of fair time restriction procedures to manage suspensions effectively within a project.

CONCLUSION

Enhancements to the contractual procedures and provisions governing work suspension in government projects were implemented to instil certainty regarding the instruction to suspend work. This issue stems from the absence of key elements of a robust construction contract, particularly in the standard form of contract provisions for work suspension. The main enhancements to the work suspension procedures in government projects focused on refining the process flow that determines whether work should be suspended, and outlining the actions for implementing prolonged work suspension. Despite various recommendations for further enhancements, the experts unanimously endorsed the proposed improvements as reliable and suitable for adoption in government projects. The proposed enhancement of the contractual provisions for work suspension established in this research also seeks to facilitate more effective work suspension management in government projects. Furthermore, future research on related provisions in the PWD203A form, specifically concerning EOT and L&E, holds potential benefits for government projects as a whole. Further research endeavours may encompass case studies examining the implementation of work suspension across various types of construction contract. Increased research efforts in this area have the potential to yield a more conclusive and comprehensive understanding of the challenges associated with work suspension in the construction industry.

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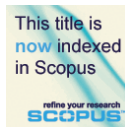
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DIGITIZING TREE INVENTORY USING GIS FOR EFFECTIVE LANDSCAPE MONITORING IN PUNCAK ISKANDAR, PERAK, MALAYSIA

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Abstract

Conventional inventories may struggle to comply with long-term planning and adaptability in changing landscape planning and management. Therefore, digitizing inventories through a GIS-integrated system enhances better platform foresight, offering efficiency, and accuracy with advanced technologies in assisting landscape planning and management. This information aids in making informed decisions about tree care, preservation, and landscape design, promoting sustainable management practices and enhancing the overall quality of the environment. This study's objective is to collect accurate and detailed spatial data on tree locations and attributes within a specified area for efficient analysis and visualization. This study adopted Geographic Information System (GIS) technology to record, analyse, and visualise the collected data, enabling spatial analysis, mapping, as well as informed decision-making. The aim of this study is to provide a robust and reliable tool for the community, professionals, planners, and arborists to effectively manage, monitor, and preserve trees towards sustainable land use practices, and a resilient environment.

Keywords: tree, inventory, GIS, landscape, management

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INTRODUCTION

A tree inventory plays a vital role in assessing the composition and distribution of trees within a landscape, identifying areas with high tree density or species diversity. This information aids in developing strategies for tree planting initiatives, ensuring balanced urban green spaces, and enhancing the overall aesthetic appeal and functionality of the environment. Conventional tree inventory requires more time, energy, and budget with insufficient access and accuracy. This situation has subsequently led to challenges in managing and maintaining tree functions, conditions, and their looks in the environment. Hence, initiating effective tree inventory through technology enables effective monitoring of tree health, and identifying trees in need of maintenance or treatment. By documenting maintenance activities and tracking their outcomes, the inventory facilitates proactive tree management, reducing the risk of tree-related hazards and promoting the longevity of trees (Hamzah et al, 2020).

In landscape management, a tree inventory provides valuable insights into the diversity, distribution, and overall health of trees within a specific landscape. By understanding the composition of tree species, landscape professionals can make informed decisions about tree planting initiatives, ensuring a balanced and resilient ecosystem. Additionally, a tree inventory enables the identification of areas with insufficient tree coverage, allowing targeted interventions to enhance the aesthetic appeal and functionality of the landscape. Conducting a tree inventory for landscape purposes is crucial for effective landscape management, urban planning, and ecological studies.

A tree inventory for landscape in a Geographic Information System (GIS) is considered as a comprehensive approach in collecting and managing data about trees within a specific landscape using spatial analysis and visualization tools. With advancements in geospatial technologies, GIS platforms are increasingly utilized to create GIS-based tree inventories. GIS also provide a powerful framework for spatial data analysis, visualization, and integration with other landscape datasets. By incorporating tree inventory data into GIS, it is possible to assess the spatial relationships between trees and other landscape features, identify patterns, and make data-driven decisions for urban planning and management. According to research by Abdullah S. et al (2021) and Liu et al. (2018), GIS-based tree inventories have become increasingly important in monitoring landscape management due to their ability to integrate spatial data and provide a comprehensive understanding of tree resources. By utilizing GIS technology, the inventory data can be effectively analysed, mapped, and visualised, as well as facilitating data-driven decision-making processes.

The integration of GIS technology into tree inventories allows for accurate mapping and spatial analysis of tree distribution patterns within the landscape (Chen et al., 2019). This spatial perspective provides valuable insights for identifying areas with high or low tree density, supporting targeted tree

planting initiatives, and enhancing the aesthetic appeal of the landscape. Furthermore, the use of GIS in tree inventories enable the assessment of the spatial relationships between trees and other landscape features. This information can assist urban planners in identifying suitable locations for parks, green spaces, and urban forests, contributing to the creation of sustainable and liveable environments (Chen et al., 2019).

In addition to landscape monitoring, GIS-based tree inventories play a crucial role in ecological studies. The integration of ecological data, such as biodiversity and habitat information, with tree inventory data in GIS, allows for comprehensive assessments of ecosystem dynamics and the impact of land management practices (Liu et al., 2018). The integration of GIS technology into tree inventories for landscape management provides a powerful framework for analysing and visualizing spatial data. This approach facilitates informed decision-making, supporting urban planning, enhancing the aesthetic appeal of the landscape, and promoting ecological sustainability. This study explores the application and perspectives of GIS in landscape architecture. It discusses how GIS technology can enhance various aspects of landscape architecture, including design, planning, and analysis.

Tree Inventory in GIS Applications

The integration of Tree Inventory in GIS applications presents a powerful approach for effective landscape management and planning, offering numerous benefits such as spatial analysis, visualization, and informed decision-making (Kant & Srinivasan, 2020). The Tree Inventory incorporation into GIS applications offer a wide range of practical uses, including urban planning, ecological analysis, and informed tree management, leading to sustainable landscape practices, and improved environmental quality (Shendy & Eldebaiky, 2021). The importance of GIS-based tree inventory lies in its ability to provide accurate and comprehensive data on tree species, locations, and attributes, enabling effective management, planning, and decision-making processes in the field of urban forestry and landscape management (Zhao et al., 2020; Almeida et al., 2020; Ciesiolka et al., 2021).

Tree inventory in GIS applications involve the integration of Geographic Information System (GIS) technology to collect, manage, analyse, and visualise data on tree species, locations, and attributes. This approach enables efficient inventory management, spatial analysis, informed decision-making, and enhanced landscape planning and management (Etemad & Pourghasemi, 2020). Moreover, for urban tree inventory, GIS allows for the systematic collection and management of tree-related data such as species, size, health condition, and location. This information can be georeferenced and stored in a spatial database, providing a comprehensive inventory of urban trees.

GIS-Based for Landscape Architecture

GIS-based applications in landscape architecture have gained significant importance in Malaysia, providing valuable tools for spatial planning, site analysis, as well as sustainable development, ultimately contributing to the enhancement of the country's urban and natural landscapes (Sulong, 2017).

The integration of GIS technology in landscape analysis and planning has revolutionized the field of landscape architecture, allowing for data-driven decision-making, efficient spatial analysis, and comprehensive visualization (Yang et al., 2021). It involved the integration of geospatial technologies with detailed information about tree species, locations, attributes, and maintenance history. This inventory serves as a valuable tool for landscape professionals, urban planners, and arborists to make informed decisions regarding tree management, urban greening initiatives, and ecological studies. By leveraging the power of GIS, the tree inventory enables efficient data analysis, mapping, and visualization, enhancing the understanding and effective utilization of tree resources for sustainable land use planning and environmental conservation.

MATERIAL AND METHOD

The research area encompasses a residential neighbourhood known as Puncak Iskandar, located in Perak. It spans an expansive 61.523-hectare area situated at latitude 4° 22' 26.4" N and longitude 100° 57' 30.24" E (Figure 1). Puncak Iskandar, situated in Seri Iskandar, is recognized as a highly desirable residential neighbourhood due to its contemporary layout, innovative housing designs, and diverse range of residential options to meet the needs of its residents. The methodology for this study is structured into three distinct stages: data acquisition, data processing, and the presentation of results.



Figure 1: Study Area Located at Puncak Iskandar, Seri Iskandar, Perak
Sources: Google Earth Pro, 2021

UAV-Based (Aerial Imaging) Data Acquisition for Puncak Iskandar Residential Areas

The data acquisition phase of this study involved an experimental approach using the UAV DJI Phantom 4 Pro to capture comprehensive imagery of Puncak Iskandar area. A total of 990 images were captured during this phase, ensuring a thorough coverage of the entire Puncak Iskandar region. The UAV was flown at an altitude of 150 meters, which provided an optimal perspective for data collection. This altitude has allowed for a stereo camera view, meaning that the images captured had enough overlap and perspective to enable 3D reconstruction or in-depth analysis in subsequent processing. To facilitate the flight planning process, the DJI Go software was utilized, enabling seamless wireless communication between the software and the UAV's remote controller. Additionally, before the flight mission, the percentage of images overlap was carefully set, ensuring optimal image capture at the designated 150-meter flying altitude.



Figure 2: The Aerial Images were obtained from the UAV Technology

Data Processing Workflow for Puncak Iskandar UAV Images

UAV (Unmanned Aerial Vehicle) image processing can be used to generate orthophotos, which are high-resolution, georeferenced images that have been orthorectified to remove distortions caused by terrain and camera perspective. Orthophotos are commonly used in various fields, including agriculture, land surveying, urban planning, and environmental monitoring. This study utilized orthophotos to conduct an inventory of tree landscaping in Puncak Iskandar. Orthophotos, which are high-resolution, georeferenced images, were employed to accurately identify and mapped the trees present in the area. The orthophotos were likely generated using UAV image processing techniques, as mentioned earlier. The process of generating an orthophoto from UAV imagery involved several steps. These images were then processed using specialized software to perform photogrammetric calculations.

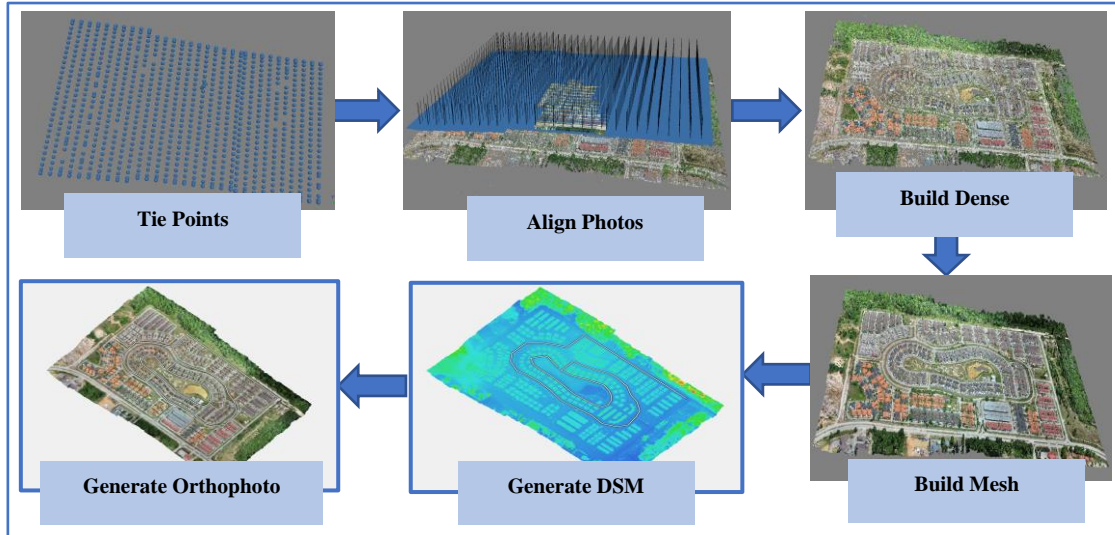


Figure 3: UAV Image Processing to Generate Orthophoto

By analysing the orthophotos, this study was able to identify and quantify the tree cover in Puncak Iskandar. This information could be valuable for various purposes, such as urban planning, environmental management, and landscape design. The inventory of tree landscaping can help assess the distribution, density, and health of trees in the area, allowing for informed decision-making regarding preservation, maintenance, or potential enhancements to the urban greenery.

Tree Locations for Inventory in Puncak Iskandar Using UAV Imagery

The study is aimed to mapped inventory tree locations in Puncak Iskandar by using UAV imagery. By utilizing UAV technology and imagery analysis techniques, this study was identified and mapped the locations of trees in the area. The UAV imagery provided a comprehensive and high-resolution view of the landscape, allowing for accurate delineation and georeferencing of tree locations. Figure 4 depicts the inventory of six tree species conducted within the Puncak Iskandar area.



Figure 4: Location of Tree Inventory at Puncak Iskandar, Perak

The images showcased the identified tree species, providing visual representation and information about the diversity of trees present in the study area. This inventory played a significant role in understanding the composition and distribution of tree species within Puncak Iskandar, contributing to effective landscape management and conservation efforts. The accurate geolocation of tree positions, obtained through the use of UAV imagery and geospatial analysis techniques, allowing a comprehensive understanding of the tree population in Puncak Iskandar. This information can be utilized for various purposes, including land management, conservation planning, and ecological assessments. The visualization presented in Figure 4 served as a valuable reference for further analysis and decision-making related to the inventory of tree locations in Puncak Iskandar.

RESULT AND DISCUSSION

The results highlighted several key applications of the tree inventory in GIS for landscape management and planning. Firstly, it enabled the identification of tree species diversity and distribution patterns, facilitating targeted conservation efforts and promoting biodiversity in the landscape. Additionally, the inventory supported effective tree management by providing information regarding tree

health, age, and maintenance requirements, allowing for proactive planning of pruning, removal, or replanting activities.

Figure 5 illustrated tree Mapping locations and analysing their spatial patterns at Puncak Iskandar provided valuable information about the distribution and arrangement of trees within the area. By using GIS and spatial analysis techniques, the tree inventory data can be visualised and analysed to identify clusters, patterns, and relationships among the trees. By mapping the tree locations, it became possible to understand the spatial extent and coverage of the tree population in Puncak Iskandar. This information helped in assessing the overall tree density and identifying areas with high or low concentrations of trees. Furthermore, spatial analysis techniques can be applied to assess the spatial relationships between trees and other features or attributes, such as infrastructure, land cover, or environmental variables. This analysis can reveal potential impacts or dependencies between trees and their surroundings, aiding in urban planning, risk assessment, or green infrastructure planning. Overall, mapping the tree locations and analysing their spatial patterns at Puncak Iskandar will provide valuable insights into the distribution, arrangement, and relationships of trees within the area. This spatial perspective support informed decision-making for tree management, conservation, and landscape planning initiatives.

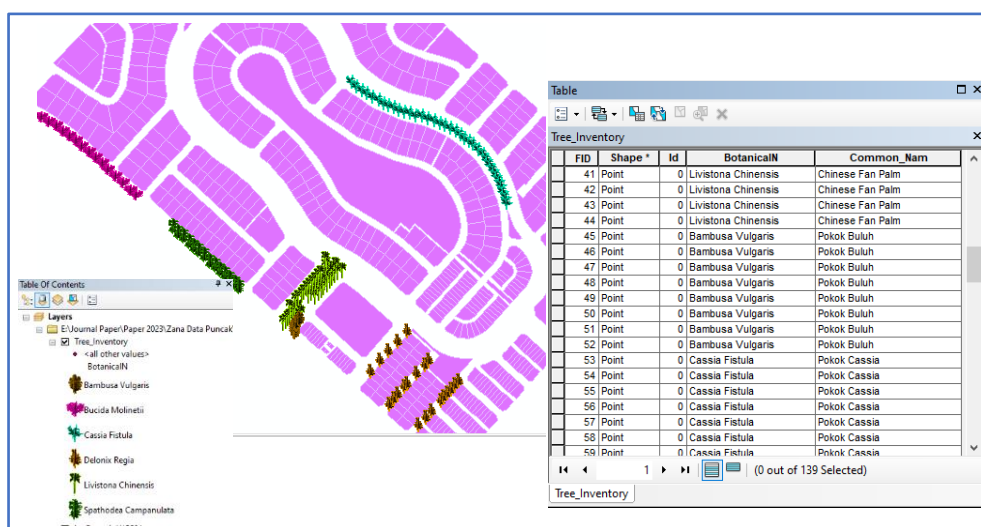


Figure 5: Mapping the Tree Locations and Analysing Tree Spatial Patterns

To ensure effective management and organization of inventory data during a tree inventory for landscaping purposes, it is crucial to establish a structured and well-organized database. This database served as a central repository for storing and managing the collected inventory data, enabling efficient data storage, retrieval, and analysis (Figures 6 and 7). A properly

structured database will facilitate easy access to information, promote data integrity, and support seamless management of the tree inventory throughout the landscaping project. By implementing a well-designed database, the inventory data can be efficiently stored, easily accessed, and effectively updated throughout the project. A structured database enabled seamless data retrieval, accurate data analysis, and informed decision-making, ensuring the success of the tree inventory and facilitating efficient management of the landscaping project.

Moreover, the integration of tree inventory data into GIS facilitated risk assessment and management. By analysing factors such as tree stability, proximity to infrastructure, and susceptibility to pests or diseases, areas with a higher risk of tree failure or hazards were identified. This information guided targeted tree maintenance activities, minimizing risks to public safety and infrastructure damage.

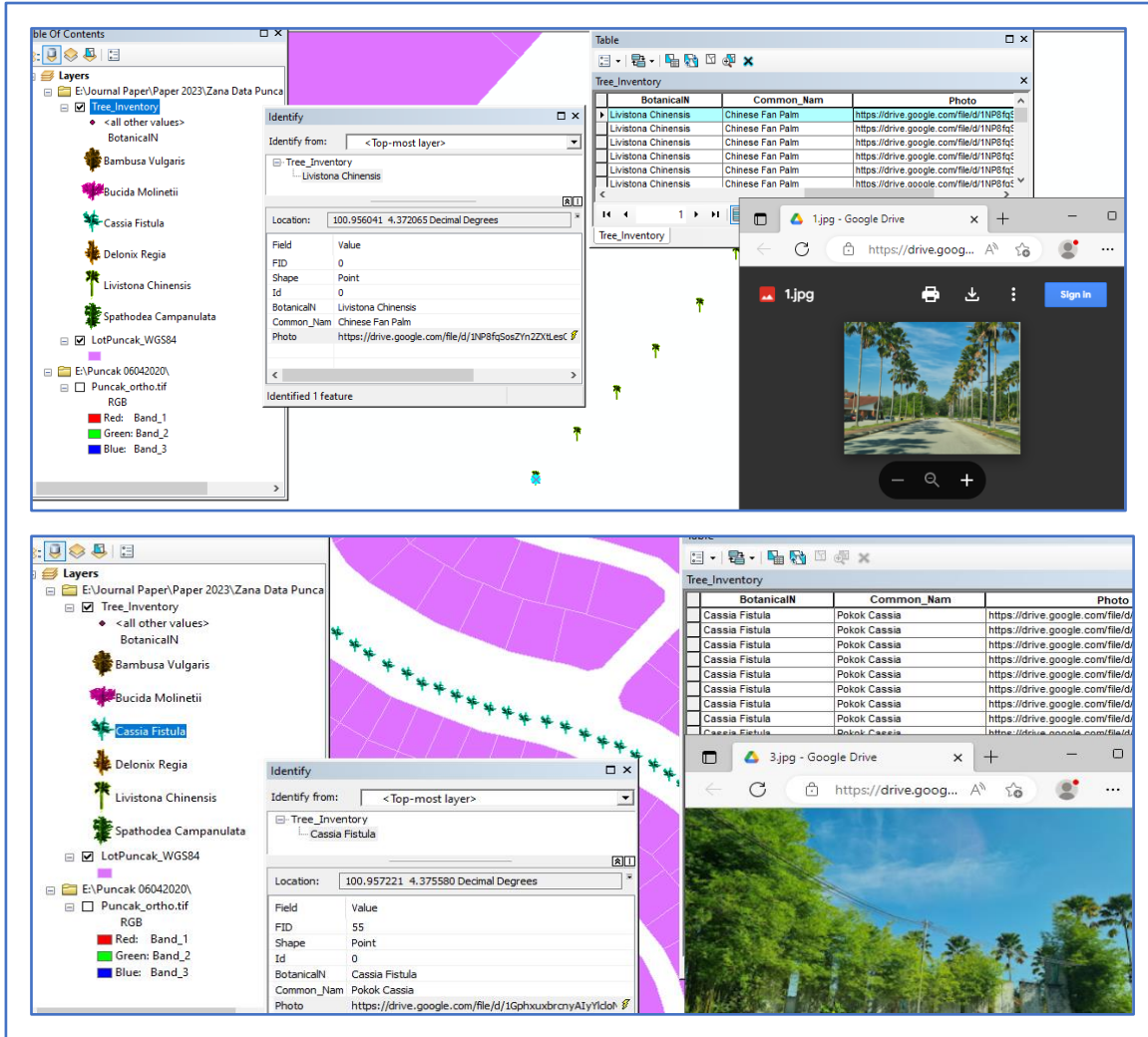


Figure 6: Databases for Tree Inventory Landscaping

Overall, the results emphasized the significance of integrating tree inventory data within GIS for effective landscape management and planning. The application of GIS provided a spatially informed approach in understanding and managing the tree population, promoting sustainable and resilient landscapes, and enhancing the overall quality of urban environments.

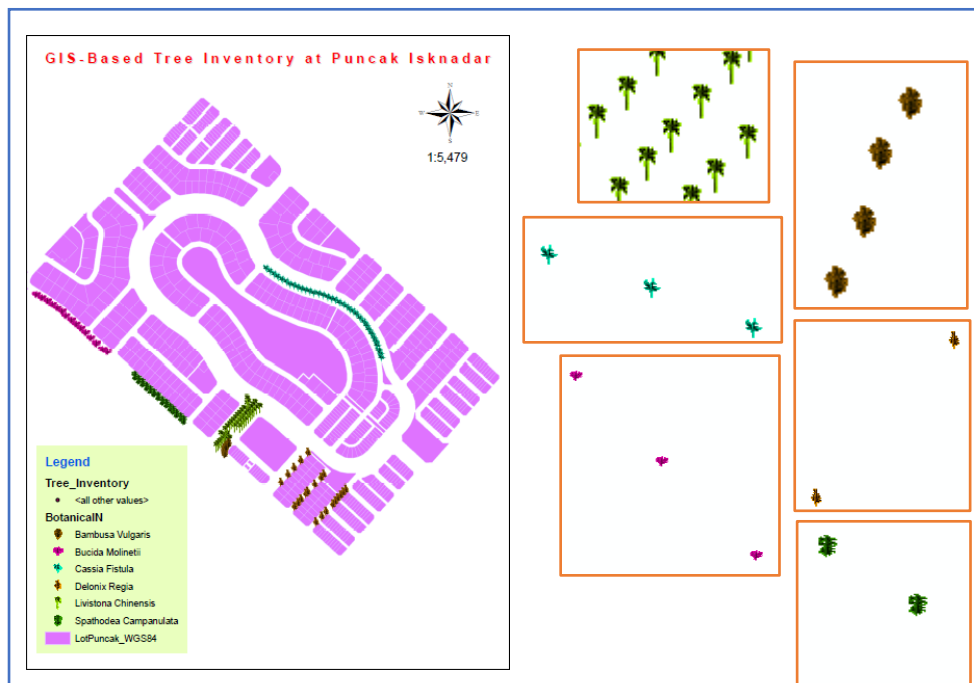


Figure 7: Databases for Tree Inventory Landscaping

CONCLUSION

The utilization of tree inventory within a GIS framework unlocks significant potential for effective landscape management and planning. By integrating tree data into GIS, a comprehensive database of plants and planting designs in community areas are digitized and analysed to better assist the identification of tree species diversity, distribution patterns, and spatial relationships, aiding in targeted conservation efforts and promoting biodiversity within the landscape. Moreover, GIS-based tree inventory supports efficient tree monitoring by providing essential information on tree health, age, and maintenance requirements, enabling proactive planning of maintenance activities. In conclusion, by unlocking the potential of tree inventory in GIS, a more resilient, green, and vibrant landscape planning towards a resilient community and environment is achievable.

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**DIGITALISATION IN BUILT HERITAGE TOWARDS PROMOTING A
CONSERVATION MANAGEMENT PLAN BY NATIONAL HERITAGE
ACT 2005: ASSESSING THE DIFFICULTIES IN MANAGING DATA
INFORMATION DURING CONSERVATION PROCESS OF
HERITAGE BUILDING IN MALAYSIA**

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Abstract

Malaysia possesses a rich tangible cultural heritage, and efforts are underway to preserve and manage it through heritage data documentation and information systems. Built heritage data documentation plays a vital role in heritage conservation and management by recording and documenting information about existing buildings and heritage sites. Despite the importance of these heritage data systems for site management, conservation, and public mediation, their implementation faces challenges. To better understand these challenges, this paper presents a qualitative study conducted through focus group interviews with stakeholders and conservation experts on 14th to 15th June 2023. The primary objective is to investigate deficiencies in current heritage data documentation practices, particularly in the context of large data management and knowledge sharing among heritage conservation stakeholders. As a result, the study proposes a theme on issues related to heritage data documentation and information.

Keywords: Heritage Data Documentation, Heritage Data Information, Conservation, Conservation Stakeholders, Digitalisation

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INTRODUCTION

Malaysia has a vast tangible cultural heritage. Various heritage data documentation and information systems have been created to safeguard and oversee this heritage. These systems are designed to manage and preserve cultural and built heritage data (Ahmed et al., 2015). Heritage information systems improve site management, conservation, dissemination of information, and public mediation. However greater effort is needed to fully comprehend such systems' potential benefits (Poux et al., 2020). In recent years, using technology has become crucial in the heritage conservation (Trillo et al., 2020), nevertheless, the current implementation of digital heritage information systems in Malaysia is encountering challenges. Despite previous digitization initiatives undertaken by certain institutions, the adoption and integration of these systems are still facing hurdles (Abd Manaf, 2007). According to (Salleh & Bushroa, 2022) Malaysian digital heritage data implementation is hindered by a lack of dissemination, transparency, data standards, and user-provider connectivity. Interoperability and standardisation complicate the processes. A Malaysian digitization case study found that while all institutions had begun digitisation, financing, infrastructure, and competence were persistent issues. Addressing these difficulties is essential for national digital heritage data information system integration (Mansor et al., 2005) (Abd Manaf & Ismail, 2010). This paper offers perspective of stakeholders, related parties and expertise in regards of current implementation and deficiencies of heritage data documentation or heritage information in Malaysia, by using qualitative approach, data collection are made based on perspective of (N=16) focus group interview sessions in order to achieve objective which is to investigate the deficiencies of current practice and implementation towards heritage information system in existing built heritage in Malaysia in addressing the issue of large data management in the context of social, historical, geographical, technological and knowledge sharing among heritage conservation stakeholders.

HERITAGE DATA DOCUMENTATION / HERITAGE DATA INFORMATION

Building heritage data documentation is essential for recording and documenting heritage sites and buildings. This practice is important to heritage conservation and management, providing accurate facts about heritage buildings and sites' conditions, materials, changes, physical characteristics, historical significance, and cultural value (Yang et al., 2020); (Mezzino et al., 2017); (WDBG Historic Preservation Subcommittee, 2023). Built heritage documentation involves digital tools and technology which enables complete documentation and strategic planning for heritage site conservation and preservation (Trillo et al., 2020).

Heritage data documentation stands as a fundamental by influencing and facilitating necessary procedures to conserve heritage buildings. Moreover, it also serves to improve their performance and future functions effectively by systematically collecting and archiving both tangible and intangible elements of heritage structures (Khalil et al., 2021). These records are instrumental in supporting historical research and contributing to a deeper understanding of the building's significance and historical context (Poux et al., 2020). Nowadays, digital tools have become increasingly important for capturing built heritage data. Some examples of digital tools used for capturing built heritage data include GIS (Geographic Information System) (Wan-Mohamad & Abdul-Ghani, 2011), laser scanning (Marzouk, 2020), photogrammetry (Santana Quintero et al., 2020), 3D Modelling (Laing, 2020), point cloud data (Poux et al., 2020), total station and voice and video recording (Santana Quintero et al., 2020). Previously, handwritten notes, sketches, measured drawings, and film photos are used to collect manual heritage data, it is laborious, time-consuming, and prone to human mistake, making organisation and management difficult as well as promoting seldom interaction between stakeholders (Letellier, 2007); (Ali et al., 2018). Digitization of heritage building data provides remote storage, sharing, and access without physical storage or transit. Moreover, it is easy to store, organise, and share, whenever physical access to heritage sites is limited, it simplifies data analysis and interaction with other digital systems, enabling easy updates and remote access (Wang et al., 2020); (Santana Quintero et al., 2020); (Münster et al., 2021)

NEEDS OF HERITAGE DATA DOCUMENTATION THROUGHOUT CONSERVATION PROCESS

Documentation is an essential part of the conservation process, as it allows conservation professionals to record current conditions, consider appropriate conservation options, plan, and monitor the implementation of the plan (Leblanc & Eppich, 2005); (Bahardin et al., 2022); (Baharuddin et al., 2020). According to Ahmad (2021), heritage documentation is important in conservation projects to preserve these historical sites for future generations. According to Laws of Malaysia National Heritage Act 645, (2005), Section 46 stipulate that a commissioner shall prepare a conservation management plan for the purpose of promoting the conservation activities of the heritage site as well as preparing a systematic data documentation to encourage multi-collaboration effort among heritage stakeholders. This legal provision emphasises the importance of working collaboratively and preparing strategically to effectively manage and protect cultural and historical heritage. In Malaysia, according to Harun (2011);

Baharuddin et al., (2022) conservation projects include vast quantities of documentation and heritage information at many phases as shown below:

- ***Pre-conservation*** – Pre-conservation is divided into three stage which includes preliminary stages, dilapidation survey and preparation of tender documents (Harun, 2023), history and background of the building or site that are intended for conservation such as historical background, construction details, architectural features, and the surrounding context of the building are documented (Zuraidi, 2014). In addition, dilapidation surveys are conducted to detect historical building defects and conditions, along with measured drawings and conservation proposals. Assessing the building's condition and preparing for conservation is essential. Preparation of a document tender includes creating a scope of conservation work, bills of quantities, and measurement drawings for the nominated contractor. Apart from that, preparation of HABS 1 report also included documenting the building's fabric in its original state at the commencement of the conservation contract (Jabatan Warisan Negara, 2017); (Harun, 2023).
- ***Execution of conservation*** – Both conservators and contractors are responsible for preparing several essential documents such as work method statements consisting of scope of work, methodology, and techniques to be employed for each specific task. This statement also includes risk assessment and safety measures including environmental considerations to mitigate any potential impacts on the environment during the conservation activities (Mezzino et al., 2017); (Ahmad, 2021). HABS II is a central role as the primary documentation and data during conservation, according to Jabatan Warisan Negara (2017), HABS II is compilation of the conservation works' progress throughout the project execution which takes the form of monthly reports, incorporating photography or other suitable recording means. It serves the purpose of gathering information from both HABS I and HABS II, facilitating an understanding of the working sequences, methods, and processes employed during the conservation project. Moreover, numerous additional reports are prepared to cater to the specific project needs such as scientific and technical details, as well as weekly and monthly progress reports. Additionally, site meeting reports are compiled to document discussions and decisions made during on-site meetings (Ahmad, 2021); (Harun S. N., 2020).
- ***Completion of conservation*** – The final stage in the conservation process involves the preparation of the final report. This comprehensive record

encompasses the entirety of the building conservation journey, serving as a vital point of reference for future endeavors in heritage preservation and maintenance. It is considered as a valuable record of National Heritage property and serves as an essential archival resource for future reference (Harun, 2011). Furthermore, video recordings represent another essential requirement in the conservation of built heritage. These recordings hold significant importance as they visually capture the entire conservation process undertaken on the heritage building. By showcasing the various stages and actions implemented, video recordings become invaluable data for documentation and analysis. Moreover, they highlight critical tasks that necessitate specialized skills and expertise in specific conservation works. Video recordings also emphasize jobs that involve handling parts and elements of the building that carry substantial heritage value (Jabatan Warisan Negara, 2017).

- ***Operation and maintenance of heritage building*** – Upon the completion of a conservation project, a maintenance plan is typically provided to the owner, maintenance team, or even the heritage building occupants to ensure the continuous monitoring, management, and proper maintenance of the building over time, employing appropriate methods and techniques. The maintenance plan serves as a guideline, outlining scheduled maintenance activities (Jabatan Warisan Negara, 2017), an accurate building assessment and condition evaluation through regular condition surveys, as well as reports from previous conservation projects, constitute additional essential documentation that should be maintained and handed over to the maintenance team or owners. This is crucial in formulating an effective maintenance strategy, ensuring that future maintenance efforts are well-informed and designed to prevent the recurrence of similar issues (Mohd-Isa et al., 2011). Scheduled maintenance data and reports need to involve routine or ongoing maintenance to protect and observe a heritage building. It addresses building operation issues and obstructions. Periodical and ongoing maintenance follow a well-planned schedule that prioritizes control measures to anticipate and resolve future issues. This systematic approach protects and preserves the building, reducing risks while encouraging sustainability (Rahman et al., n.d.), information and data integration system through maintenance manual and logbook also need to be regularly updated to ensure that all the maintenance works are delivered accordingly to the level of significance and vulnerability of the building's fabric (Mohd-Isa et al., 2011).

INVOLVEMENT OF MANAGING HERITAGE DATA DOCUMENTATION BY CONSERVATION EXPERTISE AND STAKEHOLDERS: A FOCUS GROUP

A successful heritage building conservation project is the outcome of a collaborative endeavour that brings together experts from diverse disciplines, united in their commitment to preserving the heritage's historical and cultural significance for posterity. Key stakeholders in heritage conservation, including conservator consultants, conservator contractors, contractors, architects, engineers, and government agencies, collectively drive the project's success. Their collective expertise, knowledge, and dedication contribute to preserving and restoring the building's heritage value, ensuring its enduring legacy for future generations to cherish and appreciate (Jabatan Warisan Negara, 2017). The inclusion of maintenance activities after the completion of the conservation project is a vital continuation in preservation practice, aiming to minimize inconvenience and risks in the building's operation (Rahman et al., n.d.), this continuation entails the involvement of multiple experts and stakeholders, including owners, maintenance teams, and building occupants. The conservation project typically follows four distinct stages: pre-conservation, execution, completion, and operation and maintenance. Each of these stages necessitates collaborative efforts and contributions from diverse expertise and stakeholders (Gulotta & Toniolo, 2019); (WDBG Historic Preservation Subcommittee, 2023); (Jabatan Warisan Negara, 2017). Based on the above literature study, it highlights that the identified expertise and stakeholders are well-suited participants for a focus group interview, as they possess valuable insights and perspectives regarding the implementation of the conservation process in Malaysia. Their involvement, extensive experience, and in-depth knowledge in documenting data and information throughout the conservation process make them ideal contributors to the discussion.

RESEARCH METHODOLOGY

The main objective of this research is to investigate the deficiencies of current practice and implementation towards Heritage Information System in existing built heritage in Malaysia in addressing the issues of large data management. An interview structure was developed by selecting conservation industry experts and stakeholders for this interview session who have experience and engagement in managing heritage data in conservation. The interview sessions were divided into of the four groups, each group has four participants, totalling 16. All groups are categorised by conservation stages: ***pre-conservation, commencement, completion, and operation and maintenance***. The focus group interviews were held in a circle and voice recorded. Each session lasted 45 minutes to an hour and

took two days to complete from 14th to 15th June, 2023. There are two moderators involved in this interview session.

RESULT AND DISCUSSION

Based on the interview sessions conducted, four main transcript analyses were carried out. These analyses included demographic information of the focus group respondents, understanding of definition of heritage documentation and heritage information, experience in heritage documentation data gathering for conservation process and lastly is issues in managing heritage data documentation and data information. The thematic analysis of the issues in managing heritage data documentation is presented in Table 3. This analysis provides valuable insights into the challenges and problems faced in the conservation industry concerning the recording and collection of data throughout the entire conservation process, up to the maintenance phase of heritage buildings.

Demographic Information of Respondents

Table 1: Demographic Information

Group	Position	Years of experience in Heritage Conservation Project	Numbers of involvement in Heritage Conservation Project
Group 1	Consultant (2) Conservator (1) Government Agency (1)	5 to 10 (2) 20 to 25 (2)	< 10 (2) > 10 (2)
Group 2	Contractor (3) Conservator (1)	10 to 15 (3) 20 to 25 (1)	< 10 (3) > 10 (1)
Group 3	Contractor (1) Government Agency (3)	5 to 10 (2) 15 to 20 (2)	< 10 (2) > 10 (2)
Group 4	Government Agency (4)	10 to 15 (4)	< 10 (4)

Source: Author (2024)

According to Table 1, the participants were conservators (n=2), consultants (n=2), contractors (n=4), and government agency (n=8). Most participants (7 in total) have 10–15 years of heritage conservation experience. Only 3 participants had more than 20 years of conservation experience, whereas 4 had 5 to 10 years' experience. 11 individuals had worked on fewer than 10

heritage conservation projects in their careers, while 5 had worked on more than 10.

Definition of Heritage Documentation and Heritage Information

According to the four micro focus group interviews, most respondents define heritage documents and information similarly. According to Group 1, heritage information and documentation means *"recording and documenting all data and information related to heritage buildings for use in conservation projects."* Group 2 says it includes *"any knowledge or information that is recorded and documented for conservation purposes."* Group 3 describes heritage information and documentation as *"information or data collected from the preliminary stages to the completion of conservation, including audio, oral history, photographs, drawings, and reports spanning the entire project."* According to Group 4, this is the *"collection of information gathered from oral interview, written records, audio, and pictures... it is systematically collected and retained during the conservation process and archived upon project completion."* All four focus groups agree on the definition of heritage documentation and information.

Experience in Heritage Documentation Data Gathering for Conservation Process

Each of the group are given question regarding experience in the process of data gathering / collection of heritage documentation / heritage information based on four different stages of conservation. All the answers are simplified into short information using bullet point in table 2 below.

Table 2: Experience in Heritage Documentation Data Gathering

Group	Answer
Group 1	<ul style="list-style-type: none"> • Preliminary study – assessing heritage building’s historical significance <ul style="list-style-type: none"> • Historical research – identify and collect information on features, characteristics, materials, architectural elements (documents, archives, oral histories, photograph, videos) • Dilapidation survey – record current condition, defects and preparing measured drawing, 3D drawing <ul style="list-style-type: none"> • Preparation of conservation proposal – scope of work and BQ
Group 2	<ul style="list-style-type: none"> • Preparation HABS 1, HABS 2 and HABS 3 • Preparation work method statement – clarify method of work for each element, provide photograph and information <ul style="list-style-type: none"> • CPM planning report • Report – weekly and monthly report including site meeting report <ul style="list-style-type: none"> • Photograph and video record all the work executed

Group	Answer
Group 3	<ul style="list-style-type: none"> • Handover – Final report including HABS 1,2 and 3 • Handover – as built drawing • Handover – video documentary in a CD or thumb drive • Preparation documentation for CCC/CPC
Group 4	<ul style="list-style-type: none"> • Maintenance operation and manual • Previous conservation report – for reference purpose • Preparation of schedule maintenance – daily, weekly, monthly, yearly

Source: Author (2024)

Issues in Managing Heritage Data Documentation/Information

All the respondents in four mini focus groups were answering questions regarding issues that are faced in managing heritage documentation/heritage information for conservation. All respondents agreed that there are issues in managing heritage data documentation and information. All the answer were recorded and analysed thematically as shown on table 3 below.

Table 3: Issues in Managing Heritage Data Documentation

Group	Answer	Themes (Based on Answer)
Group 1	<p>R1 – <i>“issues in historical study...couldn’t get much information from archive... uncertain information”</i>.</p> <p>R2 – <i>“need to ensure data collected is trustworthy and accurate...to determine suitable conservation approach”</i>.</p> <p>R3 – <i>“unavailability online or digital data. Physical data have high risk of missing, misplaced and damage”</i>.</p> <p>R4 – <i>“not much historical information in archive. Not much photograph, textual data, no human evidence”</i></p>	<p>Lack of data reliability (high risk of inaccuracy and untrustworthy information)</p> <p>available in physical data (risk of misplaced, damage and missing)</p>
Group 2	<p>R1 - <i>“having difficulties in handling information which causing miscommunications. Information doesn’t distribute. As if they are only working all by themselves”</i>.</p> <p>R2 – <i>“difficulty in managing big data... we might lose some data and have difficulty in tracking it back”</i>.</p> <p>R3 – <i>“difficulty in keeping information/record. Multiple duplication so everyone received latest information. Comes in hardcopy”</i></p>	<p>Lack of multi-collaboration caused by workers/involved parties who worked in silo and lack of data sustainability which most of the data are missing, not up to date and loss track</p>

Group	Answer	Themes (Based on Answer)
	R4 – “every expert has their own understanding. Cause internal conflict and causing inefficiency... no systematic approach... cause segregation among the experts”	
Group 3	R1 – “missing recording, documentation and supporting document. Need to be submitted during the end of project”. R2 – “focusing more on physical documents instead of digital documents... have to re-access the information to complete the final documentation”. R3 – “no software, server or even specialist on IT to manage the heritage information using latest technology”. R4 – “quite hard to make a change if there are no policy, budget and knowledge...reluctant to change”	Lack of data sustainability
Group 4	R1 – “Manual and operation for maintenance not provided...no schedule, repairing and forecast maintenance”. R2 – “not receiving any documentations and information of the building... need to identify the issues and problems all by themselves... any reoccurring defect, the maintenance team does not have their references”. R3 – “building that have been conserved...may not found information and documentation of previous work...need to start over...repetitive work”. R4 – “Missing information...need to re-access historical data...drawings, M&E documentation, report...incomplete and missing...affecting process maintenance and operating”	Reassess historical study and unstructured metadata

Source: Author (2024)

According to the presented Table 3, four primary challenges in the management of heritage documentation and information have been identified. These challenges predominantly arise from the issues in the context of social, historical, geographical, technological and knowledge sharing such as lack of data reliability, lack of multi-collaboration among involved parties due to working in silo, lack of data sustainability and lastly reassess historical study and unstructured metadata. Within social and historical data management issues, the lack of reliable data increases the risk of historical narratives and cultural

representations being inaccurate and untrustworthy, which could compromise cultural heritage preservation efforts. Geographical issues aggravate the situation, as spatial data errors can misread heritage site structure and context. Siloed working methods lead to incomplete, inconsistent, and redundant data sets, which can be worsened by outdated technology and incompatible formats, fragmenting knowledge exchange actions. Stakeholders' data sustainability issues also affecting geographical, social, and historical heritage data management. Old records need constant documenting and maintenance to avoid loss or degradation. Spatial data analysis and documentation track physical changes around heritage assets in sustainable data management. Technically, handling vast amounts of heritage data requires scalable and adaptive data storage solutions. Lastly, knowledge exchange difficulties and technology factors like interoperability by earlier working groups leads to unstructured metadata that needs to be reassessed for operation, maintenance, and conservation.

Towards National Heritage Act 2005 (Act 645)

The entire four primary challenges found in the management of heritage documentation and information should be alleviated prudently particularly during planning permission to ensure systematic management plan for heritage sites. Referring to Section 46 (Conservation Management Plan - CMP), National Heritage Act 2005, the commissioner shall, in consultation with the council, prepare a conservation management plan for the purposes of:

Section 46 (1) stipulate that CMP should be prepare to:

- i. promoting the conservation, preservation, rehabilitation, restoration, or reconstruction of a heritage site.
- ii. ensuring the proper management of a heritage site including the use and development of all buildings and lands in the heritage site and the preservation of the environment including measures for the improvement of the physical living environment, communications, socio-economic well-being, the management of traffic and the promotion of economic growth; and
- iii. promoting schemes for the education of, or for practical and financial assistance to, owners and occupiers, and for community involvement in decision making.

This study has contributed to knowledge current issues and deficiencies of heritage data documentation that have been faced in Malaysia conservation

industry. As a result, the study reveals there are four main issues that in management of heritage data information systems are provided in Figure 1 below.

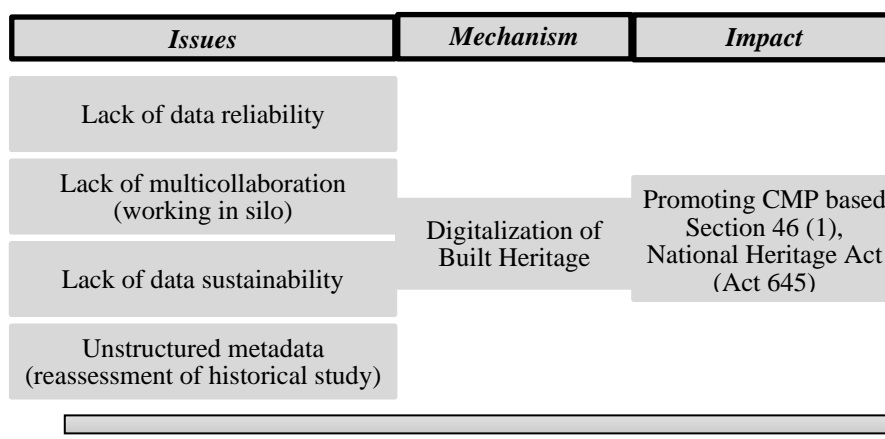


Figure 1: Issues and Deficiencies on Implementation of Heritage Data Documentation towards promoting CMP based on Section 46 (1) by transforming into digitalization approach.

Source: Author (2024)

CONCLUSION

In a nutshell, a comprehensive solution to transform the conventional practice into digitalization approach where it promotes a shared knowledge platform will emphasize the connectivity between stakeholders and data sustainability (Bahardin, 2022); (Karim, 2022); (Harun, 2020) towards systematic conservation management plan as stipulated in Section 46 (1), Act 645, National Heritage Act 2005.

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PERCEPTION OF SAFETY AND OUTDOOR PHYSICAL ACTIVITY AMONG STUDENTS IN UNIVERSITY CAMPUSES: DOES PLACE ATTACHMENT MATTERS?

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Abstract

Gaining insight into how people view their daily routines and engage with their surrounding environments is critical in shaping decisions regarding outdoor physical activity. This research investigates a framework for the direct and indirect effects of students' perceptions of their university surroundings on their participation in outdoor physical activities. A total of 269 students participated in this study. Findings reveal that place attachment may mediate the relationship between safety perception and outdoor physical activity. This study suggests that universities should enhance students' living environments by adopting safe environmental designs. Campus planning schemes should provide facilities that foster place attachment and encourage social interactions.

Keywords: University Campus Environmental Design, Place Attachment, Outdoor Physical Activity

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INTRODUCTION

The advantages of physical exercise in reducing health risks are extensively documented, as are its positive effects on mental health (Da Silva et al., 2012; Ghadzlie et al., 2024; Gordon et al., 2018; Lee, 2003; Löllgen et al., 2009; Paffenbarger Jr et al., 2001; Sigal et al., 2006). Interest in the role of the built environment in promoting physical activity is growing, with researchers assessing activity levels within these spaces (McCormack & Shiell, 2011; Safizadeh et al., 2024). A safe built environment fosters physical activity (Alshahrani, 2024; Annemans et al., 2024; Safizadeh et al., 2024).

Crime and feelings of insecurity can discourage physical exercise, resulting in reduced participation in outdoor activities because of a diminished perception of safety (Constable Fernandez et al., 2023). Thus, creating built environments that encourage physical activity is regarded as a sustainable strategy for health promotion (Annemans et al., 2024; McCormack & Shiell, 2011). However, previous studies examining the connection between safety perception and physical activity have produced inconsistent results (Bracy et al., 2014; De Dominicis et al., 2015; Wilson et al., 2004). The relationship between safety perception and outdoor physical activity is influenced by a mix of factors, such as social environment characteristics, building environment traits and individual factors (Foster & Giles-Corti, 2008). Only a few studies offer insightful recommendations for the design and development of outdoor physical spaces (Wang et al., 2016).

Using an ecological model to study diverse influences on physical activity is beneficial (Bracy et al., 2014). University students face numerous obstacles to physical activity in multiple areas: psychological, emotional and cognitive factors (time limitations and diminished motivation); environmental factors (shortage of accessible facilities) and socioeconomic and demographic factors (insufficient financial means) (Silva et al., 2022). Place attachment, a psychological aspect influenced by interactions with the environment, correlates with outdoor physical activity (Nursyamsiah & Setiawan, 2023). Previous research has explored this relationship, suggesting that attachment to specific outdoor spaces may motivate individuals to maintain physical activity routines (Koohsari et al., 2023; Lee & Shen, 2013).

This research focuses on investigating how perception of safety in university campus environment characteristics, along with objectively measured and subjectively perceived place attachment, influences outdoor physical activity among Malaysian university students.

Malaysia ranks among the 10 most sedentary nations in Asia, with the World Health Organization reporting that 61.4% of Malaysians aged 15 and over lack of exercise (Thijssen et al., 2010). Little information is available about obstacles to physical exercise among university students in Malaysia. The

country has five public universities, and science students participate in field excursions and intensive laboratory sessions more than art students do. Most students at Universiti Sains Malaysia (USM) lack physical activity and exhibit high sedentary behaviour (Silva et al., 2022).

The main purpose of this study is to evaluate the connection between outdoor physical activity on the USM campus and students' perceptions of safety, in an effort to address the gaps in previous research. Furthermore, this study assumes that place attachment mediates the connection between outdoor physical activity and safety perception. The study's key points are elaborated in the subsequent sections.

LITERATURE REVIEW

Perception of Safety and Place Attachment

Numerous studies have demonstrated the connection between individuals' perception and assessment of a place and their attachment to it. Place attachment is influenced by one's perception of safety. Place attachment in public open spaces refers to the connection that individuals have with their physical surroundings and their perception—whether negative or positive—of the location (Karsono & Shindi Indira, 2016). A strong emotional connection to a place may make one feel protected and encourage them to ignore any risks (Armaş, 2006). The need for safety and security drives place attachment (Han et al., 2023). According to Hester (2013), place attachments arise from the desire to fulfil fundamental needs like security, but this desire may be overshadowed by competing 'monsters', like fear of crime. If these fears are unacknowledged, they can obscure the significance of place attachment and its role in place-making (Manzo & Devine-Wright, 2013). Several studies have identified the perception of safety in the surrounding environment as a key positive indicator of place attachment (Lewicka, 2010; Nursyamsiah & Setiawan, 2023). Thus, the perception of safety affects individuals' activity levels and walking rates. Environments perceived as safe are associated with high walking rates (Bracy et al., 2014; Saelens & Handy, 2008).

Place Attachment and Outdoor Physical Activity

Place attachment describes the deep bond individuals form with the places they live in, encompassing functional and emotional aspects that imbue meaning into their environment (Chang et al., 2023; Dallago et al., 2009; Han et al., 2023; Karsono & Shindi Indira, 2016; Madkhali et al., 2024). When individuals form a strong bond with particular places, such as their neighbourhoods, they are motivated to engage in regular outdoor exercise routines (Han et al., 2023; Koohsari et al., 2023). Some studies have found a positive link between strong place attachment and outdoor physical activities, such as walking (Chang et al.,

2023; Koohsari et al., 2023; Lee & Shen, 2013; Madgin et al., 2016). This finding indicates that the emotional connection individuals feel towards their surroundings can influence their engagement in physical activities within those spaces.

Perception Of Safety, Place Attachment and Outdoor Physical Activity

Adults and adolescents, especially women, report lack of safety as a deterrent to using outdoor spaces and participating in physical exercise (Baran et al., 2014). Current findings on the primary effects of safety perception variables are inconsistent (Bracy et al., 2014; De Dominicis et al., 2015). Place attachment controls interactions between individuals and their surroundings in several pertinent environmental–psychological processes. However, disagreement exists over its role in mediating the connection between perceived environmental dangers and coping strategies. Place attachment is hypothesised to mediate the connection between safety perception and outdoor physical activity because it is closely tied to personal identity and

may be associated with spatial preferences (Dominicis et al., 2015).

H1: A positive relationship exists between perception of safety and place attachment.

H2: A positive relationship exists between place attachment and outdoor physical activity.

H3: A positive relationship exists between perception of safety and outdoor physical activity

H4: Place attachment mediates the relationship between perception of safety and outdoor physical activity.

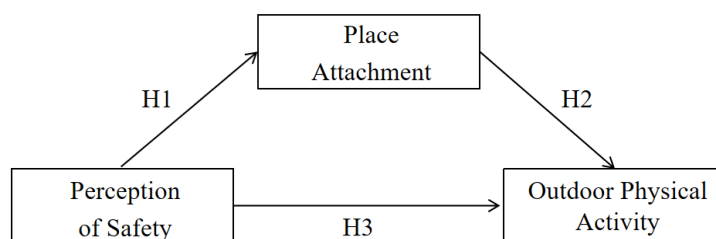


Figure 1: The Conceptual Pathway Between the Study Variables

Source: Author's Summarize

RESEARCH METHODOLOGY

Site Selection

This study is part of a larger project examining the relationship between campus-built environments and health rates. In Malaysia's four public university campuses, several unsecured locations, such as roads, walkways and parking areas, are the riskiest (Figure 2) (Abd-Razak et al., 2011). According to reports,

campus crime primarily includes violent and property crimes (Cundiff, 2021; Nobles et al., 2013; Woolnough, 2009). Property offenses include burglary, theft and car theft, whereas violent offenses involve aggravated assault, robbery, homicide or non-negligent manslaughter and forcible rape (Cundiff, 2021). Security issues are the main cause of crime at USM’s main campus (Omar & Cusairi, 2018).

The crime index (Table 1) is refined with the university’s security department to reflect relevant crimes on the USM campus, including violent and property crimes, from 2021 to 2023. Studies have shown that criminal activity often clusters in specific geographic areas known as ‘crime hot spots’ (Eck et al., 2015; Sherman, 1995; Sherman et al., 1989; Sherman & Weisburd, 1995; Weisburd & Eck, 2004). USM’s crime index identifies these hotspots (Figure 3).

This study concentrated on the core region of USM, a crime hotspot with the highest burglary rates. As part of a larger project, this study utilised probability sampling in public areas. Prior to data collection, respondents were informed about the research and asked to scan a QR code to ensure they were USM students familiar with the area and regular visitors. The eligibility criteria included students across all academic levels (undergraduate, graduate and PhD) residing on or off campus and utilising any mode of transport to campus (car, walking, bicycle and bus).

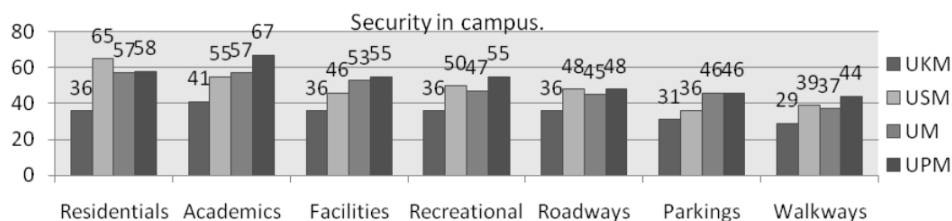


Figure 2: Students’ Feedbacks on Security Level in Their Campuses

Source: Abd-Razak et al (2011)

Table 1: The USM Crime Index

Crime Type	Crime Index
Violence Crime	Causing Injury
	Others Theft
Property Crime	Housed breaking-in & Theft
	Careless Theft

Source: USM Security Department, 2024



Figure 3: Crime Hot Spots

Source: The authors based on the crime data taken from USM Security Department (2024)

Survey Instrument

This research used a cross-sectional design conducted on a university campus, employing a quantitative method in which participants completed a series of survey questionnaires. Even though its main goal is not theory development, the study took an exploratory approach to gain insights into the direct and indirect linkages between safety perception and physical activity on university campuses. Structural equation modelling was used to empirically evaluate the theorised variables and relationships.

A pilot survey was conducted with a random selection of 36 respondents. The construct reliabilities were all deemed satisfactory, with the SPSS results showing Cronbach's alpha (α) values ranging from 0.732 to 0.943, which exceeded the 0.70 threshold for reliability. The final questionnaire comprised 27 items, categorised as follows: nine items on respondent

demographics, four items on physical activity adapted from IPQA (2002), six items on the perception of safety adapted from Fernandez (2005) and Starkweather (2007) and eight items on place attachment adapted from Williams and Vaske (2003) and Xu et al. (2015). Responses were evaluated using a five-point Likert scale, with ratings ranging from 1 for 'strongly disagree' to 5 for 'strongly agree', except for outdoor physical activity.

RESULTS

Respondent Profiles

A total of 269 respondents participated in the study. The average age of the respondents is 26 years (SD=5.479). Of these respondents, 62.5% are female, and 37.5% are male. Chinese make up 55% of the sample, followed by Malay (25.7%), Indians (7.1%), Malaysian Chinese locals (5.2%) and individuals from the Middle East (7%). In terms of educational attainment, 42.4% are pursuing an undergraduate degree, 31.2% a PhD degree 26.4% a master's degree. Regarding monthly earnings, 55.4% of respondents earn less than RM1000, 41.6% earn between RM1001 and RM2000, 0.4% earn between RM 3001 and RM4000 and 0.4% earn RM5001 and above.

Measurement Model Results

Construct validity was assessed using convergent validity and discriminant validity (Hair et al. 2007). Four methods were employed to evaluate convergent validity (Table 2): factor loading, Cronbach's α , composite reliability (CR) and average variance extracted (AVE). Hair et al. (1998) suggested using a cross-loading cut-off value of 0.4 to assess how well each item represents its corresponding latent variable. The results indicate no multiple cross-loadings on any of the items, supporting initial discriminant validity. An AVE value of 0.5 or above indicates sufficient convergence (Bagozzi & Yi, 1988). A CR rating of 0.7 or above is recommended because it indicates strong dependability. The CR values in this study range from 0.867 to 0.945, well above the cut-off point.

Overall, the measurement model shows adequate reliability and convergent validity based on parameter estimates and statistical significance, suggesting that all items are reliable measures of their respective constructs. Every factor's Cronbach's α score is higher than the suggested cut-off value of 0.7 (Nunnally, 1978), with values ranging from 0.694 to 0.924, which show high scale reliability.

Table 2: Reliability and Convergent Validity Results

Variable	Item	Loading	Alpha (α)	CR	AVE
Place Attachment	PA1	0.900	0.923	0.945	0.812
	PA2	0.896			
	PA3	0.925			
	PA4	0.887			
	PA5	0.919	0.915	0.940	0.796
	PA6	0.893			
	PA7	0.861			
	PA8	0.901			
Perception of Safety	POS1	0.614	0.876	0.908	0.624
	POS2	0.761			
	POS3	0.818			
	POS4	0.853			
	POS5	0.840			
	POS6	0.842			
Outdoor Physical Activity	OPA1	0.871	0.694	0.867	0.766
	OPA2	0.879			
	OPA3	0.919	0.798	0.908	0.831
	OPA4	0.904			

Source: Author's Calculation

Table 3: Results of HTMT Ratios

	Jog	Perception of Safety	Place Dependency	Place Identity	Walking
Jog Perception of Safety	0.139				
Place Dependency	0.11	0.418			
Place Identity	0.119	0.559	0.803		
Walking	0.375	0.146	0.268	0.194	

Source: Author's Calculation

Structural Model Results

Path analysis was conducted to evaluate the four hypotheses formulated for this study. After validating the model through the outer model assessment, the inner model estimates were examined to assess the proposed relationships between the constructs in the conceptual model (Hedayati et al., 2019). Researchers can test their proposed model easily when they have evidence of the inner model's quality, as demonstrated by the significance levels and standardised path coefficients (Hair et al., 2012). The relationship between POF and PA is positive ($\beta=0.519$, $p<0.01$). The idea that improving the campus public spaces may

enhance students' attachment to these places is supported by previous research on the relationship between safety perception and place attachment (Lewicka, 2010; Nursyamsiah & Setiawan, 2023).

Table 4: Results of Path Coefficient and Hypothesis Testing (Direct and Indirect Effects)

Hypot hesis	Relationship	β	T	P	f^2	Decision
H1	POF→PA	0.519	10.626	0	0.291	Supported
H2	PA→OPA	0.168	2.109	0.035	0.018	Supported
H3	POF→OPA	0.077	0.887	0.375	0.004	Not supported
H4	POF→PA→OPA	0.087	1.978	0.048		Supported

Source: Author's Calculation

Table 4 presents the results of the path analysis conducted to assess the direct effects between latent variables. A positive and significant effect of POF on PA (H1; $\beta=0.519$, $p<0.01$) is observed. This finding suggests that a strong place attachment is reported by people with high perceptions of safety.

H2 posits that a strong place attachment positively influences and significantly increases engagement in outdoor physical activity (H2; $\beta=0.168$, $p<0.05$). Consistent with previous research, the findings indicate that students with a strong place attachment to their surroundings are likely to participate in outdoor physical activities. However, no meaningful correlation is found between outdoor physical exercise and perception of safety (H3; $\beta=0.077$, $p>0.05$). Therefore, the results support H1 and H2 but not H3. The R^2 value is 0.039 for outdoor activities. This study demonstrates the discrepancy between perception of safety variables and outdoor physical engagement—a pattern also noted in other studies (Bracy et al., 2014).

Our research analysed the mediating role of place attachment in the connection between perception of safety and outdoor physical activity. Using the specific indirect effect from the PLS output and a bootstrapping approach with 5,000 samples, as recommended by Hayes (2009), the indirect effect's t-value was calculated. The findings indicate that t-value is statistically significant at 0.05, thus supporting H4.

The aim of determining the effect size (f^2) is to evaluate the effect of an independent latent variable on a dependent variable. Changes in the coefficient of determination (R^2) are used to calculate effect size. Chin (1998) stated that the levels of effect size at 0.02, 0.15 and 0.35 correspond to small, moderate and substantial effects, respectively. According to Table 4, the f^2 values for outdoor physical activity and perception of safety related to place attachment are 0.018 and 0.289, respectively. As a result, perception of safety ($f^2>0.15$) has a

moderate effect on place attachment, whereas place attachment ($f^2 < 0.02, f^2 > 0$) has a small effect on outdoor physical activity (Al Mamun & Fazal, 2018).

An assessment was conducted to detect multicollinearity among the model variables. None of the variance inflation factor values, as shown in Table 6, exceed the suggested threshold of 5.00, indicating no cause for concern (Hair et al., 2014). Hair et al. (2017) suggested evaluating the predictive correlation of the model through the blindfolding procedure. The Q^2 values for place attachment ($Q^2=0.153$) and outdoor physical activity ($Q^2=0.013$) are greater than 0, meaning the model has sufficient predictive significance.

DISCUSSION

Our research investigates a conceptual model examining the connection between perceived built environment, particularly safety perception, and outdoor physical activity, with place attachment as a mediator. The findings reveal no significant relationship between safety perception and outdoor physical activity, aligning with the results of previous research (Bracy et al., 2014; De Dominicis et al., 2015). However, safety perception positively influences place attachment, and place attachment positively influences outdoor physical activity. Place attachment mediates the relationship between safety perception and outdoor physical activity. The research emphasises the important influence of the built environment in shaping students' place attachment and activity choices. Neglecting the physical environment can lower perceptions of safety, reduce place attachment and decrease outdoor activity. These findings highlight the significance of the outdoor space in fostering active and connected communities.

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

This research provides valuable insights into understanding campus environmental safety design. It reveals that students' perception of safety significantly influences their place attachment, which in turn correlates with increased outdoor physical activity. The practical implications for USM's environmental design underscore opportunities to enhance livability. Recommendations include implementing safety-focused environmental design methods and enhancing facilities to foster place attachment and social interactions within USM's planning schemes.

Despite these contributions, several limitations present possibilities for further investigation. Firstly, this study focused solely on an educational institution in a developing country. Although the study region represents the typical university environmental design in Penang, Malaysia, the conclusions may not apply to other educational institutions in industrialised nations. Secondly, given the inconsistent findings in the literature on the relationship between safety perception and outdoor physical activity, results may vary if

outdoor physical activity is replaced with other environmental factors, such as residential settings. Thirdly, the f^2 for the relationship between place attachment and outdoor physical activity is weak in this study. Future research can explore additional variables, such as environmental aesthetics and crime prevention through environmental design, to strengthen this relationship. Furthermore, the observed conflicts in this study highlight the potential moderating effects, such as gender difference, on the connection between physical environment and outdoor physical activity. Using this methodology, future studies should evaluate how demographic characteristics affect the relationships in the study.

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THE INFLUENCE OF URBAN STREET FURNITURE TOWARDS HOMELESS IN KUALA LUMPUR, MALAYSIA

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Abstract

Urban street furniture stands as a silent yet influential force in shaping the city's landscape and the lives of its residents. By studying urban street furniture in the context of homelessness, urban planners can work towards creating more inclusive cities for sustainable urban development. Thus, this qualitative research utilised three methods for data collection: literature review, semi-structured interviews, and participant observation. This comprehensive approach aimed to thoroughly understand the relationship between urban street furniture and the experiences of the homeless population in Kuala Lumpur, Malaysia. The findings of the observation in the case study, followed by the interviewed survey, revealed the multifaceted impact of urban street furniture on homeless individuals. Recognising and incorporating features such as comfortable seating, proper lighting, multi-functional planter boxes, access to clean water, and enhanced mobility through transportation hubs can all contribute to creating more supportive and inclusive urban environments for those experiencing homelessness.

Keywords: exclusionary architecture; homeless; hostile; street furniture; urban

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INTRODUCTION

Homelessness typically refers to people living on the streets; they have no permanent residence and constantly move from one temporary shelter to another. Homeless people stay in hostels, and anyone who defines "no place to call home" on their census forms is considered homeless (Alowaimier, 2017; Hamdan et al. 2020). Several factors contribute to homelessness in Malaysia, including unemployment, low income, lack of affordable housing, ageing, debt, drug, or alcohol addiction, and mental or health problems (Kay Li, 2018). This phenomenon is a social issue that has affected the whole world, including Malaysia. Homeless people living in public spaces, particularly in big cities such as Kuala Lumpur, have drawn significant visual attention from various community groups (Schindler, 2015; Yeoh, 2017). The phenomenon of "hard-to-reach" urban refugee communities is growing, even though Kuala Lumpur City Planning and Development has consistently aimed to strengthen equitable urban life and an inclusive society. As a result, the majority of the homeless are currently living in towns and cities rather than in camps (Hamdan et al., 2020).

Kuala Lumpur Structure Plan 2040 (KLSP2040) was established in 2020 to guide the city's strategic development over the next two decades. The vision is to secure the city's long-term viability and prosperity for all its residents—"a city for all." KLSP2040 comprises six (6) goals to establish a framework for spatial development and planning in Kuala Lumpur and incorporates previous census input into the KLSP2020. The second goal of KLSP2040 is "an Inclusive and Equitable City", that addresses homeless issues in Kuala Lumpur (Jabatan Perancangan Bandar dan Desa Negeri Selangor, 2017). A study of the number of homeless people in Kuala Lumpur revealed that 46% of the homeless were due to unemployed, while 18% were due to a lack of income to rent accommodation (Ahmad Yani et al., 2016; Kay Li, 2018). Despite efforts to provide transit housing for the homeless with minimal rental costs in Kuala Lumpur City, the number of homeless remains worrisome (Badrudin et al., 2022).

RESEARCH BACKGROUND

An overview of the number of homeless people in Kuala Lumpur which was provided by research found that Kuala Lumpur, Selangor, and Penang had the highest percentage of homeless populations in Malaysia. Despite the efforts carried out to provide transit housing for the homeless with minimal rental costs in Kuala Lumpur, the number of homeless is continually rising. The number of homeless has increased from 600 in 2014 to 1500–2000 in 2016 (Michael et al., 2023). Homelessness is on the rise in Malaysia, as well as in developing and developed countries globally (Amalina et al., 2018).

Figure 1 shows the research case study area which is located in Kuala Lumpur city centre, within the City Region Triangle. This research location was chosen because it has the highest number of homeless people in Malaysia.

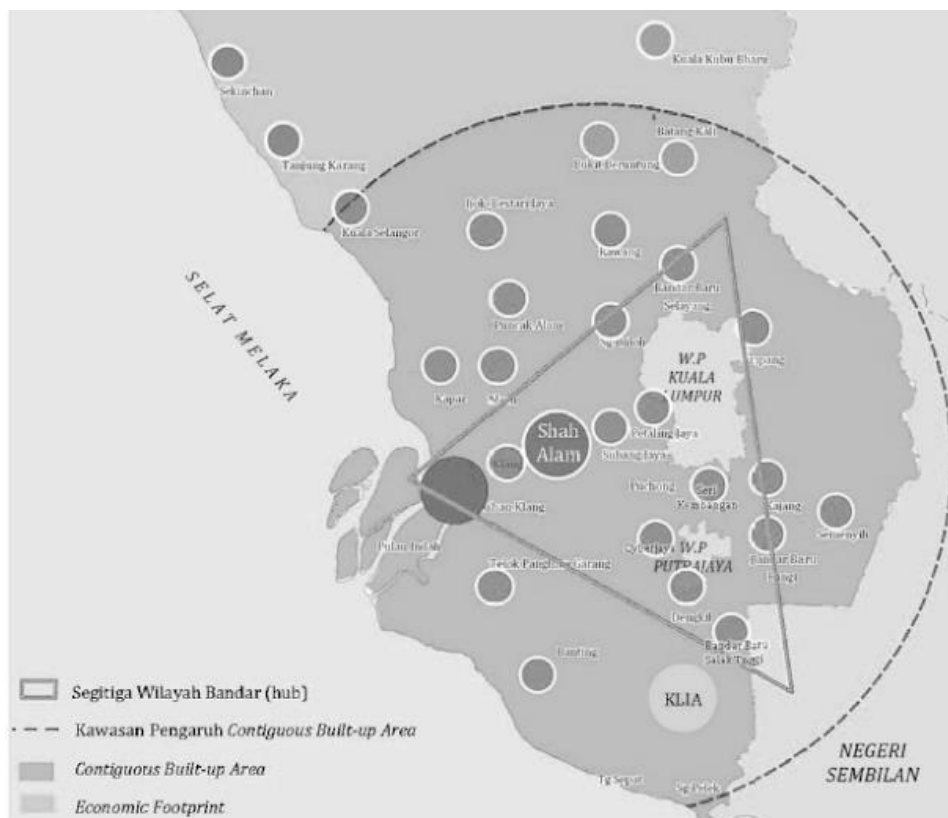


Figure 1: City Region Triangle in the Selangor State Structure Plan
 Source: *Jabatan Perancangan Bandar dan Desa Negeri Selangor (2017)*

HOMELESSNESS TYPOLOGY

Homelessness typology refers to a classification system that categorises homeless people based on specific characteristics or needs. The typology helps researchers understand the diverse nature of homelessness and tailor interventions accordingly. There are several typologies, each focusing on a different aspect such as the conceptual category, operational category, and individual living condition. Table 1 shows the homeless typology in European countries. The conceptual categories and living situation in Kuala Lumpur have been derived from Table 1 to understand the living situation of the homeless on the urban street.

Table 1: European Typology of Homelessness and Housing Exclusion (ETHOS)

Conceptual category	Operational category	Living situation
ROOFLESS	1 People living rough	1.1 Public space or external space
	2 People staying in a night shelter	2.1 Night shelter
HOUSELESS	3 People in accommodation for the homeless	3.1 Homeless hostel 3.2 Temporary accommodation 3.3 Transitional supported accommodation
	4 People in women's shelter	4.1 Women's shelter accommodation
	5 People in accommodation for immigrants	5.1 Temporary accommodation, reception centres 5.2 Migrant's workers accommodation
	6 people due to be released from institutions	6.1 Penal institutions 6.2 Medical institutions 6.3 Children's institutions/home
	7 People receiving long-term support (due to homelessness)	7.1 Residential care for older homeless people 7.2 Supported accommodation for formerly homeless persons
	8 People living in insecure accommodation	8.1 Temporarily with family/friends 8.2 No legal (sub)tenancy 8.3 Illegal occupation of land
	9 People living under threat of eviction	9.1 Legal orders enforced (rented) 9.2 Repossession orders (owned)

Source: (Amore et al., 2011; Pleace&Hermans, 2020)

GOVERNMENT INITIATIVES

To achieve the second goal of KLSP2040, which is to resolve the social problems associated with homelessness, the Malaysian government has proposed transit housing nearby to commercial areas and mixed development areas to cater to the homeless, newly hired youths, and other forms of household. *Pusat Transit Gelandangan Kuala Lumpur* and *Anjung Singgah Kuala Lumpur* are co-living houses initiated by the Malaysian Government. Regardless of the initiatives taken to address this social issue and work towards accomplishing the second goal of KLSP2040, some people continue to sleep on the streets. Some people choose to sleep on the streets because they are unwilling to pay the daily expense of public transportation and prefer to sleep in public areas closer to their workplaces (Mohamed et al., 2018; Syafiq, 2018).

The government of Malaysia, including the local authorities, has launched several initiatives to resolve the issue of homelessness in Malaysia. Some of the initiatives launched by the Malaysian government include *Ops Qaseh*, *Anjung Singgah*, and *Desa Bina Diri*, while *Kechara Soup Kitchen*, *Dapur Jalanan*, and *Kaseh4U* were several food-serving initiatives conducted by Malaysia's Non-Governmental Organisations (NGOs) (Ramlan et al., 2014; Syafiq, 2018; Uta Dietrich, 2018; Young & Petty, 2020). Other initiatives

implemented by local authorities include addressing unemployment issues among the homeless through extensive partnerships with NGOs (Amalina et al., 2018; Yeoh, 2017). KLSP2040 has been announced and launched by Kuala Lumpur City Hall in 2020 with six main goals. The second goal is to resolve the issue of homelessness inclusively and equitably. As a result, this research intends to address the challenges encountered by Kuala Lumpur urban areas, which are to identify the urban street furniture elements that contribute to the number of homeless and provide insight to Kuala Lumpur City Hall on how to achieve their visions for future urban living.

HOMELESS-INCLUSIVE URBAN STREET FURNITURE

The local authorities have designated pedestrian areas as places to rest. In contrast, the homeless who prefer distant and quiet locations to sleep see pedestrian areas as a place to reside. A study postulated that landscape and street furniture have been recognised as indicators of a well-kept area and give visual cue to pedestrians that the area is being maintained and safe (Alamouh et al., 2018; Rashid et al., 2020). The study identified six types of public spaces that might attract the homeless in Johor Bharu, Malaysia. These public spaces include the building corners, open corridors, hallways, under the staircases, public seats, and abandoned stores (Ismail & Turiman, 2016).

In this intricate tapestry of homeless preferences on street furniture, Valado (2006) revealed five (5) prevalences of homelessness regarding urban street furniture that might attract them, including the seating, lighting, planter boxes, fountains, and bus or taxi stands. Each of them is explained as follows:

Seating: Public seating can provide a resting place for people experiencing homelessness. Designing seating areas with features such as armrests or dividers offers a degree of privacy, and some cities have explored incorporating cultural elements that can bring the identity of the place.

Lighting: Adequate lighting in public spaces is crucial for safety. Well-lit areas can provide a sense of security for homeless people, making public spaces more welcoming and lowering the risk of crime. In addition, lighting design can be considered for the needs of people who may need to navigate public areas at night.

Planter box: Planter boxes have a variety of uses. They can be designed to provide comfortable seating, and some innovative designs include storage compartments built right into the planter boxes. Additionally, community-driven initiatives might use planter boxes for urban gardening projects that involve homeless people, promoting a sense of purpose and community.

Fountains: Fountains can be a source of water, addressing the basic need for hydration. Designing fountains with accessible features and water refill stations can benefit not only the homeless population but the broader community as well.

Bus/Taxi stand: Bus and taxi stand provide access to public transportation, enabling people to get to shelters, social services, or employment opportunities. Designing these areas with seating and information about local services might make them more accessible to homeless people who rely on public transit.

Understanding the function and effect of street furniture in Malaysia and European countries based on previous research gives valuable insights into the similarities and differences in the challenges faced by homeless populations. The street furniture in many European cities is often designed to enhance public spaces and provide facilities for residents and visitors. Public benches, bus shelters, and other street furniture may serve as places to rest, socialize, or wait for public transportation (Abusaada&Elshater, 2021; Carmona, 2021). Homeless people may use these structures for shelter, especially in adverse weather conditions. Certain European cities implement initiatives to design street furniture that discourages prolonged use for sleeping or dwelling, while others may incorporate features to make public spaces more welcoming and inclusive (Pable et al., 2022; Reeve & Batty, 2011).

In Malaysia, however, street furniture may have different designs depending on cultural preferences and urban planning strategies. Public seating, transit shelters, and other street furniture are intended for the convenience and comfort of the public, access to services, and public perception (Ismail &Turiman, 2016; Uta Dietrich, 2018). A detailed analysis of urban planning, laws, and community dynamics is necessary to comprehend the particular applications of street furniture that homeless people make (Rashid et al., 2020). Research conducted locally and globally can shed light on how street furniture functions as a part of the urban environment for both the public and the homeless. Thus, Figure 2, which was extracted from past research, illustrates the four (4) influences of urban street furniture on homelessness.



Figure 2: The Influence of Urban Street Furniture on Homelessness
Source: Author (extracted from Carmona, 2021; Uta Dietrich, 2018)

Even though the issue has been discussed widely in the literature, the urban street furniture that attracts homeless people into city centres such as Kuala Lumpur is still underexplored. Thus, this research will identify the level of homeless preference towards street furniture and indications of urban street furniture that attracts homeless people to the city centre.

METHODOLOGY

The research deployed qualitative approaches. The data collection involved three methods, consisted of a literature review, semi-structured interviews, and participant observation. These methods aim to fully comprehend the relationship between urban street furniture and the experiences of the homeless population in the specific context of Kuala Lumpur. The written documents on homelessness from academics and the local city council served as the foundation for the literature review. The data was also collected through reports, newspapers, and local authority websites, where the local authority provides guidelines, policies, strategies, the local agenda, implementation plans, and current practices as relevant resources. The street furniture preference and related activities that the homeless chose to do in those locations were the focus of the observation.

Table 2: Research Method Procedures

Procedures	Description
Research Design	Qualitative – literature review
Data Collection	Conduct semi-structured interviews and participant observations to gather qualitative and quantitative data regarding the homeless' preferences and indications of preference toward urban street furniture. In the photography and visual observation session, the focus was on investigating how urban street furniture influences homelessness. It aims to investigate and verify key variables such as homeless typology and the types of street furniture. The interview questions, utilising measuring indicators for street furniture physical settings, were derived from the literature review and the observation method in the study area, focusing on elements of seating, lighting, planter boxes, fountains, and bus/taxi stands.
Sampling and Participant Selection	Identify and interview 20 homeless people staying in Kuala Lumpur within the city region triangle who are available during interview sessions. They were selected through simple random sampling and interviewed via face-to-face guided interviews using a semi-structured questionnaire.
Data Analysis	Analyse the collected data using thematic analysis, to identify the level of homeless preference toward urban street furniture and understanding preference indications among the homeless.

Procedures	Description
Finding	Prepare findings outlining the conclusions drawn from the analysis, providing insights into the factors of urban street furniture that may influence homelessness in Kuala Lumpur.

Source: Author

A qualitative content analysis method was used in this study to summarise the data from all three methods. The research discusses the theoretical and empirical evidence for factors that cause or influence homelessness to stay in the city centre, as well as identifies the categories of urban street furniture that contribute to the number of homeless in Kuala Lumpur. To determine the measuring indicator, the homelessness preference was asked during the interview session to identify the level of their preference towards the categories of urban street furniture. Public furniture preferences for homeless people can be quite subjective and dependent on personal experiences and needs. Nonetheless, certain types of public furniture might be more conducive to meeting the basic needs and enhancing the well-being of homeless people. The preference level for the homeless on the current street furniture will be highlighted in the discussion. Thus, the categories of urban street furniture that attract homeless people are being examined based on that satisfaction level. Following that, a conclusion was reached regarding the urban street furniture relationship to homelessness in Kuala Lumpur.

DISCUSSION OF FINDINGS

Through photography and visual observation, this study discovered three (3) categories of homeless people with different profiles and living situations in Kuala Lumpur city centre (see Table 3). The study will focus on the first and second categories, as the third category is not intended to stay in public spaces.

Table 3: Observation Results of Homeless Typology in Kuala Lumpur

	Profile category	Living situation
Conceptual Category	1) People with no home or shelter	<ul style="list-style-type: none"> ● Living in urban streets and public spaces. ● Long stay period.
	2) People with mental health or illness	<ul style="list-style-type: none"> ● Sometimes living without a shelter can be characterised as living space. ● The period of stay is intended to be short-term in a certain space and will move to another space.
	3) People with drug dependence or alcoholism	<ul style="list-style-type: none"> ● Make use of the public spaces for overnight shelter. ● Not intend to stay

Source: Author



Figure 3: Visual observation photography of homeless typology in Kuala Lumpur
 Source: Author

The following analysis determines the differences in the level of preference for the homeless when using urban street furniture for daily routine purposes. To further understand the feeling of being homeless, the following conditions were given to create a scenario for the homeless, with the statement “I am comfortable if there is...”. The results obtained from the interview regarding the level of preferences of those who are homeless are shown in Table 2. This is a very important analysis to find answers on how urban street furniture has attracted homeless people whose preferences are also influenced by their diverse needs.

Table 2: The mean score of the analysis regarding the level of homeless’ preference for urban street furniture

Urban Street Furniture	Measuring Indicator	Mean Score
	1) Seating	4.65
2) Lighting	4.30	
3) Planter Box	4.45	
4) Fountains	3.40	
5) Bus or Taxi stand	4.20	

*1-Strongly Disagree
 5-Strongly Agree

Source: Author

Most of the homeless who responded to this question indicated that they either 'strongly agree' or 'strongly disagree' with the statements given regarding their level of preference for urban street furniture for transit in certain spaces. It is presented in the Table above that seating has a higher indication of preference regarding urban street furniture with a mean score of 4.65. The second level of preference indication was highlighted by the planter boxes. The results of the third-highest, fourth and lowest average scores are presented in the Table above.

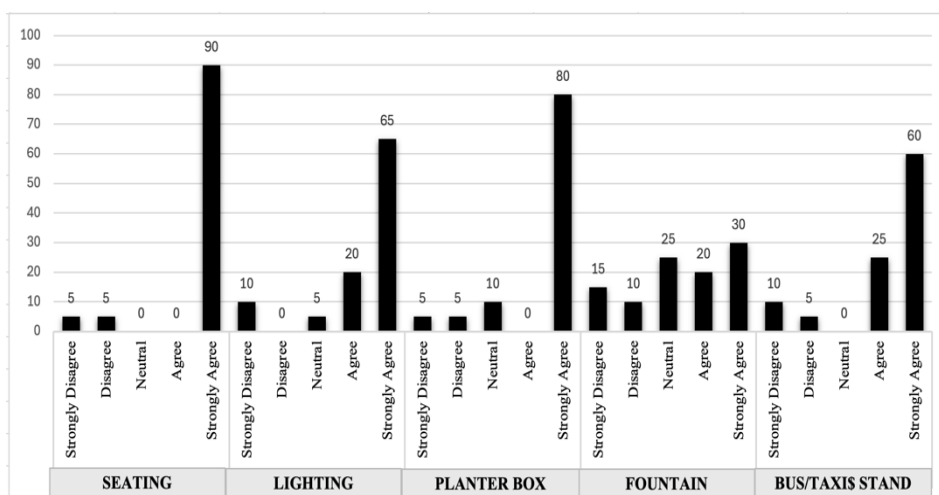


Figure 4: Homeless preference indication for urban street furniture
Source: Author

Figure 4 illustrates the breakdown of feelings according to the situation given to them, ranging from 'strongly disagree to strongly agree'. The findings revealed that more than 65% of the total respondents indicated 'strongly agree' that they are comfortable with the street which has seating, lighting, and a planter box.

RECOMMENDATIONS

The findings of the analysis revealed significant insights into the factors of urban street furniture that attract the homeless population in Kuala Lumpur. The homeless people interviewed expressed varying preferences regarding the specific features of street furniture. The recommendations drawn from the analysis are as follows:

Seating Preferences: Homeless people showed a strong preference for well-designed and comfortable seating options. Enhance the public seating features such as armrests and dividers were particularly favoured. The availability of such

seating not only addressed the basic need for rest but also contributed to a sense of welcome and well-being.

Lighting Impact: Adequate lighting in public spaces was highlighted as a crucial factor. Well-lit areas not only enhanced the safety of these spaces, but they also positively influenced the overall well-being of the homeless population. Properly illuminated spaces were perceived as more inviting and contributed to a sense of security at night.

Planter Boxes as Multi-functional Elements: Planter boxes were identified as multi-functional elements that could serve multiple functions in urban design, such as productive and therapeutic activities, and can create inviting and aesthetically pleasing environments. Beyond their traditional use, some homeless people valued planter boxes that doubled as seating. Engaging homeless people in urban gardening projects within these spaces also emerged as a positive and inclusive initiative.

Access to Fountains and Hygiene Facilities: Fountains were seen as potential sources of clean water, meeting the fundamental need for hydration. The provision of accessible water fountains positively improved the daily lives of the homeless. Furthermore, the availability of nearby hygiene facilities, such as public restrooms and handwashing stations, contributed significantly to improved personal hygiene and general well-being.

Utilising Bus/Taxi Stands for Accessibility: Bus and taxi stands were recognised as essential elements for accessibility, enabling homeless people to reach shelters, social services, and employment opportunities. Design features that incorporated seating and information about local resources at these locations were found to be valuable in supporting the homeless population's mobility and access to necessary services.

In conclusion, the analysis emphasizes the importance of thoughtful urban street furniture design in addressing the needs and preferences of the homeless population in Kuala Lumpur. The findings of observation in the case study area are discussed, followed by the questionnaire interview. The influence of urban street furniture on homeless people was found to be multifaceted, impacting various aspects of their daily lives and well-being. Figure 3 shows how five (5) factors of urban street furniture influence the homeless in Kuala Lumpur.

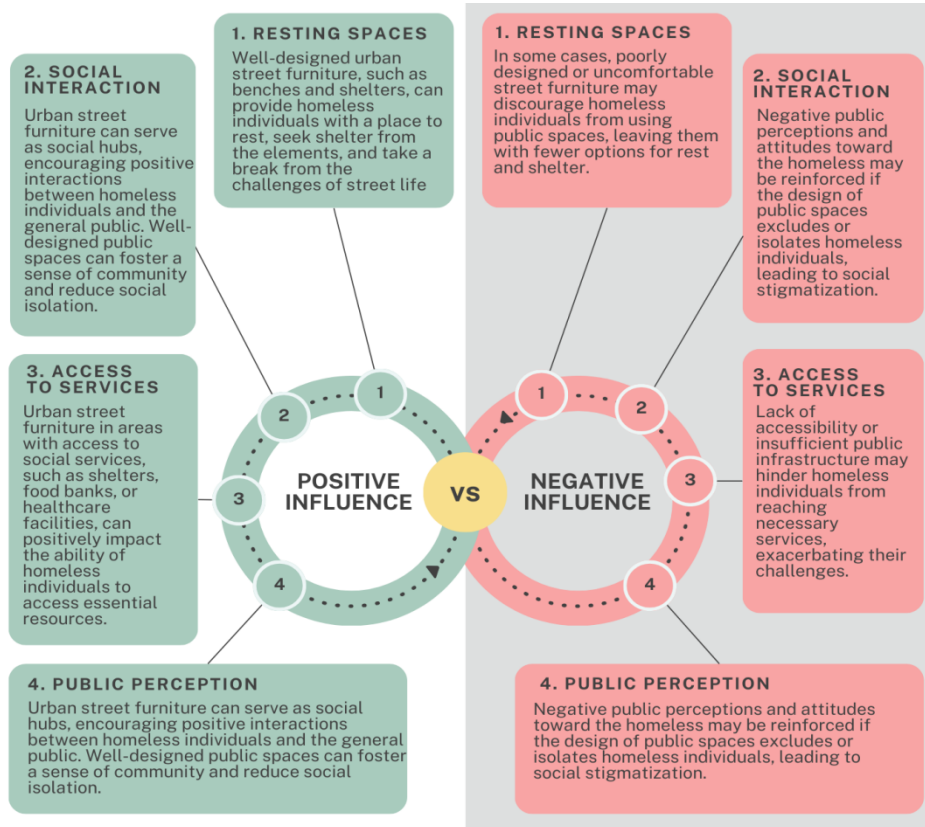


Figure 4: Interview findings on the positive and negative influence of urban street furniture on homeless
 Source: Author

CONCLUSION

In summary, researching urban street furniture in the context of homelessness is crucial for creating urban environments that are not only functional and aesthetically pleasing, but also compassionate and supportive of the diverse needs of all community members, including those experiencing homelessness. Understanding the complex interplay between urban street furniture and homelessness requires a holistic approach that considers the physical, social, and psychological aspects of public spaces. Successful initiatives often involve collaboration among local governments, community organizations, and urban planners to develop inclusive environments that address the diverse needs of homeless people. Providing significant value to street furniture, which ranges from seating to public spaces and amenities, plays a pivotal role in determining the accessibility and comfort of public areas. Even while these elements are

designed to enhance the overall urban experience, their impact on vulnerable populations, particularly the homeless, requires nuanced exploration.

Suggestions for Future Research

By examining the influence of urban street furniture on the well-being and social dynamics of homeless people in Kuala Lumpur, future research endeavours could explore and determine the characteristics of urban street furniture that invite homeless people into the city centre. Collaborative efforts can help to ensure that public spaces are designed inclusively. These dynamics are crucial for crafting more compassionate, effective policies and fostering a city that truly serves all of its residents. Exploring the well-designed seating, lighting, planter boxes, fountains, and bus or taxi stands could contribute to providing respite and a sense of security for those experiencing homelessness and the general public. Thus, it is suggested that future research explore the cultural nuances and variations in homeless-inclusive urban street furniture initiatives across different regions. Identifying culturally sensitive design elements that resonate with diverse communities experiencing homelessness is also important. By focusing on these areas, future researchers can contribute to a more comprehensive understanding of the relationship between urban street furniture and homelessness, resulting in informed policies, inclusive design practices, and better outcomes for vulnerable populations.

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SPATIAL ANALYSIS OF ROAD TRAFFIC ACCIDENT HOTSPOTS AND PATTERNS IN MUSCAT, OMAN: AN EXPLORATORY RISK MANAGEMENT ASSESSMENT

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Abstract

Oman is grappling with a significant challenge posed by road accidents, with approximately 1,539 accidents recorded in 2021. To tackle this issue, this study showcases the potential of Geographical Information Systems (GIS) technology in mapping and analysing road accident hotspots and distribution patterns in Muscat, Oman. The data (from 2019 to 2021) was gathered from the Omani Royal Police Department, with ArcGIS Pro serving as the geographical representation and analysis platform. The study identified high-risk locations for road accidents in specific areas of Mutrah, Bawshar, and Al-Amerat, which were attributed to densely populated areas and heavy traffic flow. The spatial pattern of accidents appeared dispersed, with Fridays and Mondays recording the highest number of accidents due to increased traffic associated with social gatherings and commuting to work or school after the weekend. Qualitative effect analysis revealed that factors such as roadway characteristics, environmental conditions, traffic volume, driver behaviour, and vulnerable road users may influence local accident hotspots. These GIS-based road accident analyses can enhance road accident guidelines and traffic prevention strategies in the Muscat region.

Keywords: GIS, Hotspots, Muscat Oman, Road Traffic Accidents, Spatial Pattern

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INTRODUCTION

Transportation is crucial for economic success and quality of life in urban and rural areas. However, population growth, increased private car usage, and longer travel distances can lead to air pollution, noise pollution, traffic congestion, and road accidents (Mounce et al., 2019). These accidents occur during sudden collisions between vehicles. Many countries worldwide face transportation challenges due to factors such as drivers, roads, and surrounding areas. Researchers are exploring methods to mitigate this harm, as road accidents are the most common cause of death and severe injury globally. These accidents consume significant human resources and energy, resulting in substantial loss of life and property.

Controlling road accidents in Oman is challenging (Belwal et al., 2015). Statistics from the Omani Royal Police indicate a steady increase in traffic accidents, which have resulted in far-reaching social and economic effects. This problem deserves investigation to reduce road accidents and daily deaths. There is a need to identify road locations where road accidents occur frequently before proceeding to clarify underlying issues and develop preventive measures. Hotspots are simply groups that present high-risk accident areas and are used to identify accident-prone sites in urban settings. In this study, the numerical results obtained from the Omani Royal Police in Muscat using traffic accidents between 2019 and 2021 are examined spatially.

Oman is intensively preparing for a modern road network comparable to many countries worldwide. Many roads have been upgraded over the past few years, alongside the construction of bridges and tunnels. As a result, the roads connecting the Sultanate's regions are enhanced, and ongoing development of services and traffic safety measures are visible. To analyse the network, fundamental knowledge of road accident hotspots is required. Due to numerous problems and limitations, collecting accurate and timely statistics on the volume of road accidents is challenging. The issue is the increasing number of traffic accidents in the Sultanate of Oman and the resulting negative consequences. This research aims to understand the current state of road accidents in Muscat by analysing the sites where accidents are increasing and exacerbating this problem.

The Sultanate of Oman aims to comprehend the geographic distribution of traffic accidents and implement the necessary measures to alleviate this significant issue that Omani society faces. Extensive research has been conducted to study road accidents in Oman and globally (Ramana et al., 2018). However, accidents should be spatially studied in GIS with their occurrence coordinates, type, effects, and frequency to devise preventive measures (Mansour, 2016). Identifying hotspot areas is essential for road safety activities as it allows for a more efficient distribution of resources through prioritising safety measures and infrastructure evaluations (Alam & Tabssum, 2023; Aldala'in et al., 2023;

Hazaymeh et al., 2022; Pleerux, 2019; Manap et al., 2019). The research focuses on discovering and detecting the spatial distribution of the accident location. Additionally, spatial features with high spatial accuracy and GIS software are needed to approach accidents systematically and scientifically on the road network. The main objective of this study is to locate and analyse the road accident hotspots and their possible factors in Muscat.

A REVIEW OF GIS ANALYSIS OF ROAD TRAFFIC ACCIDENTS IN OMAN

Traffic accidents and deaths are increasing in Oman, requiring policymakers' urgent attention and action. In Oman, roads are the primary means of transportation for people and goods. Unlike other countries with options like railways, Oman relies solely on roads for transportation (Al-Hasani et al., 2019). The number of traffic accidents in Oman is steadily increasing, and certain regions like Al Batinah, Muscat, Ash-Sharqiyah, and Adh-Dhahirah are particularly prone to accidents (Belwal, 2015).

According to official reports from the Ministry of Health in Oman, highway and road accidents are a significant concern as they cause many premature deaths and disabilities (Ramana et al., 2018). The reasons behind these accidents are complex and involve a variety of factors. These include human-related factors, such as driver behaviour, vehicle-related factors, and the conditions of the roads (Ramana et al., 2018). According to the National Centre for Statistics (2019), the traffic accident rate in the Sultanate of Oman, with a population of 4,527,446, has reached 1,539 in 2021. In Muscat, with a population of 1,310, approximately 371 accidents have occurred, including 78 deaths and 349 injuries. From 2011 to 2013, 2,726 traffic accidents were recorded, and the Muscat Governorate is ranked first in the Sultanate of Oman for the number of traffic accidents (Al-Jubouri, 2015).

Many factors contribute to road accidents in Oman, including reliance on vehicles for transportation, the rise in car demand, and industrial growth and development. These factors have attracted people, including expatriates and locals, to areas of Oman where activities and services are abundant (Belwal, 2015). Consequently, traffic on particular road axes for work and the pressures of commercial activities have increased the likelihood of road accidents. For instance, a study by Ramana et al. (2018) identified Muscat's riskiest areas as at-grade intersections and Y-junctions, where regular roads intersect with the main express highway. Common issues involve rear-end collisions caused by driver errors. To address road accidents, the government has taken stricter measures to enhance rules for obtaining a driving license, including age requirements, driving test appointments, and higher fees for driving schools. Despite these efforts, the number of accidents and injuries continues to rise, with the younger generation

driving without a license. Proper training and knowledge of traffic rules are crucial for those under 25, as the lack of training can lead to reckless driving and speeding, the leading causes of fatal road accidents in Oman.

Over the years, Oman has managed to control the frequency of road traffic accidents (RTAs), but concerns persist regarding the increasing number of injuries and fatalities (Belwal, 2015). While respondents generally comply with road safety measures, the rising toll of injuries and deaths underscores the need for further action. These actions may include integrating various public transportation options into urban planning and offering proactive and reactive treatment for accident victims (Belwal, 2015).

Identifying RTAs in urban areas with GIS is another alternative to prevent local accidents. Hotspot analysis entails spatial analysis and mapping techniques that focus on pinpointing clusters of spatial phenomena represented as points on a map, indicating event or object locations. Under a random distribution of events, a hotspot is an area with a higher concentration of 12 events than expected. Hotspot detection has evolved from studying point distributions or spatial arrangements in a given space (Chakravorty, 1995). Geoinformation technology aids in understanding the localisation and distribution of hotspots in transportation networks, highlighting the impact of spatial and temporal factors (Prasannakumara et al., 2011). This analysis assists in identifying areas with high accident concentrations, determining the main reasons behind the increased accidents, and finding solutions to address the issue.

Traffic engineers and city officials can improve road safety by identifying potential accidents, enabling the modification of signs and roads, and enhancing the efficiency of traffic enforcement agents (Romano, 2017). GIS is a crucial tool for studying road accidents, analysing their location on maps, identifying patterns and hotspots, and determining their distribution in areas with a facility accessibility system (Zain Rashid et al., 2019; Jalil et al., 2018; Rasam et al., 2018; Likhman et al., 2012). With GIS, researchers can understand how accidents are connected to factors like the local economy, land use, and people's travel. There are different ways to analyse accident data using GIS. One popular method is called Kernel Density Estimation (KDE), which helps us understand the distribution and hotspots of accidents. Other methods, such as Average Nearest Neighbour (ANN) and Getis-Ord G_i^* , have also been used to study the spatial pattern of accidents (Alam & Tabssum, 2023; Aldala'in et al., 2023; Hazaymeh et al., 2022; Pleerux, 2019; Manap et al., 2019).

The hotspots analysis tool uses the Getis-Ord G_i^* statistic to find patterns in a dataset. The Z score shows how close high and low values are to each other (Alam & Tabssum, 2023; Alkaabi et al., 2023; Hazaymeh et al., 2022; Pleerux, 2019). KDE is another method for identifying road accident patterns and creating a map without strict assumptions. The size and distance of the shapes

impact the map's detail, while the "average nearest neighbour" method measures proximity to each other. The ratio of distances to the nearest neighbouring item's centre point determines the average nearest-neighbour ratio, indicating a clustered pattern or a trend towards dispersion or spreading out (Yue, 2018).

These GIS-based methods can be further improved using more complex analytical methods and risk factors to find meaningful insights. These methods include geospatial artificial intelligence (GeoAI), open GIS-cartographic sources, multi-criteria decision analysis (MCDA), visualisation, and others. Scholars such as Alam and Tabssum (2023), Lin et al. (2023), Adnan et al. (2023), Abdul Rasam et al. (2023), Ramli et al. (2022), Omar et al. (2021), Sha'aban et al. (2021), and Azewan et al. (2020) have contributed to this progress.

RESEARCH METHODOLOGY

This study consists of several vital steps to achieve its goal (Figure 1). The steps include project planning, data acquisition, data processing, data analysis, and results. Through careful project planning and applying advanced spatial analysis tools, project planning identifies areas with a high frequency of accidents, analyses contributing factors, and selects appropriate sites for targeted interventions. Project planning is the first step, and the original plan is discussed. Planning involves creating a calendar as a Gantt diagram, typically completed in the initial phase as a table containing dates and times.

For data acquisition, this study utilises secondary data on accidents in Muscat from 2019 to 2021 obtained from the Royal Police of Muscat. Data was collected in an Excel file containing details about the accidents' locations. The data was organised based on the type of accidents, number of people affected, time of the accident, and type of roads involved. The boundaries of Oman were used as a base map to show the accidents' location on a map. A layer that displays the primary and secondary roads in Muscat Governorate was used to identify where the accidents occurred. The researcher created a location-based system using this descriptive information. This process is called geocoding, which involves converting the accident descriptions into geographic coordinates (latitude and longitude) to pinpoint the positions on a map.

During data processing, this study engaged in activities such as modifying, transforming, and effectively managing the existing data to ensure a seamless workflow throughout the project. This study relied heavily on two primary tools: spatial analysis and spatial statistics tools in ArcGIS. These tools played a pivotal role in creating distinct types of hotspot maps. A comprehensive breakdown of the data processing steps is provided in a dedicated section within the study.

The data analysis involved two types: accident hotspots and correlation analysis. The study began by analysing the location and pattern of accident

hotspots using an initial Excel format (.csv). Then, the data is converted into a feature class before creating heat maps and hotspot maps. Next, the Average Nearest Neighbour (ANN) tools are used to identify the spatial pattern, either clustered, random, or dispersed, depending on the radius between the set of point features. A nonparametric density can be applied to KDE. The authors were assessing technology within GIS. Like a standard SIG algorithm, KDE may create a density map based on car crash hotspots to show density.

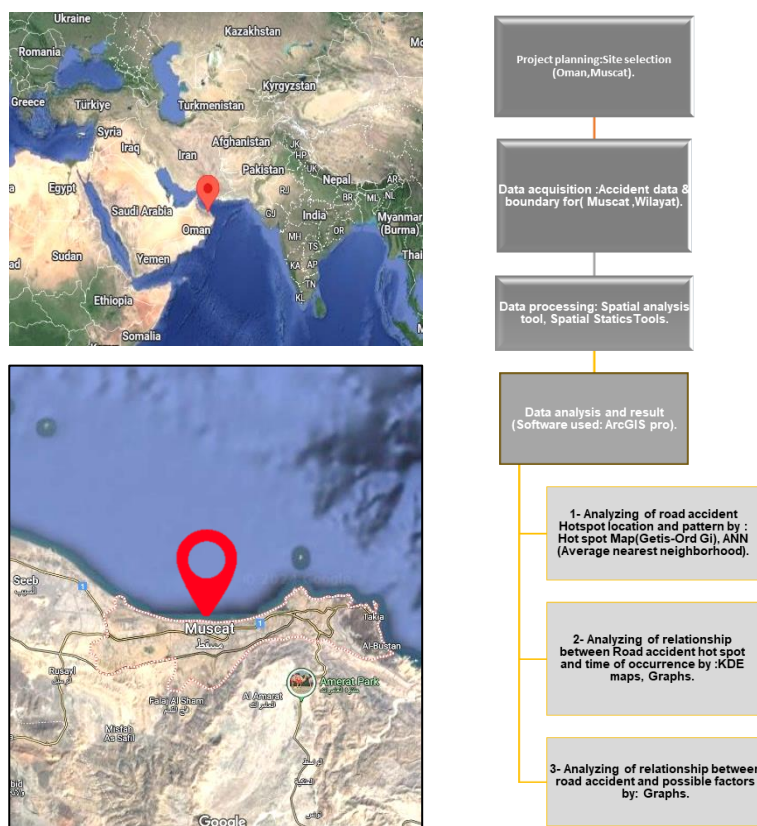


Figure 1: Study Area and Research Methodology
Source: Authors (2024)

For analysing the relationship between road accident hotspots and the time of occurrence, the temporal distribution of car accidents during the three years is measured annually, daily, and in a timely fashion using a graph that shows temporal distributions of road accidents. This identifies the maximum number of road traffic accidents by year, day, and hour. Creating a KDE map can demonstrate the relationship between road accident hotspots and possible

variables and provide valuable insights into the spatial distribution and correlation between accidents and various factors. KDE maps are practical visual tools that help identify high-risk areas, understand underlying patterns, and guide interventions to improve road safety.

ANALYSIS AND DISCUSSION

The Road Accident Hotspots and Patterns

A hotspot map was created to identify areas with higher or lower concentrations of road accidents in the Muscat Governorate (Figure 2).

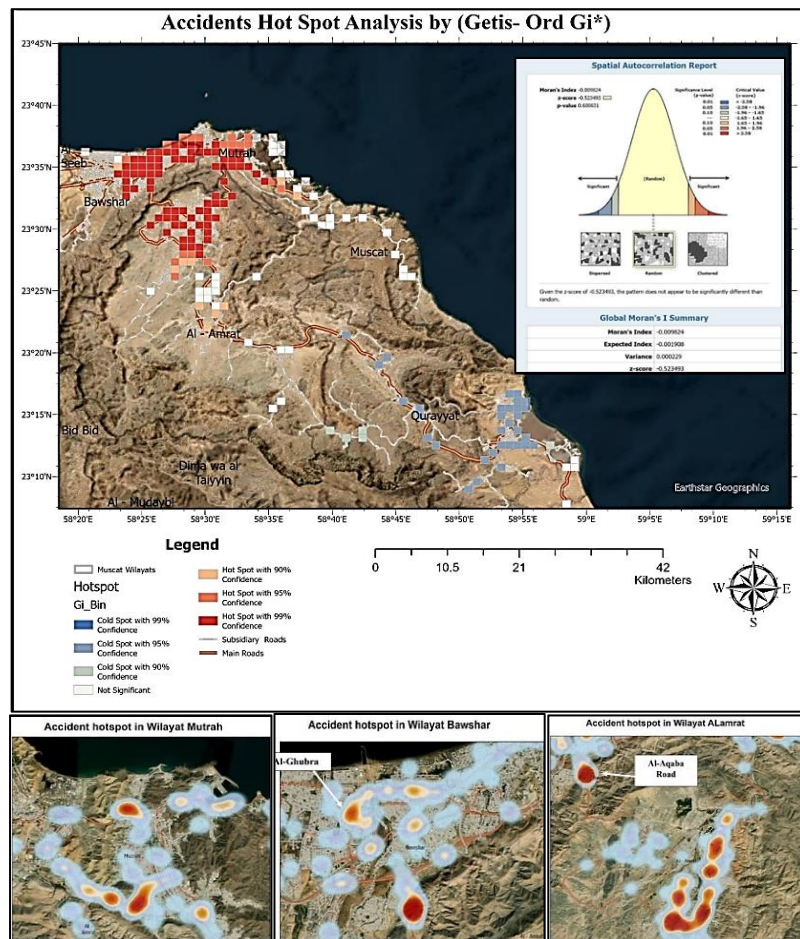


Figure 2: Accident Hotspots and Spatial Pattern in Muscat, Oman
 Source: Authors (2024)

The map, created using accident data from 2019 to 2021, uses colour gradients to represent accident intensity. High-risk areas are highlighted in red, while fewer areas are shown in blue. The map was generated using a tool based on hotspot analysis (Getis-Ord G_i^*). It shows red hotspots in Wilayah Mutrah, Bawshar, and Alamrat and a blue cold spot in Wilayah Qurayyat.

ArcGIS Pro's ANN analysis is a spatial statistical technique used to assess the dispersion or clustering of a dataset pattern. It compares the observed pattern of accidents to complete spatial randomness, providing three key results: the nearest neighbour ratio, the z-score, and the p-value. The analysis shows that the spatial pattern of accidents, evaluated using ArcMap's Average Nearest Neighbor analysis, is significantly dispersed. This suggests that accidents are not clustered but exhibit a dispersed spatial pattern, possibly occurring more scattered across the study area. The analysis is conducted on maps of Muscat's wilayat, Mutrah, Bawshar, and Al Amarat.

Mutrah is a popular tourist destination with high pedestrian traffic due to its traditional markets and tourist attractions (Al-Shakri, 2009). The reliance on private vehicles due to limited public transportation options can contribute to higher traffic congestion, increasing the likelihood of accidents as more vehicles compete for limited road space. There are areas with frequent accidents.

One of these areas is Darsait Street, which gets crowded and allows cars to go very fast, even though the road is curved. Another hotspot is Ruwi Street, an integral part of Muscat city. Ruwi is a busy neighbourhood with many shops, businesses, and government offices. It is also a central hub for public transportation, with buses going to different parts of the city. Figure 2 shows a map of accident hotspots in Muscat. Thirty-three cities, including Dubai, are included. Many government agencies have offices in Ruwi. Inadequate pedestrian facilities, such as poorly marked crossings and insufficient sidewalks, coupled with drivers' disregard for pedestrian safety, also contribute to pedestrian accidents (Maouli, 2014).

Al-Ghubra in Wilayah Bawshar is a vital business area with numerous shops, malls, and hotels. It is also a hotspot for accidents in Mutrah 34. Al-Jabal Street, particularly Al-Aqaba Road, connects Al Amerat with Bawsher, allowing access to Muscat and other governorates. However, expanding residential and commercial areas without improvements in road infrastructure has resulted in congested and poorly designed networks. Bawshar's limited public transportation options have caused an increased reliance on private vehicles, leading to traffic congestion and more accidents during peak hours. Effective enforcement of traffic laws may be necessary in Bawshar. Al-Amerat's growing population and influx of residents have also heightened traffic congestion and accidents, putting pressure on the existing transportation infrastructure. The rising number of

vehicles on the roads in Al-Amerat highlights the need for improved traffic laws and regulations.

Several actions were taken to tackle these issues. The construction of the Wadi Adai Bridge Road and Al Jabal Street, also known as the Aqabat Al-Amerat-Bawshar, has significantly facilitated transportation and enhanced social connections between Al Amerat and other regions and governorates. The Wadi Uday Bridge Road spans 14 kilometres and has contributed to improved mobility and connectivity. Additionally, the Quriyat-Tur dual road construction has contributed to improved traffic flow, ease of movement for vehicles and cargo, and the development of residential and industrial areas along the route. The convergence of a burgeoning population in the Al-Amerat region, combined with the implementation of new thoroughfares and bridges to facilitate transportation between Muscat and other governorates via Al-Amerat, has significantly contributed to a marked rise in the occurrence of accidents on the roads of Al-Amerat (Fadha et al., 2018).

The Road Accident Hotspots by Accident Time of Occurrence

Road traffic accidents (RTAs) can occur at any time of the day, but specific periods tend to have higher accident rates than others. Understanding the timing of road accidents is critical for developing effective strategies to improve road safety and allocate resources appropriately. Muscat's Traffic Police have consistently reported high traffic-related fatalities and injuries within the city. The graph in Figure 3 presents the number of road traffic accidents between 2019 and 2021 in Muscat.

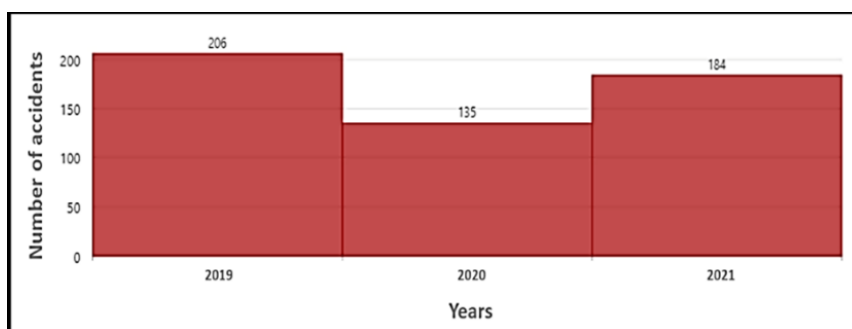


Figure 3: Road Traffic Accidents between 2019 and 2021 in Muscat
Source: Authors (2024)

In 2019, Oman also experienced 24 deaths and 338 injuries due to accidents. The number of deaths decreased by eight from the previous year, while the number of injuries also decreased by 171. Although deaths and injuries decreased, the number of injuries remained high, indicating the severity and

impact of accidents on individuals and society. Moving on to 2020, a further decrease in deaths and injuries is recorded. The number of deaths dropped to 16, showing a decrease of 8 compared to the previous year. The number of injuries decreased to 167, indicating a decline in cases compared to the previous year. This decline suggests that efforts to enhance road safety and accident prevention measures may have a positive impact. However, the data for 2021 shows a slight increase in deaths and injuries compared to the previous year. There were 26 deaths recorded, indicating a rise of 10, whereas the number of injuries increased to 226, representing an increase of 59. Although the overall trend of accidents has improved in previous years, the slight increase in 2021 suggests that continuous efforts are needed to maintain and further improve road safety in Oman. KDE maps are also produced to represent such data by creating a continuous surface that estimates the density of accidents across a geographical area and analyses the number of injuries and fatalities resulting from accidents.

In the weekly analysis of accident situations, accidents are highest on Fridays and Mondays, with 86 incidents, as shown in Figure 4. These accidents could be attributed to various factors. On Fridays, people commonly gather with family and friends, leading to increased traffic as they head to various destinations for social gatherings, shopping, or recreational activities.

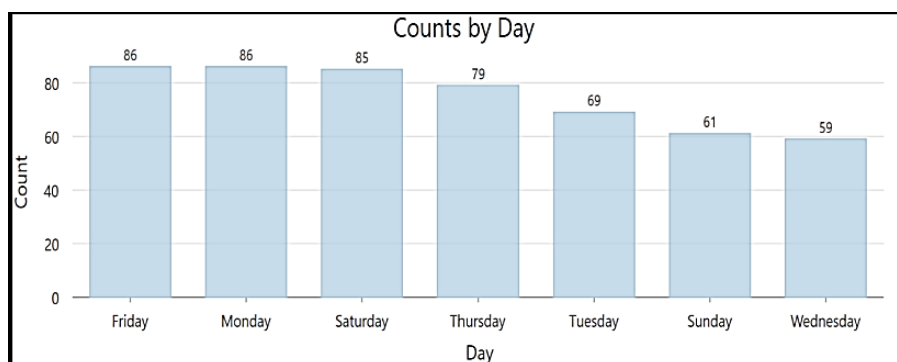


Figure 4: Graph of Accidents per Weekday
Source: Authors (2024)

Saturday has the second-highest number of accidents, with 85 recorded incidents. This could be due to people returning to work or school after the weekend, while Monday mornings can be hectic, leading to a higher risk of accidents. Sundays saw a decline, with 61 accidents. Disciplined driving and fewer distractions may contribute to fewer accidents on Sundays. Authorities can improve road safety by implementing targeted awareness campaigns, increasing traffic law enforcement during peak hours, and promoting responsible driving

behaviour. Encouraging public transportation or carpooling on weekends can also help alleviate traffic congestion.

According to the daily analysis shown in Figure 5, accidents in Al Amerat, Oman, tend to increase throughout the week, with Saturdays and Thursdays experiencing the highest number of incidents. Thursdays mark the end of the work week. The accidents occurred over the weekend, resulting in increased movement of residents from Muscat, the business centre, to their respective areas. A rise in accidents on Saturdays is recorded as people return from their localities to Muscat for work. Figure 6 also displays an hourly analysis of accidents recorded. It shows a relatively low number of accidents during the early morning hours, from 4:00 AM until around 8:00 AM. Accident numbers rise gradually from 8:00 AM until 9:00 AM, indicating increased traffic volume during rush hour.

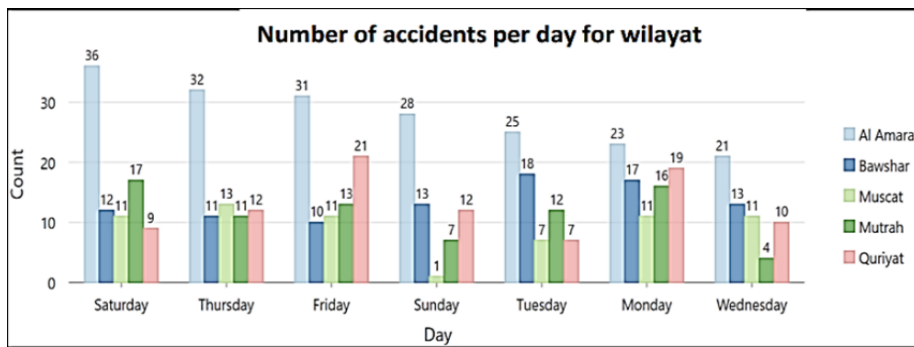


Figure 5: Graph of the Number of Accidents for the Wilayat
 Source: Authors (2024)

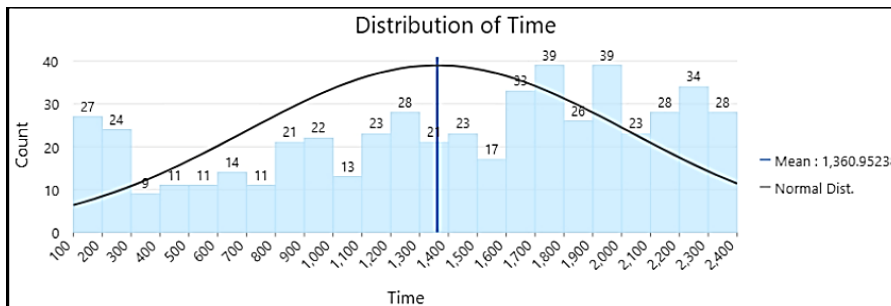


Figure 6: Graph of the Number of Accidents Per Day by Hour
 Source: Authors (2024)

The accident count in the Wilayat area fluctuates between mid-morning and early afternoon hours with moderate traffic flow. However, it increases significantly from 4:00 PM to 5:00 PM, reaching its peak in the evening. The

highest accident count occurs between 5:00 PM and 05:00 AM. This surge in accidents during the evening hours is attributed to increased traffic congestion during the evening rush hour, shorter reaction times, and more aggressive driving behaviour. The graph shows the daily number of accidents for each Wilayah.

After a long day, drivers may experience fatigue or become distracted, potentially impairing their ability to maintain focus on the road. This factor, along with the use of mobile devices while driving, can significantly increase the risk of accidents. During the evening hours, natural light diminishes, and visibility decreases. Reduced visibility can make detecting potential road hazards more challenging, increasing the likelihood of accidents. Driving during the evening hours requires different skills compared to daylight driving. Factors such as oncoming headlight glare, increased difficulty judging distances, and impaired depth perception can pose challenges for drivers, leading to accidents.

The Possible Relationship between Hotspots and Possible Factors of Road Accidents: A Qualitative Approach

Understanding the relationship between hotspots, defined as areas with a high concentration of road accidents, and the potential factors contributing to these accidents is crucial for effective accident prevention and road safety measures. By identifying and analysing the factors associated with accident hotspots, authorities, policymakers, and traffic safety experts can develop targeted interventions and strategies to reduce the frequency and severity of accidents in these areas.

The factors influencing accident hotspots include roadway characteristics, environmental conditions, traffic volume, and driver behaviour. Environmental conditions, such as adverse weather conditions, can significantly impact driver visibility, vehicle handling, and braking capabilities. Identifying areas prone to flooding or poor drainage can prioritise safety measures. Driver behaviour, including speeding, aggressive driving, distracted driving, impaired driving, and non-compliance with traffic rules, contributes to accident-prone areas.

As indicated in Figure 7, this study reveals that speed is the primary cause of accidents, with 264 reported incidents. Speeding increases the likelihood and severity of accidents due to reduced control, longer stopping distances, and decreased reaction times. Driver error or negligence, such as running red lights or ignoring traffic rules, contributes significantly to road incidents. Careless driving accounts for 71 accidents, indicating a lack of attention, failure to anticipate hazards, or insufficient safety distance, including distractions like texting or eating while driving.

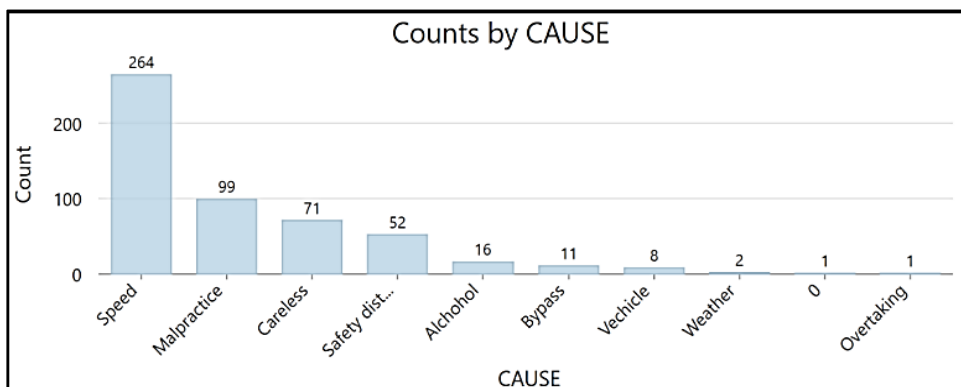


Figure 7: Graph of the Number of Accidents by Cause
 Source: Authors (2024)

Maintaining a safe distance between vehicles is crucial for preventing accidents. Alcohol-related accidents account for 16 incidents while driving under the influence increases the risk. Bypass, vehicle-related issues, weather conditions, and overtaking cause fewer accidents but still warrant attention and potential interventions. These factors should be addressed to prevent accidents. The graph analysis also shows that speed, malpractice, and careless driving are the leading causes of accidents, with speed being the most common. Addressing these factors is crucial for improving road safety. Measures include enforcing speed limits, educating drivers on responsible driving, promoting safe distances, and implementing policies to discourage alcohol-impaired driving. These targeted interventions can reduce accident rates, mitigate consequences, and enhance road safety.

CONCLUSION

Road traffic accidents in Oman, particularly in the Muscat Governorate, have significant social and economic impacts. Innovative approaches to processing spatial data are crucial to addressing this issue. GIS and spatial analysis are valuable techniques for mapping and analysing road accidents, providing insights into distribution patterns. This study identified the high-risk locations in the Muscat Governorate from 2019 to 2021 due to densely populated areas and heavy traffic flow. The spatial pattern of accidents was dispersed, indicating the need for a thorough investigation of this critical scenario. Qualitative effect analysis between hotspots and road accidents revealed potential risk factors such as roadway characteristics, environmental conditions, traffic volume, driver behaviour, and vulnerable road users. Speeding, malpractice, careless driving, and safety significantly impact the accident hotspots, providing valuable insights for prioritising safety measures, evaluating infrastructure, and implementing

targeted interventions. Improving road infrastructure, promoting responsible driving behaviour, and enhancing overall safety are essential to reducing accidents in the governorate. Future research will integrate geospatial data sources such as road networks, demographics, human behaviour, and land use data to understand the factors influencing accident hotspots empirically.

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THE NEXUS OF LANDSCAPE: INTERRELATION BETWEEN LANDSCAPE VALUE WITH ASSOCIATED REGULATIONS IN MALAYSIA

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Abstract

The landscape spectrum of Malaysia portrays rich, multiple natural and developed landscapes. Surprisingly, there are not any regulations that directly govern the landscape. It depends entirely on existing regulations that are not mentioned in detail regarding the 'landscape' specifically. As an alternative mechanism, it has several regulations used by landscape practitioners that help to manage and govern landscape planning and development. It regrets that these regulations have not been properly enforced due to some issues, which potentially can cause inefficiencies in development. Landscape value is an effective way to deeply understand the significance of landscape holistically. This study aims to examine related acts concerning landscape value in Malaysia using an archival review, identify the interrelationship of the landscape with associated regulations and analyze the relationship between these acts and the understanding of landscape in Malaysia. The findings of this research will be used to discover potentialities and constraints of the associated landscape regulations regarding their relationship with landscape value and landscape governance in Malaysia.

Keywords: landscape value, landscape governance, associated landscape regulation

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INTRODUCTION

The term “landscape” is used by many different disciplines with various connotations (Teh et al., 2020). Landscape includes ecological diversity, botanical or cultural significance, history, traditions, evolution, spatial structure, economic value, countless narratives describing the way it impacts us and the aspirations we have for its future (Doherty & Waldheim, 2016). The landscape is an important component of quality of life for people everywhere both in urban and rural areas, degraded areas or of high quality, and in areas recognized for their outstanding beauty as well as in everyday areas (Council of Europe, 2000).

Over the last five decades, Malaysia has experienced rapid economic, social, and environmental changes, with development processes ongoing. In Malaysia, currently there is no specific law and regulation pertaining to landscape (Ibrahim et al., 2009). The only written regulation mentioned about landscape is National Landscape Policy, published in 2011 by *Jabatan Landskap Negara, Kementerian Perumahan dan Kerajaan Tempatan Malaysia*. Landscape regulations are seen as a cause of delays in the development implementation process by landscape practitioners. Consequently, landscape practitioners may not aware of the magnitude and complexity of the associated regulations because they involve management and enforcement by several agencies which later leads to conflicts in determining the source of power in landscape development process.

The aim of this study is to examine relevant facts regarding landscape value in Malaysia using a document review method. The objectives are to identify the interrelationships between landscape and associated regulations. Then, to analyze the relationship of these acts with the understanding of landscape in Malaysia.

LANDSCAPE AND REGULATIONS

The landscape is a vital part of our environment which influences the quality of life (Teh et al., 2020). It is a spatial social-ecological system that allows the identification of specific management challenges: integration of multiple views, organizational levels, intricate spatial-temporal patterns, and uncertainties (Allain et.al., 2017). Two crucial aspects of the landscape in the transformation process are its role as resources and its capacity for transformation (Suryantini, et al., 2021). Landscape represents a section of the environment. It consists of natural components such as soil, trees, landforms, and water, as well as the various cultural components or developed forms, such as farms, recreational areas and engineered developments, and housing (Jackman, 1980). It is a significant part of people’s quality of life in all areas and obliges signatories to make legal provisions for landscape protection, management, and planning. (Jones, 2007). It also often changes according to specific needs, whether they are to be developed, preserved, or conserved. (Teh et al., 2020). The definition of landscape also allows for the consideration of potential conflicts between natural and human-

related processes and the achievement of healthy multifunctional and resilient landscapes (Pereponova et al., 2023). Even though “landscape” is a term frequently used in landscape policy and planning, the term lacks a clear definition. However, generally, it can be understood as the physical and visible features of a particular area, including its natural elements, such as mountains, rivers, and vegetation, as well as human-made elements, such as buildings, roads, and infrastructure. A regulation or law that mandates certain categories to go through specified evaluations serves as the catalyst for environmental protection in land development projects both, globally and locally (Suaree et al., 2023).

The landscape is an important national resource and outstanding natural and cultural inheritance that is widely appreciated (Teh et al., 2017). However, landscape resources and elements have not been given due attention and recognition holistically (Teh et al., 2018). Integrating the right-based landscape regulation approaches into the landscape development process is necessary for better governance of the landscape. Landscape governance involves how public administration manages its policies, from its inception through action, with the involvement of the public and private sectors (Muhamad et al., 2023). Landscape governance serves as a source of environmental regulation and policy integration. It engages landscape resources, stakeholders, the stage of the landscape development process, and landscape practitioners in the decision-making procedures through the establishment of a platform to manage the landscape development process. Most associated regulations and policies related to landscape-related environmental law in Malaysia are based on administrative affairs, managing, developing, and protecting the land.

In Malaysia, landscape is not mentioned directly in any bounded regulations which leads to inconsistencies in implementation. (Wirawan et al., 2023). This problem is evident when there is no policy or legislation focusing directly on landscape management, development, maintenance, conservation, or protection. Therefore, proper initiatives for adapted policy and rules for landscape management and protection (Antrop, 2005) need to be established using existing regulations to obtain a method that can be a source of legislation for landscape governance in Malaysia.

LANDSCAPE VALUE

Landscape value refers to the relative value or importance attached to different landscapes by society based on their landscape qualities (Landscape Institute, 2021). It is related to increased awareness, responsibility, and place attachment (García-Martín et al., 2018). Besides, landscape values reflect personal guiding principles and enduring beliefs, recreation represents a diverse set of human behaviours influenced by their values and beliefs (Biedenweg et al., 2019). The concept of landscape value can capture the holistic character of landscape-related benefits and values. (Gamboa et al., 2023). Landscape value research has been

motivated by the need to inform and enhance land use planning and environmental management. (Brown & Brabyn, 2012). Thus, landscape values range from instrumental values (for places that may provide sustenance) to symbolic values (for places that may represent abstract ideas). (Zhu. et. al, 2010). Landscape value has various benefits and values that landscape to people and the environment. (International Federation of Landscape Architects,2021). Landscape value is the relative value or importance attached to different landscapes by society on account of their landscape qualities.

Landscape values are the sum of the physical, biological, aesthetic, cultural, and social aspects and attributes of the landscape that contribute to the well-being of individuals and communities. Landscape value highlights the importance of protecting and enhancing landscapes, for both current and future generations. (International Federation of Landscape Architects,2021). Landscape values are understood as a “relationship value” that bridges held and assigned values (Brown and Weber, 2012). They are perceived attributes of a landscape that are thought to result from a transactional concept of human–landscape relationships (Brown, 2005). The original typology of landscape values was developed by (Brown and Reed, 2000), who established a set of 13 values (aesthetic, recreation, biodiversity, life-supporting, economic, learning, historical, cultural, future, intrinsic, spiritual, therapeutic, subsistence). This typology has been adapted and used for different applications, such as public lands, country management, urban areas, rural landscapes, and coastal landscapes. It is used as a guidance for most researchers to identify landscape values for different places and conditions.

However, there has been no comprehensive review on the interrelation of landscape values and regulations in Malaysia. This is due to the lack of bounded regulations and strong enforcement for landscape regulation and protection.

METHODOLOGY – TOWARDS THE COMPATIBILITY OF LANDSCAPE VALUE WITH ASSOCIATED REGULATION IN MALAYSIA

In the early stages of this study, archival review from associated regulations related to the landscape was essential to obtain clear fundamentals from the analysis. From 1957 until 2022, 836 acts have been enacted and published under the series of Laws of Malaysia. A review of 737 active acts with ninety-nine (99) non-active acts. In figure 1 mention, there are twenty-five (25) acts related to the landscape development process were analyzed (Teh et al., 2024). According to Tun Ariffin Zakaria in 2015, the former Chief Justice of Malaysia, the Malaysian government is striving to provide the best legal infrastructure for the environment. We have 34 pieces of principal legislation enacted for environmental protection.

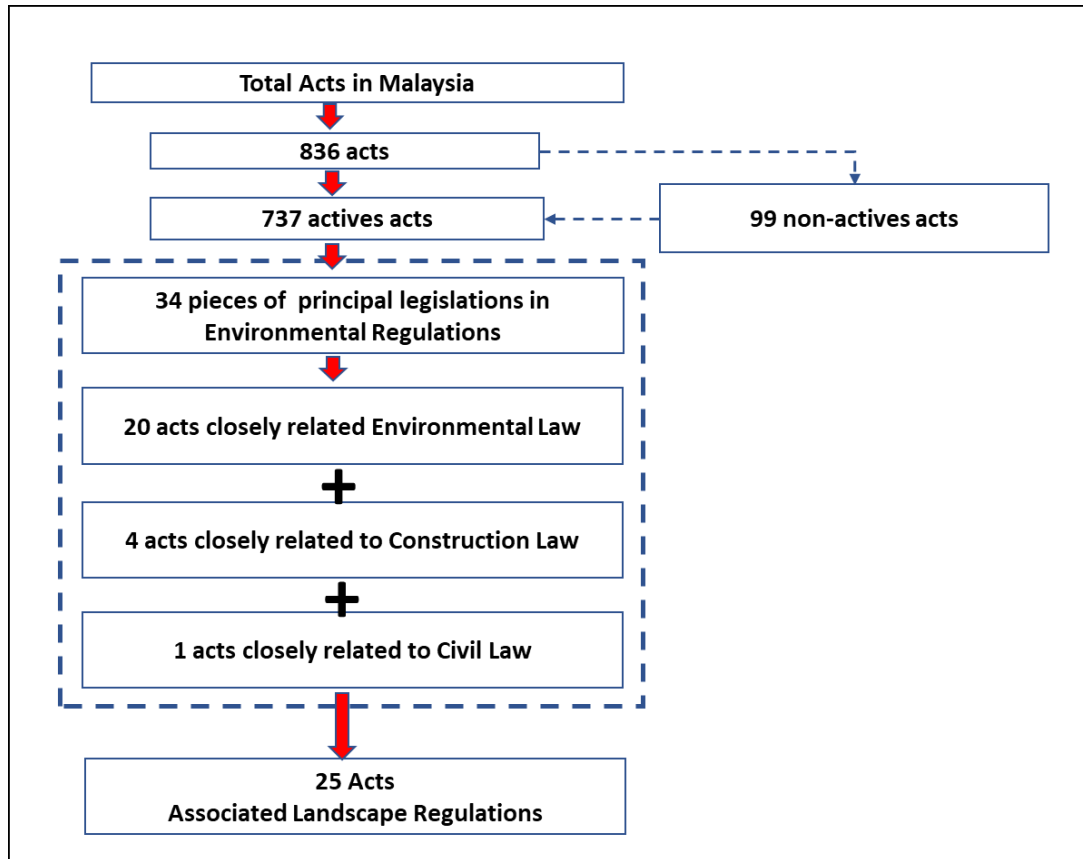


Figure 1 Flow of Associated Landscape Acts in Malaysia

Source: Authors

The impact of this lack of understanding creates a waste of a lot of time and causes delays in the landscape development process. Environmental law, together with associated regulations, stems from thirty-four (34) pieces of principal legislation enacted for environmental protection, and twenty-five (25) acts are closely related to stages of the landscape development process in Malaysia (Teh et al., 2024). Therefore, these associated regulations will be mapped with the 13-landscape value factors contained in 33 literature reviews. The aim is to determine which landscape value factor is significant in relation to associated regulation in Malaysia.

FINDING AND DISCUSSION

Assessing Landscape Value within Associated Landscape Regulations in Malaysia

There are 33 articles related to landscape value were reviewed. These articles were filtered based on suitability for Malaysian conditions. There are 13 landscape value categories identified by Brown & Reed (2000).

Analysis of the Relationship of Landscape Value Categories with the Literature

Table 1 explains about 13 categories of landscape value found in 33 articles in the literature review. The category with the strongest relationship with the literature is biodiversity with a score is 97% showing that 33 articles mentioned biodiversity as a landscape value. The lowest scoring category is learning, with a score of 45%, mentioned in 15 articles as a landscape value. Overall, 7 of the categories of landscape value scored more than 70% indicating a good relationship between landscape value and current associated landscape regulation in Malaysia.

Table 1: Analysis of the Relationship of Landscape Value Categories with the Literature Review

Reference	Aesthetic	Recreatio	Biodiversi	Life-Supportin	Economic	Learning	Historical	Cultural	Future	Intrinsic	Spiritual	Therapeut	Subsistenc
1 Landscape Institute, 2021	●	●	●	●			●	●	●	●	●	●	●
2 International Federation of Landscape Architects, 2021	●	●	●	●	●	●	●	●	●	●	●	●	●
3 Zaman et al., 2022	●	●	●	●	●		●	●	●	●	●		●
4 García-Martín, M., Plieninger, T., & Bieling, C., 2018	●	●	●	●	●		●	●	●	●	●	●	●
5 Baylan, E., & Karadeniz, N., 2018	●	●	●	●	●	●		●	●	●	●	●	●
6 Solecka et al., 2022	●		●	●				●		●			
7 Biedenweg et al., 2019	●	●	●	●		●	●	●		●	●		
8 Martín, R., & Yepes, V., 2023	●	●	●		●	●		●	●	●		●	
9 Cerveny, L. K., Biedenweg, K., & McLain, R., 2017	●	●	●	●	●	●	●	●	●	●	●	●	●
10 Ernoul et al., 2018	●	●	●		●					●			●
11 Havas et al., 2016	●	●	●	●	●	●	●	●	●	●	●	●	●
12 Zhu et al., 2010	●	●	●	●	●	●	●	●	●	●	●	●	●
13 Kovács et al., 2022	●	●	●		●	●	●	●	●	●	●	●	
14 Inoue et al., 2022	●	●	●	●	●	●	●	●	●	●	●	●	●
15 Korpilo et al., 2023	●	●	●	●						●		●	

	Reference	Aesthetic	Recreatio	Biodiversi	Life-Supportin	Economic	Learning	Historical	Cultural	Future	Intrinsic	Spiritual	Therapeut	Subsistenc
16	Stephenson, J., 2008	●	●	●	●			●	●	●	●	●		●
17	Gamboa et al., 2023		●	●		●		●	●					●
18	Stahl Olafsson et al., 2022	●	●	●		●		●	●					●
19	Brown, G., & Brabyn, L., 2012	●	●	●	●	●	●	●	●	●	●	●	●	●
20	Othman, N., Mohamed, N., & Ariffin, M. H., 2015	●	●	●			●				●			
21	Schulz, C., Martin-Ortega, J., & Glenk, K., 2018			●		●			●	●	●			●
22	Šťastná et al., 2018		●	●	●		●	●	●	●		●	●	●
23	Garcia et al., 2017	●	●	●	●	●	●	●	●		●	●	●	●
24	Baránková et al., 2011	●		●	●	●		●	●		●			
25	Parron, L. M., Villanueva, A. J., & Glenk, K., 2022	●		●		●					●			●
26	Plieninger et al., 2018	●	●	●		●		●	●		●			●
27	Tindale et al., 2023	●		●	●	●		●	●		●	●	●	●
28	Brown, G., Weber, D., & de Bie, K., 2014	●	●	●	●	●	●	●	●		●	●	●	●
29	Chen, Y., Parkins, J. R., & Sherren, K., 2018	●	●		●			●	●			●		
30	Willis et al., 2012			●							●			●
31	Plieninger et al., 2023	●		●	●	●		●	●		●	●		●
32	Hejnowicz, A. P., & Rudd, M. A., 2017			●	●						●			●
33	Türkyilmaz, Ç. C., 2016	●	●	●				●	●		●	●		●
Total of LR		28	25	32	22	22	14	23	27	15	29	20	16	25
Percentage (%)		85	76	97	67	67	45	70	82	45	88	61	48	76

Source: Author

Analysis of the Relationship of Landscape Value Categories with 25 Associated Acts in Malaysia

Table 2 presents the analysis of the relationship of landscape value categories with 25 associated landscape acts in Malaysia. It is meant to clearly define the mapping of 13 categories with these acts. The landscape value category “life-supporting” is related with 22 acts, representing 88% of the overall 25 acts. Meanwhile, the lowest, “spiritual” is only related to 4 acts which makes up 16% of the overall acts. The overall score is not impressive. It portrays the real picture of landscape regulation in Malaysia which lacks a clear understanding to govern landscapes. 10 of the categories score below 70%.

The analysis explains Act 171 - Local Government Act 1976, covers 100% of the 13 categories. While Act 332 - Copyright Act 1987 only covers 8%, addressing only 1 category. Overall, the relationship is not in good condition, with 15 acts scoring below 70%. The second analysis shows that 25 associated

landscape acts in Malaysia are not effectively governing the landscape. The relationship between landscape and environmental law is separated into several categories. The categories include environmental quality, construction, land planning, marine environment, horticulture and agriculture, and civil law. Based on an analysis of existing law, twenty-five (25) regulations can be cross related to landscape regulations.

Table 2: Analysis of the Relationship between Landscape Value Categories and 25 Associated Acts in Malaysia

Act	Aesthetic	Recreation	Biodiversity	Life-	Economic	Learning	Historical	Cultural	Future	Intrinsic	Spiritual	Therapeutic	Subsistence	Total	Percentage (%)
1 Act 172- Town and Country Planning Act 1976	•	•	•	•	•	•			•			•		8	62
2 Act 134 - Aboriginal People Act 1954	•		•	•	•	•	•	•	•	•	•	•	•	12	92
3 Act 167 - Plant Quarantine Act 1976			•		•	•						•		4	31
4 Act 190 – Federal Capital Act 1960	•	•		•	•	•	•	•	•	•		•	•	12	92
5 Act 226 - National Park Act 1980	•	•	•	•		•	•	•	•	•	•	•	•	12	92
6 Act 385 - Land Conservation Act 1960	•	•	•	•		•	•	•	•	•			•	10	77
7 Act 634 - Protection of New Plant Variety Act 2004			•	•	•	•								4	31
8 Act 311 - Exclusive Economic Zone Act 1984			•	•	•				•					4	31
9 Act 317 - Fisheries Act 1985	•	•	•	•	•	•	•	•	•	•			•	11	85
10 Act 418 - Water Act 1920	•	•	•	•	•	•	•	•	•	•			•	11	85
11 Act 127- Environmental Quality Act 1974			•	•		•			•			•		5	38
12 Act 474 - Land Development Act 1956	•	•	•	•	•	•		•	•			•		9	69
13 Act 313 - National Forestry Act 1984	•	•	•	•	•	•			•	•		•	•	10	77
14 Act 645 - National Heritage Act 2005	•	•	•	•		•	•	•	•	•	•		•	11	85
15 Act 56 - National Land Code 1956	•	•		•	•				•			•		6	46
16 Act 133 - Street Drainage and Building Act 1974		•		•	•				•			•		5	38
17 Act 716 - Wildlife Conservation Act 2010		•	•	•		•				•			•	6	46

Act	Aesthetic	Recreation	Biodiversity	Life-	Economic	Learning	Historical	Cultural	Future	Intrinsic	Spiritual	Therapeutic	Subsistence	Total	Percentage (%)
18	Act 171 - Local Government Act 1976	•	•	•	•	•	•	•	•	•	•	•	•	13	100
19	Act 354 - Drainage Works Act 1954		•		•				•			•		5	38
20	Act 386 - Irrigation Areas 1953		•	•	•				•	•		•	•	8	62
21	Act 520 - Construction Industry Development Board Act 1994	•	•		•				•					5	38
22	Act 746 - Construction Industry Payment and Adjudication Act 2012 (CIPAA)				•	•								2	15
23	Act 118 - Housing Development (Control and Licensing) Act 1966		•		•	•			•					4	31
24	Act 514 - Occupational Safety and Health Act 1994				•	•			•			•		4	31
25	Act 332 - Copyright Act 1987				•									1	8
Total of Acts		13	17	16	22	20	15	8	9	19	11	4	14	11	
Percentage (%)		52	67	64	88	80	60	32	36	76	44	16	56	44	

Source: Author

CONCLUSION AND LIMITATION

The term "landscape" has been defined as a system of spatially arranged entities that are structurally and functionally interconnected, allowing for flexibility to consider the dynamic nature of relationships between environmental, economic, and social elements of complex systems. It is not tied to geographical or temporal boundaries and enables continuous learning and adaptation processes for improved management in changing conditions (Pereponova et al., 2023).

Overall, according to the methodology that has been implemented and tested, identifying the landscape in Malaysia itself is not clear enough and is not given the concern it deserves. In the analysis that has been carried out, the relationship between landscape value and the existing regulation is very limited and there is a gap in understanding that can impact on the landscape industry in Malaysia. Thus, it is appropriate to improve the context of landscape regulation to provide legal direction in the development and preservation of the landscape. It provides a clear path to govern and manage all landscape contexts and strengthen the character of the landscape. Therefore, the test in the document

review and the test in the literature review need to be synthesized. From the document review, the clear part of defining the landscape is in the landscape value analysis. To get a positive impact, a low landscape value score is considered.

Limitations of this research include little cross-fertilization across disciplines of landscape in Malaysia, the lack of accessibility/comprehension ability of landscape legislation research to suit the Malaysian condition, and the orientation of much research towards theoretical rather than practical implementation. It also includes identifying the relationship of landscape value with associated landscape regulation in Malaysian context. There is a limitation of literature closely related to this research. For future research, these findings can be more significant and useable to create an impactful outcome to the landscape regulation and landscape value in Malaysia.

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ANALYSING NEIGHBOURHOOD SAFETY FOR CHILDREN IN SHAH ALAM, MALAYSIA USING FUZZY-AHP AND GIS

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Abstract

Children could be vulnerable to being victims of kidnapping cases due to their cognitive level in perceiving safety. Until September 2023, 4,471 missing persons were reported all around Malaysia. As there is a growing concern regarding children's safety, this study was conducted throughout the Shah Alam region as it is one of the biggest cities in Selangor, which has several factors contributing to kidnapping cases towards children. However, does every section in Shah Alam have a high level of safety and is suitable for children? Geographic Information System (GIS) and Fuzzy-Analytic Hierarchy Process (AHP) are used as the main processes in decision-making when identifying the Neighbourhood Safety for Children in Shah Alam, Selangor, Malaysia. Based on previous studies, five (5) main criteria were selected, i.e., Perceived Safety, Transportation Accessibility, Land-Use, Public Facilities and Population Density. They were represented on the ground using the sub-criteria. Spatial data was collected, and 15 criterion maps were established, undergoing editing, rasterisation and reclassification. A pairwise comparison matrix was created to determine the weightage of these criteria, and Weighted Overlay Analysis was used to identify the safety level for each section. The results showed moderate neighbourhood safety (index level 5 or 6) for children in Shah Alam, with southern and western areas having worse safety levels (index value 4) compared to the middle and eastern parts. The safety index exhibits a random pattern (Moran I: -0.3333), indicating that it is spatially independent and unaffected by nearby sections. This index could help local authorities improve safety measures in the area.

Keywords: children safety, fuzzy-ahp, GIS, MCDA, spatial analysis

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INTRODUCTION

In Malaysia, children make up 27.1% of the population, with Selangor having the highest number of children under 18 (DOSM, 2021). Childhood is regarded as the most crucial time for social, physical and mental growth. Even depriving children of their nourishment, healthcare, education and affection for a short period can give them long-term and permanent effects. Therefore, child protection is crucial in creating a safe environment for children. Neighbourhood safety among the residents should be analysed, especially in Shah Alam, to make sure that the environment is safe and that all measures are calculated for children's safety.

In September 2022, Malaysia experienced an increase in kidnapping cases in school areas, causing concern for parents' safety, which may affect children's mental, physical and social development. Neighbourhood safety is crucial for improving child safety, particularly in playgrounds, surrounding areas and education selection. Addressing these issues is essential for ensuring the safety of children in Malaysia. Kidnapping cases could be influenced by several factors that are related to the poor neighbourhood safety for children, such as there is poor walkability around the area, poor lighting sources, a high number of crime cases, low constant police presence, a lot of abandoned houses and storefronts and lack access to well-maintained recreation areas (Kallus, 2015).

Kidnapping cases could be influenced by several factors that are related to the poor neighbourhood safety for children, such as there is poor walkability around the area, poor lighting sources, a high number of crime cases, low constant police presence, a lot of abandoned houses and storefronts and lack access to well-maintained recreation areas (Montréal, 2015). The factors that influenced neighbourhood safety among the children were identified by using GIS technology, and the data was translated into the GIS database for spatial analysis. Neighbourhood Safety for Children in Malaysia is a very less common topic to be studied based on the findings of previous research and studies related to GIS. Nonetheless, the concept of the GIS Index Model may be used to assess it.

Multi-Criteria Decision Analysis (MCDA) technique, AHP especially, was frequently used in GIS models to make the best decision depending on the criteria. The rise in kidnapping cases necessitates a better technique for identifying neighbourhood safety for children using Spatial-MCDA. In spite of that, using the AHP method has some limitations due to uncertainty or fuzzy information. Thus, Fuzzy-AHP was introduced to address the uncertainty issue. Therefore, this study used Fuzzy-AHP and GIS to evaluate safety for children in Shah Alam, Selangor. The factors influencing safety were determined and used for the evaluation to categorize the study area into the safest to least safe neighborhoods. The findings suggest the need for further research on neighborhood safety measures using MCDA.

LITERATURE REVIEW

Neighbourhood Safety for Children

Neighbourhoods are residential areas within towns or cities, designed for development and social issues (Gokumen, 2018). They include structures, roads, public areas and walkways, providing opportunities for physical activities. City planners, architects and urban designers focus on neighbourhoods as remedies for urban social issues, often based on preindustrial cities' interactions (Gheda & Ilmi, 2019).

Children's growth is affected by their neighborhood environment (Yusuf et al., 2021). It can be said that difficulties regarding the safety of children occur, especially in nearby industrial and developed cities (Gheda & Ilmi, 2019). Studies suggested that most children clearly preferred to be involved in outdoor activities such as play and learning outside of the housing area (Jacobs, 1961; Gemmel et al., 2023). However, the neighbourhood area could be less safe for the children.

A crime against children has often been heard and talked about either on social media or in person. The topic has frequently been read and listened to on the radio, in newspapers, on gadgets, and on television, which brings fear to all parents (Jain, 2011). Children's safety is one of the most important things to be identified, handled and taken into account. Children normally tend to enjoy physical activity, whether it is around the neighbourhood area, in the park or in other places, as long it is outside of their houses. Therefore, the safety of the children around the neighbourhood area must be considered. Due to the high exposure to danger that has been brought about by modern development, there might no longer be freedom for children to roam around while enjoying outdoor activities without feeling paranoid and anxious about their safety (Jacobs, 1961).

The development and design of a neighbourhood play a huge role in producing a safe community to overcome parental fear (Lueder, 2007). Safety is described as one of the methods to protect a person or group of people against any accident that might be harmful to others. If some precautions were taken, unnecessary accidents could be avoided, and safety measures could be identified and carried out. Compared to an untrained city street, a well-used city street is more likely to be a safe street (Ali, 2020). Hence, to design a safe neighbourhood, there is a need to consider the number of shops and public areas dispersed along the sidewalks, which comply with the concept of Crime Prevention through Environmental Design (CPTED) that is widely used these days.

Neighborhood safety for children is influenced by factors such as residential density, public transit density, and crime density. Residential density impacts walkability and environment, while public transit density increases the risk of accidents and crimes involving children. Land-use crime density, including residential, commercial, educational, industrial, and recreational facilities, also affects safety. High crime density in these areas poses significant

dangers to children, making it crucial to consider these factors when assessing child-friendly environments.

Table 1: Criteria Influencing Children’s Safety in a Neighbourhood

Author(s)	Perceived Safety	Transportation Accessibility	Land Use	Public Facilities	Population Density
Zougheibe et al., 2021	✓	✓		✓	✓
Azmi et al., 2015	✓	✓	✓	✓	✓
Ogneva-Himmelberger et al., 2019	✓		✓	✓	✓
Ilmi et al., 2018	✓		✓	✓	✓
Rakhimova et al., 2022	✓		✓	✓	✓
Azlan and Naharudin, 2020	✓	✓	✓		
Tappe et al., 2013	✓	✓	✓	✓	✓
Ilmi et al., 2018	✓		✓	✓	✓
Tupenaite et al., 2018			✓	✓	✓
Lueder, 2007	✓	✓	✓	✓	✓
Brown et al., 2019	✓		✓	✓	✓

Source: Authors (2024)

Spatial-MCDA in Measuring Neighbourhood Safety for Children

GIS and non-GIS methods can be used to assess neighbourhood safety for children. One of the GIS methods, is GIS index model that is related to the mathematical or computation model, which combines multiple criteria in order to produce an index value for the purpose of representation of specific data, such as for suitability index map or phenomena (Chang, 2016; Roslan & Naharudin, 2023). There are several index models that are normally used in a multi-criteria analysis, such as the Weighted Linear Combination method, which is divided into two index models: the vector-based index model and the raster-based index model. The vector-based index model refers to creating a ranking by aggregating the attribute based on the features such as points, lines and polygons, while a raster-based index model is the data that are represented as a grid of cells where each cell has its own value.

GIS index model uses the concept of MCDA including AHP (Saaty, 1980; Malczweski & Rinner, 2015; Elhosni & Faiz, 2021). Spatial-MCDA is a general decision theory and analysis that often implemented in decision-making by integrating geographical details (Malczweski & Rinner, 2015; Vogdrup-Schmidt et al., 2019). It is also known as the combination of GIS data processing combined with the process and capabilities of MCDA decision-making. The combination is very useful for data collection, keeping, processing, interpretation and analysis.

The decision-making phase in AHP involves overlapping criteria and can be divided into three levels: hierarchy, pairwise comparisons, and uncertainty

(Ruslan et al., 2023). The uncertainty of MCDA in the weighting method is the confidence in assuming that the decision maker has the capabilities to make an accurate analysis (Malczweski & Rinner, 2015). This uncertainty is often mistaken for the MCDA model, as the information gathered is incomplete or imprecise, resulting in inaccurate decision-making. This causes preference error, a term of preference uncertainty, which defined as the difference between assessed weight and real value criteria.

The Fuzzy-AHP method is an enhanced analytical methodology developed from classical AHP, which is used to solve the uncertainty of both quantitative and qualitative criteria in MCDM problems. This technique aims to overcome the fuzziness problem in decision-making, which can cause imprecise judgments when using conventional AHP approaches (Malczweski & Rinner, 2015). Fuzzy sets provide a smooth transition between elements and non-elements, allowing decision-makers to focus on crucial factors. With that, Fuzzy-AHP ignores less significant criteria, giving equal weighting to each other, enabling evaluation of uncertainty.

RESEARCH METHODOLOGY

Figure 1 illustrates the flow of methodology used in this study that implement a combination of Fuzzy-AHP and GIS. The former was used to calculate the weightage for each criterion and its sub-criteria, while the latter was utilised to create all spatial data and measure the safety level for children in a neighbourhood.

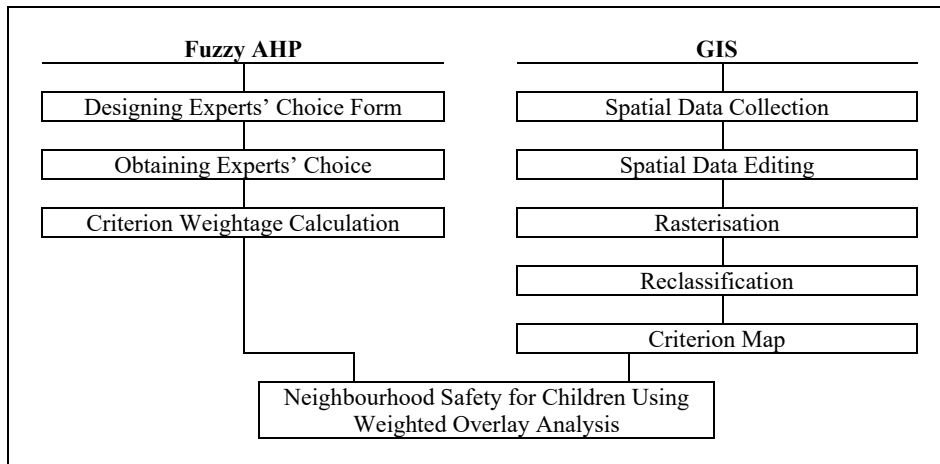


Figure 1: Research Methodology Flowchart
Source: Authors (2024)

Fuzzy-AHP to Determine Weightage of Criteria and Subcriteria

Figure 2 shows the hierarchical structure that was used to represent criteria and sub-criteria and their dependencies in the decision-making. The first level of the hierarchical structure was identified by the goal of the study, which is the Neighbourhood Safety for Children. The second level of the hierarchy is the criteria that was chosen to determine the level of safety in the neighbourhood for children, and the third level consists of the sub-criteria of each main criteria.

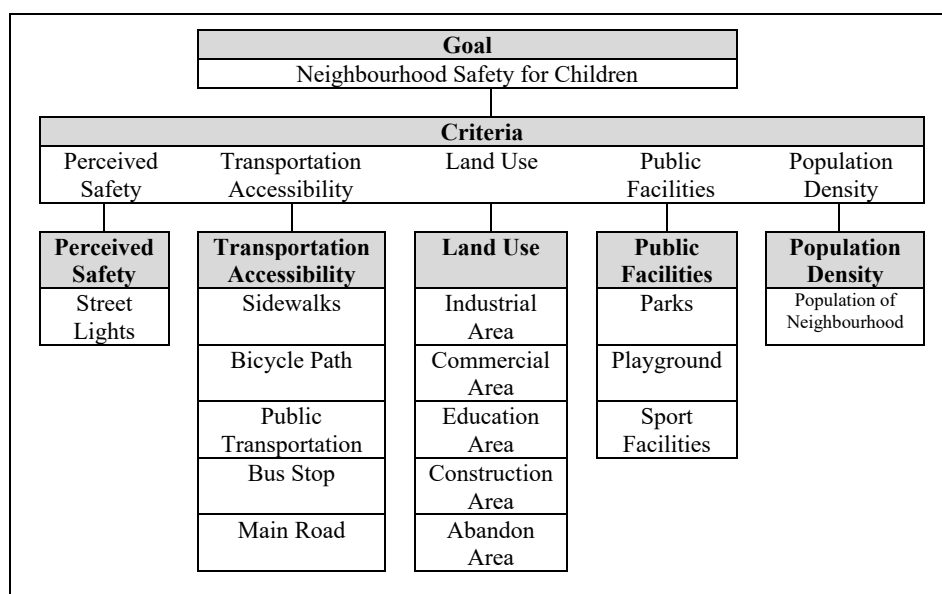


Figure 2: Hierarchical Structure

Source: Authors (2024)

The experts' choice form (Figure 3) was designed according to the dependencies in the hierarchical structure. Each node in the same cluster was compared to each other in a pair. Thus, in this case, all main criteria and subcriteria were compared to each other in a pair. A brief description and example of how experts (Table 2) can give their judgement on the pairwise comparison was included in the form to enhance familiarity in answering the questions.

Table 2: Experts' for Pairwise Comparison Survey

Expert(s)	Description	
Academician	A1	Professor in Local University
	A2	Professor in Local University
Industrial	I1	Expert from local authority
	I2	Expert from crime perspective
	I3	Expert from child welfare agency

Source: Authors (2024)

Pairwise Comparison of Main Criteria

	Extremely Importance (9,9,9)	Intermediate Value (7,8,9)	Very Strong Important (6,7,8)	Intermediate Value (5,6,7)	Strong Important (4,5,6)	Intermediate Value (3,4,5)	Moderate Important (2,3,4)	Intermediate Value (1,2,3)	Equal Importance (1,1,1)	Intermediate Value (1,2,3)	Moderate Important (2,3,4)	Intermediate Value (3,4,5)	Strong Important (4,5,6)	Intermediate Value (5,6,7)	Very Strong Important (6,7,8)	Intermediate Value (7,8,9)	Extremely Importance (9,9,9)	
Perceived Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Transportation Accessibility
Perceived Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Land-Use
Perceived Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Public Facilities
Perceived Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Population Density
Transportation Accessibility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Land-Use
Transportation Accessibility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Public Facilities
Transportation Accessibility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Population Density
Land-Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Public Facilities
Land-Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Population Density
Public Facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Population Density

Pairwise Comparison for subcriteria of Transportation Accessibility

	Extremely Importance (9,9,9)	Intermediate Value (7,8,9)	Very Strong Important (6,7,8)	Intermediate Value (5,6,7)	Strong Important (4,5,6)	Intermediate Value (3,4,5)	Moderate Important (2,3,4)	Intermediate Value (1,2,3)	Equal Importance (1,1,1)	Intermediate Value (1,2,3)	Moderate Important (2,3,4)	Intermediate Value (3,4,5)	Strong Important (4,5,6)	Intermediate Value (5,6,7)	Very Strong Important (6,7,8)	Intermediate Value (7,8,9)	Extremely Importance (9,9,9)	
Sidewalks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Bicycle Path
Sidewalks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Public Transport
Sidewalks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Bus Stop
Sidewalks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Main Road
Bicycle Path	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Public Transport
Bicycle Path	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Bus Stop
Bicycle Path	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Main Road
Public Transport	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Bus Stop
Public Transport	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Main Road
Bus Stop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Main Road

Pairwise Comparison for subcriteria of Landuse

	Extremely Importance (9,9,9)	Intermediate Value (7,8,9)	Very Strong Important (6,7,8)	Intermediate Value (5,6,7)	Strong Important (4,5,6)	Intermediate Value (3,4,5)	Moderate Important (2,3,4)	Intermediate Value (1,2,3)	Equal Importance (1,1,1)	Intermediate Value (1,2,3)	Moderate Important (2,3,4)	Intermediate Value (3,4,5)	Strong Important (4,5,6)	Intermediate Value (5,6,7)	Very Strong Important (6,7,8)	Intermediate Value (7,8,9)	Extremely Importance (9,9,9)	
Industrial Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Commercial Area
Industrial Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Education Area
Industrial Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Construction Area
Industrial Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Abandon Area
Commercial Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Education Area
Commercial Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Construction Area
Commercial Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Abandon Area
Education Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Construction Area
Education Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Abandon Area
Construction Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Abandon Area

Pairwise Comparison for subcriteria of Public Facilities

	Extremely Importance (9,9,9)	Intermediate Value (7,8,9)	Very Strong Important (6,7,8)	Intermediate Value (5,6,7)	Strong Important (4,5,6)	Intermediate Value (3,4,5)	Moderate Important (2,3,4)	Intermediate Value (1,2,3)	Equal Importance (1,1,1)	Intermediate Value (1,2,3)	Moderate Important (2,3,4)	Intermediate Value (3,4,5)	Strong Important (4,5,6)	Intermediate Value (5,6,7)	Very Strong Important (6,7,8)	Intermediate Value (7,8,9)	Extremely Importance (9,9,9)	
Parks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Playground
Parks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sport Facilities
Playground	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sport Facilities

Figure 3: Pairwise Comparison
 Source: Authors (2024)

The experts' choice was based on the Fuzzy-AHP method as the expert's choices are very important as it helps to identify the weight of the criteria based on the scale in the fuzzy scale of (1,1,1) to (9,9,9). Therefore, the experts

identified the importance of the criteria in determining the safety of the children in the neighbourhood area. From the experts' choice that was obtained, the weightage of the criteria was calculated using Microsoft Excel software, which was then used to determine the safety in the study area. The pairwise comparison matrix for each criterion and their subcriteria is shown in Figure 3.

GIS in Measuring Neighbourhood Safety for Children

This study involves two (2) types of data collection, which are primary and secondary data collection as described in Table 3. Primary data collection is based on the process of gathering the information and data that are related to the study through surveys, while secondary data collection is based on the data that was collected from other sources such as government agencies and open sources.

Table 3: Data Collected in the Study

Data		Type	Source(s)	Reason(s)
Rating of Criteria and Subcriteria		Table	Experts' Choice – Primary Data Collection	To determine the weightage of criteria and their subcriteria
Spatial Data of Subcriteria	Perceived Safety	Street Lights	Table in Excel	Primary Data Collection
	Transportation Accessibility	Sidewalks	Shapefile	Open Street Map
		Bicycle Path	Shapefile	
		Public Transport	Scanned Data	City Council
		Bus Stop	Shapefile	Open Street Map
	Main Road	Shapefile		
	Industrial Area	Shapefile		
	Land Use	Commercial Area	Shapefile	Ministry of Education
		Education Area	Table in Excel	Primary Data Collection
		Construction Area	Shapefile	
		Abandon Area	Shapefile	
	Public Facilities	Parks	Shapefile	Open Street Map
		Playground	Shapefile	
		Sport Facilities	Shapefile	
Population Density	Population of Neighbourhood	Table in Excel	Department of Statistics	Represent criteria in the spatial environment

Source: Authors (2024)

The process of spatialising the data involves georeferencing images, digitising features and checking topological data. This process uses software tools

to convert scanned images into digital formats or maps. However, errors are common in editing, affecting the quality of GIS data. To eliminate errors, topology editing is used to improve data quality. Topology editing includes adding rules to digitise data, with ten available for error identification. According to the study, one (1) data was obtained in a scanned format data that required to go through this process, which was the data on public transportation, while several data were collected in a digital format, which is in a shapefile format. This data was represented by point, polygon, or line features. The education area is represented in tabular data. To display it in ArcGIS Pro software, the tabular data are converted to a shapefile format. Geocoded tools were used to automatically identify the location of the education centre using its addresses in the tabular data and represented in point features.

Next, the rasterisation process was completed to convert the data to raster data. The rasterisation process in Shah Alam was automated using Modelbuilder software from ArcGIS Pro. Automation in GIS processing aims to reduce human errors and mistakes, as processing may involve multiple tasks. The process involved extracting raw data into various feature classes and population data for each boundary of sections. The output was then used for the next process. Reclassification processes are completed to process the data by using the technique of Weighted Overlay Analysis. The reclassification was done in the reclassify table, and the final output is for the Criterion Map for each of the sub-criteria of this study.

Criterion maps were created after processing GIS operations, representing each criterion as a map layer in the GIS database. These maps represent the evaluation criteria for alternative decisions. A criterion map represents the spatial dataset of criteria for this study, and the steps for creating a criterion map and geographic database are similar. The process of creating a criterion map was conducted using Euclidean Distance, creating a raster of each criterion. Then, the raster values were reclassified to create a standard scale value from 1-9 according to the Saaty scale. These maps are utilised to determine neighbourhood safety for children using Weighted Overlay Analysis.

The neighbourhood safety for children was modelled and measured using Weighted Overlay Analysis (WOA). Generally, WOA is the most popular approach used in identifying site suitability, but in this study, it was used to identify the safety of the neighbourhood area. This is because using WOA can determine the quantitative and qualitative data. Therefore, in this study, the weight was calculated based on the criteria that have been determined by the experts. The expert's weightage for each sub-criteria was assigned in the Influence tabular column based on the percentage of weightage. It was also classified into nine classes where the determination of the value of the weightage was classified and changed according to the parameter needed.

After that, the Spatial Autocorrelation of neighbourhood safety for children in Shah Alam was conducted as part of the analysis to identify the statistical relationship of the distribution of safety through every section in Shah Alam that has been obtained from the result of WOA. In this study, it is used to identify whether the distribution of the safety index is dispersed, random or clustered. The final map of the safety index was verified by an expert from the local authority. This stage is important to validate the method used and verify the results found to be similar to those of the real world. For this stage, the expert from the local authority was interviewed.

RESULTS AND ANALYSIS

Weightage of Criteria for Neighbourhood Safety for Children

Table 4: Overall Priorities of Criteria and Sub-Criteria

Main Criteria	Sub-Criteria	Weightage	Overall Priority	Percentage (%)
Perceived Safety	Streetlight	0.133	0.133	13
Transportation Accessibility	Sidewalks	0.089	0.013	1
	Bicycle Path	0.187	0.027	3
	Public Transport	0.250	0.036	4
	Bus Stop	0.191	0.028	3
	Main Road	0.282	0.041	4
Land Use	Industrial Area	0.307	0.083	8
	Commercial Area	0.152	0.041	4
	Education Area	0.138	0.037	4
	Construction Area	0.124	0.034	3
	Abandon Area	0.278	0.075	8
Public Facilities	Parks	0.321	0.060	6
	Playground	0.234	0.044	5
	Sport Facilities	0.445	0.083	8
Population Density	Population of Neighbourhood	0.264	0.264	26

Source: Authors (2024)

Table 4 shows the weightage of the criteria and its sub-criteria for overall priorities, which helps represent the final output of Neighbourhood Safety for Children in Shah Alam. The results indicate that the most influential criterion for children’s safety in a neighbourhood is Land Use, with a weightage of 0.271, followed by Population Density (0.264), Public Facilities (0.187), Transportation Accessibility (0.145), and Perceived Safety (0.133). Notably, there is a significant gap between the second and third criteria, Population Density and Public Facilities, with a difference of 0.077. The smallest gap is between the first and second criteria, Land Use and Population Density, with a difference of only 0.0068. Land Use is considered the most critical due to children’s frequent presence in educational areas. Population Density poses risks such as accidents

and limited outdoor spaces. Public Facilities, though generally safe, can have hazards like poor maintenance and lack of supervision. Transportation Accessibility is influenced by factors such as traffic accidents and pollution. Perceived Safety is the least influential, likely because street lighting is commonly present in urban areas, enhancing perceived safety.

For subcriteria, the least influential sub-criteria referring to the expert’s choice is the sidewalks, which are under the main criteria of Transportation Accessibility with a percentage of 0.013. The most influential subcriteria is the presence of streetlights (0.133), which is undoubtedly important for the safety of children. The findings revealed that proximity to certain land uses is the second most influential factor for safety, such as to industrial areas and abandoned areas, which is in line with previous literature by Gheda & Ilmi (2019).

Neighbourhood Safety for Children in Shah Alam

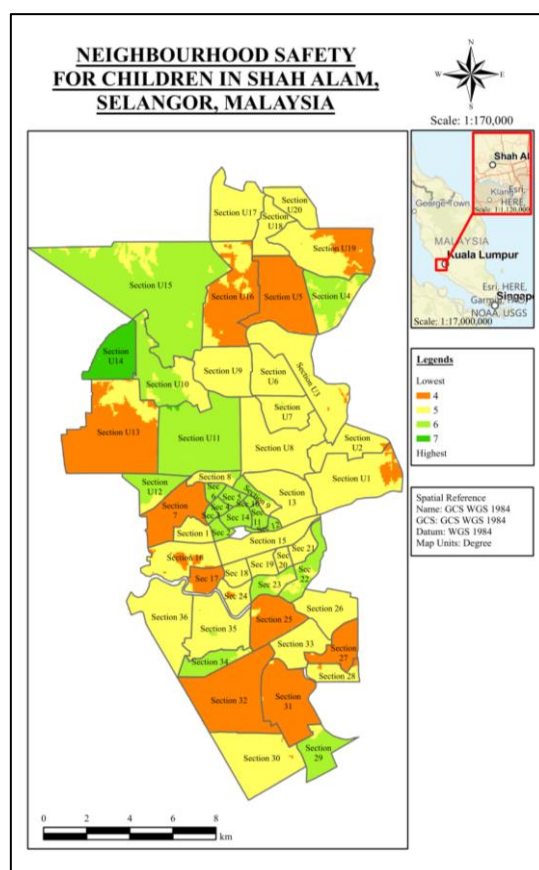


Figure 4: Map of Neighbourhood Safety for Children in Shah Alam
 Source: Authors (2024)

Figure 4 illustrates the map of Neighbourhood Safety for Children in Shah Alam, Selangor. Section U14 has the highest level of safety, influenced primarily by its low population of 998, which accounts for 26% of the weightage. This suggests that higher populations correlate with decreased safety. The findings, verified by experts, also reveal that 17 sections exhibit low safety levels. Factors contributing to these low safety levels include proximity to abandoned areas, construction sites, and industrial zones, supporting the hypothesis that greater distances from such areas increase safety.

A comparison of the sections with the lowest safety levels identified population density and streetlight presence as critical parameters, with high population density (26% weightage) and low streetlight presence significantly impacting safety. This underscores the importance of managing population density and enhancing street lighting to improve neighbourhood safety for children. Table 5 summarises how each factor plays a role in the safety index by comparing results for two (2) sections.

Table 5: Comparison of Parameters

Section 7 (Least Safe)	Parameters	Weightage (%)	Section U5 (Safe)
15	Industrial Area	8	1371
162	Commercial Area	4	782
5	Construction Area	3	3
4	Abandon Area	8	2
43,200	Population Density	26	59,760
2798	Street Light	18	6257

Source: Authors (2024)

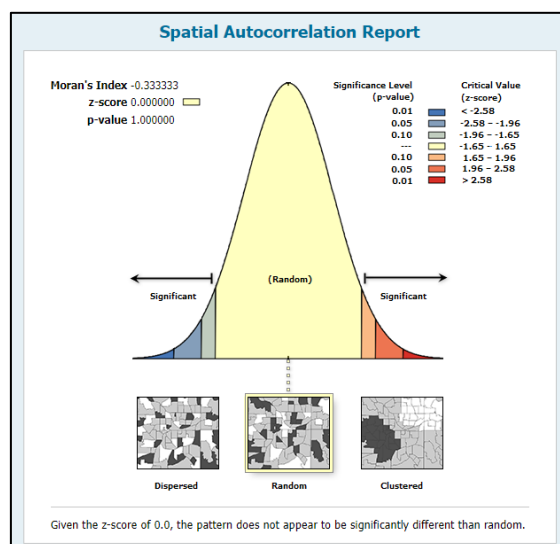


Figure 5: Spatial Autocorrelation of Neighborhood Safety for Children

Source: Authors (2024)

To understand the pattern of safety in the neighbourhood for children, Spatial Autocorrelation Analysis was used to identify the pattern of the distribution of safety throughout every section in Shah Alam, whether it is dispersed, random or clustered. The spatial autocorrelation results shown in Figure 5 show that the level of safety for children around Shah Alam is distributed randomly indicating that the level of safety for children is spatially independent and is not influenced or affected by other nearby sections. It may be caused by several factors, such as different sections having different criteria.

The final output was verified by using two different methods and approaches where the first verification was completed with the help of Shah Alam's experts, who are from a local government agency, and the second method of verification was made by field verification. It helps to avoid and reduce any inaccurate or imprecise data measurement that may affect the quality of the GIS analysis.

CONCLUSION

The study aims to analyse the neighbourhood safety for children in Shah Alam, Selangor, Malaysia, using the Fuzzy-AHP and GIS methods. First, Fuzzy-AHP was used to determine the weightage of criteria, such as perceived safety, transportation accessibility, land use, public facilities, and population density and then GIS was used to develop a model that measures the level of safety in each neighbourhood area. The study finds that land use is the most important criterion for neighbourhood safety for children, followed by population density, while perceived safety is the least important. The study also finds that the level of safety in Shah Alam is average, with some areas being safer than others. The study uses spatial autocorrelation to identify the factors that influence the level of safety and finds that the distribution of safety is random. The study concludes that a safe neighbourhood is crucial for protecting children and contributes to the field of GIS by introducing a novel approach to addressing neighbourhood safety for children in Shah Alam. For future improvement of this study, it is recommended that more criteria such as crime rate and speed limits could be added to be evaluated as the method that has been chosen is Fuzzy-AHP. Other than that, a spatial relationship analysis can be conducted to identify the relationship between the final safety level results and real crime cases such as kidnapping cases.

The research contributes in introducing a novel approach to analysing neighbourhood safety for children by Fuzzy-AHP with GIS. This combination leverages the strengths of Fuzzy-AHP in handling the inherent uncertainties and subjectivities in evaluating safety criteria while utilising GIS for precise spatial analysis and visualisation. By applying Fuzzy-AHP, the study enhances the accuracy of weighting diverse safety factors reflecting their true impact on neighbourhood safety. GIS enables the detailed mapping and spatial analysis of these weighted criteria, providing a comprehensive and visual representation of

safe and unsafe areas for children. This innovative methodology not only improves the reliability of safety assessments but also offers urban planners and policymakers a robust tool for making informed decisions to create child-friendly environments.

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SITE SUITABILITY ASSESSMENT FOR SELECTED NATURE-BASED SOLUTION (NBS) IN FLOOD-PRONE AREA

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Abstract

In recent decades, Malaysia has experienced an increase in both the frequency and severity of flood events, making the country particularly susceptible to flooding. Therefore, is a growing recognition of the importance of nature-based solution (NbS) as a viable approach to enhance flood resilience. This study utilized Geographic Information System (GIS) technologies to address this challenge by identifying optimal locations for implementing selected NbS in Kota Tinggi district, Johor. The research involved selecting suitable NbS measures using Multi-Criteria Decision Analysis (MCDA). A two-phased approach was employed. Firstly, RECONNECT's Measure Selector tool, a web-based tool was used to generate a preliminary list of NbS aligned with local conditions in Kota Tinggi. Following the initial screening, MCDA, a decision-making approach that considers multiple criteria was then used to evaluate the shortlisted NbS options. A site suitability analysis was then performed based on slope, distance to rivers, land use and distance to roads. Two NbS options, floodplain restoration and retention ponds, were chosen for further analysis with a more specific requirement. The results identified a total area of 126,798 hectares suitable for NbS implementation based on the general criteria. Floodplain restoration emerged as the more suitable option, with 107,929 hectares (89.67%) meeting the criteria compared to 12,419 hectar (10.33%) for retention ponds. Understanding the potential of NbS for flood mitigation in Kota Tinggi can assist with the selection and implementation of NbS in flood-prone areas to enhance flood resilience and create a more sustainable future.

Keywords: Flood management, Geospatial analysis, Nature-based solutions (NbS)

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INTRODUCTION

Nowadays, floods caused by the changing climate impacts a substantial population globally, resulting in human fatalities and significant damage. The phenomenon of climate change has been observed to have detrimental effects on the hydrological cycle, thereby influencing the precipitation patterns and potentially developing a lot of extreme weather events (Tarmizi et al., 2021; Anuar et al., 2022, Ata et al., 2023). Extreme events such as flooding are expected to become more common in the 21st century (Tabari, 2020). Moreover, the severity of tropical storms in the South-East Asian (SEA) region is also anticipated to intensify due to climate change (Asian Development Bank, 2021). The majority of Malaysia's losses are due to flooding, even though it is also susceptible to drought, landslides, earthquakes and storm surges (World Bank Group, 2021). The changing climatic conditions, including increased rainfall intensity and frequency, pose a threat to the country's urban areas (Yassin et al., 2023), particularly in low-lying regions. Research done by C40 Cities (2023) highlights that although cities across the globe will experience the impact of climate change, populations residing in the global south are at a significantly higher risk of experiencing the adverse effects of flooding and drought, as compared to their counterparts residing in the global north, with a tenfold difference in likelihood. Therefore, it is anticipated that Malaysia will experience increased occurrences of rainfall extremes, characterized by intensified precipitation during the wet season and reduced precipitation during the dry season. This phenomenon would result in increased high flows, which would consequently lead to more severe floods (Rahman, 2018).

According to the report by World Bank (2021), in recent decades, Malaysia has experienced an increase in both the frequency and severity of flood events, making the country particularly susceptible to flooding. This resulted in an increase in the median of the population impacted by an extreme river flood (90th percentile) due to climate change is estimated to be around 102,290 individuals by the year 2035-2044. This showed a rise of 140% from the population that was subjected to it during the period of 1971-2004. Local communities in flood-prone areas may be adversely affected by future land use changes, which will intensify the frequency and severity of flooding (Yassin et al., 2022). Flooding is a significant environmental challenge in Kota Tinggi district, Johor (Anuar & Rahmat, 2022) causing damage to infrastructure, property and livelihoods (Tam et al., 2014). In response to the flood risk associated with climate change, it is recommended that a suitable combination of measures be implemented to address this issue (Ferreira et al., 2021; Hamid et al., 2022). There is a growing recognition of the importance of nature-based solution (NbS) as a viable approach to enhance flood resilience. The implementation of NbS as a means of achieving sustainable mitigation and adaptation to floods has garnered increasing attention. This is due to the

insufficiency of conventional solutions to overcome the problem. Conventional flood mitigation strategies often rely on grey infrastructure solutions, which can be expensive and have limited ecological benefits (Sowińska-Świerkosz & García, 2022). NbS leverages natural processes and features such as wetlands, green spaces and natural drainage systems to mitigate the impacts of floods (Castelo et al., 2023). This research aims to address this challenge by exploring the potential of NbS for flood mitigation in Kota Tinggi district. Implementing NbS effectively requires identifying suitable locations that maximize their flood control benefits. By understanding the specific challenges and opportunities, the study could contribute to the knowledge base and provides valuable insights for policymakers and stakeholders working on flood management strategies in the region.

RESEARCH METHODOLOGY

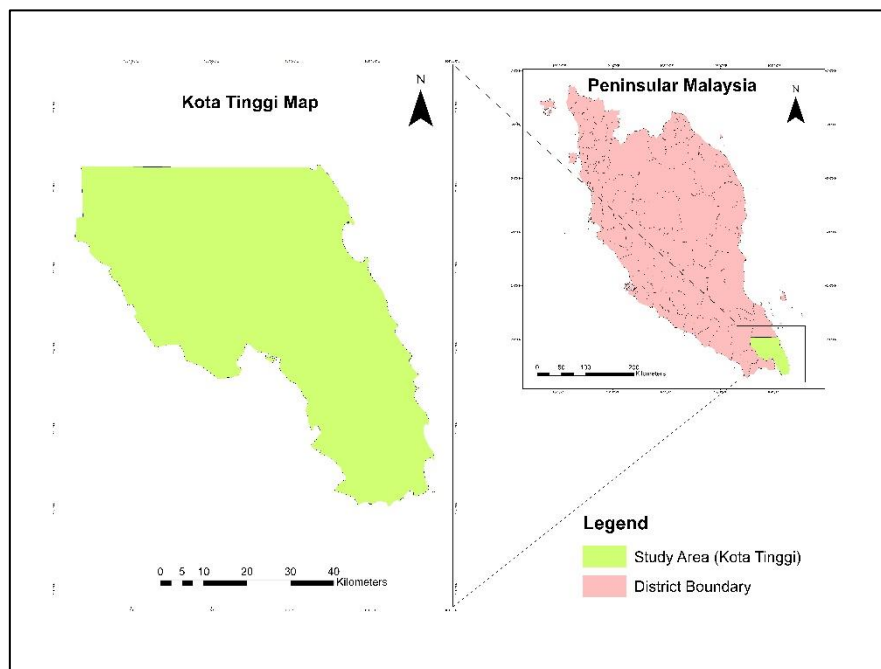


Figure 1: Geographical location of Kota Tinggi district in Malaysia

Located in the eastern portion of the state of Johor with the sea encircling 65% of its border, Kota Tinggi is among the districts that are severely impacted by floods nearly every year (Anuar & Rahmat, 2022). Kota Tinggi, located in 1°44'N 103°54'E, consists of a large watershed area and receives an annual average of 2,470 mm of precipitation. With a population of over 200,000

people, urbanization in this area is rapidly increasing with a focus on agricultural activities and housing development. This district's administrative town is also called Kota Tinggi. However, there is lack of comprehensive understanding of suitable locations for deploying specific NbS types within the area. This study hence is intended to identify optimal locations for implementing selected NbS in Kota Tinggi district, Johor. Due to its risk of having extreme rainfalls and floods in many future projection studies (Tarmizi et al., 2021; Hamid et al., 2022; Anuar & Rahmat, 2022), Kota Tinggi was chosen for this research.

Data Processing & Analysis

The methodology that was used to map out the site suitability analysis of selected NbS consists of two steps, which are the selection of NbS measures and site suitability analysis of selected NbS measures.

Selection of NbS measures

The initial screening for suitable NbS utilized the Measure Selector tool. This application is a web-based application that enables decision makers to choose preliminary measures for NbS depending on local considerations. The tool was created using a database including a comprehensive list of strategies for reducing hydrometeorological concerns. To narrow down the list of NbS measures, six filters (types of measures, hazard type, affected area, potential location for measures, project type, land surface relevant for application) are utilised to select appropriate solutions for a particular scenario. Each potential NbS option is evaluated against pre-defined criteria such as its effectiveness, feasibility, environmental impact and social benefits. Based on the filter, five NbS were listed out which includes floodplain restoration, re-meandering, retention ponds, wetland restoration and riparian buffers. These NbS options were prioritized for further analysis.

Following the initial screening, a method of decision-making that takes into account several criteria called multi-criteria decision analysis, or MCDA was then used to evaluate the shortlisted NbS options. Three key criteria were identified for evaluating NbS options based on their relevance to flood mitigation in Kota Tinggi which are effectiveness in flood mitigation, environmental impact and social benefits (Table 1). Specifically, a simple weighted linear was used to determine the score for each of the criterion. This method draws inspiration from the Weighted Average Linear Model (WALM). It provides a straightforward way to consider the relative importance of various factors when evaluating potential locations for NbS (Bhole, 2018). The weights assigned to each criterion were determined through a comprehensive literature review of scientific studies on NbS implementation in similar riverine floodplains. Based on Table 2, the analysis shows that floodplain restoration emerges as the most favourable option with the highest total score (5). This reflects its strong performance in all three

criteria, particularly its high effectiveness in flood mitigation and its positive environmental and social benefits. Retention ponds follow closely behind with total scores of 4.4. Wetland restoration also offers similar effectiveness to floodplain restoration but with slightly lower social benefits.

Table 1: Criteria and Weighting for NbS Options in Flood Mitigation

Criteria	Description	Weight
Effectiveness in Flood Mitigation	Ability to reduce flood risk through storing/slowing runoff, reducing peak flow, and minimizing erosion.	0.4
Environmental Impact	Positive or negative consequences for the environment. Measures considered include soil improvement, pollution reduction, habitat or biodiversity enhancement and climate benefits.	0.3
Social Benefits	Social and economic benefits for the community. Measures considered include creation of recreational opportunities and new job opportunities.	0.3

Table 2: MCDA Analysis of NbS Options for Flood Mitigation in Kota Tinggi, Malaysia (Weighting Scheme: WLAM)

Criteria (Weight)	Floodplain Restoration	Re-meandering	Wetland Restoration	Retention Ponds	Riparian Buffers
Effectiveness in Flood Mitigation (0.4)	High (5)	Medium (3)	High (5)	High (5)	Medium (3)
Environmental Impact (0.3)	High (5)	High (5)	High (3)	Medium (3)	High (5)
Social Benefits (0.3)	High (5)	Medium (3)	Medium (3)	High (5)	Medium (3)
Total Score	5	3.6	3.8	4.4	3.6

Site suitability analysis of selected NbS measures

A site suitability analysis was performed to identify the areas where selected NbS can be implemented. An extensive study found that slope, soil type, distance from the river, land use type, and urban land use are the most common criteria for selecting NbS sites (Mubeen et al., 2021). A derived map was produced using the base map by processing all of the key considerations required for spatial allocation to construct the suitability map (Figure 2). The acquired derived maps were then be used to perform a site suitability analysis using ArcGIS. Base maps utilize buffer tool and Euclidean distance calculation to calculate slope rate, distance from rivers, and road buffers. They are then transformed into Boolean maps that indicate places that match the following conditions as proposed by Mubeen et al. (2021): (1) slope rate $\leq 5\%$, (2) distance from river ≤ 1 km and (3) distance from road ≥ 50 m. For each criteria, raster maps were created and then transformed into Boolean maps that illustrate the areas that meet that criterion. A

general suitability map for allocating NbS in Kota Tinggi results from the combination of these maps. Justification on the above conditions are as follows:

Slope rate $\leq 5\%$: Gentle slopes ($\leq 5\%$) allow for better infiltration of rainwater into the ground, reducing surface runoff and potential flooding (Morbidelli et al., 2018). Gentle slopes are generally easier and less expensive to work with for constructing and maintaining NbS features compared to steeper terrain.

Distance from river ≤ 1 km: Locating NbS near rivers allows them to directly intercept and filter runoff before it reaches the waterway. This can help reduce the peak flow of water quality entering the river. Being close to rivers can also enhance the ecological value of NbS by creating a buffer zone and potentially providing habitat for riparian plants and animals (Fletcher et al., 2014).

Distance from road ≥ 50 m: Areas close to roads are often already developed or have limited space for implementing NbS features hence a buffer zone ensures sufficient space for effective functioning (Longato et al., 2023).

Based on the conditions for the general suitability map, a simplified Boolean formula approach in ArcGIS was being used to identify potentially suitable areas for NbS:

(Suitable_Slope AND Near_River AND Buffer_From_Road) AND NOT Urban_Area

Vector layers are created and calculated using the transformed Boolean raster maps to yield discrete polygons that illustrate areas that satisfy every spatial allocation criterion. This generates the general suitability map which is used as the basis for spatial allocation. In order to identify areas where these measures can be employed, the general suitability map was further improved with additional particular criteria that differ based on the type of NbS. The flow length tool generates a raster of upstream and downstream distances in a catchment where the watershed is then separated into two sections: upstream and downstream. This helps identify places suitable for both the floodplain restoration and retention ponds (Mubeen et al., 2021). Vector layers containing polygons for retention ponds and floodplain restoration are the output of the suitability map for each NbS.

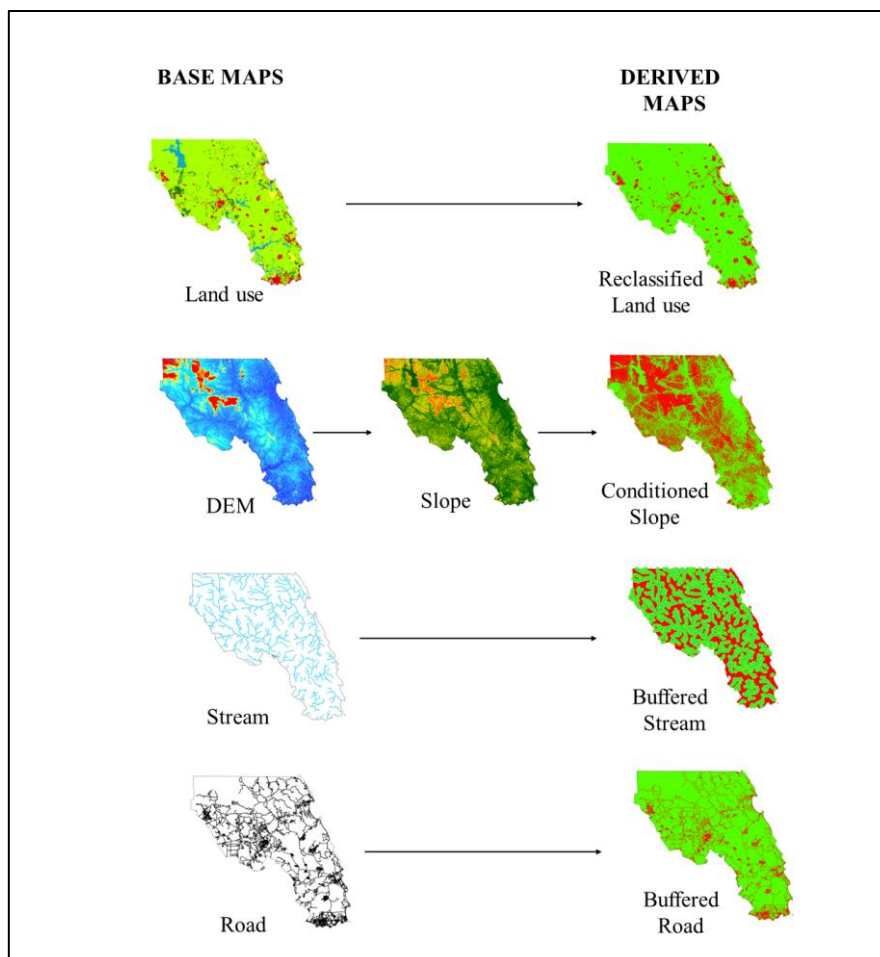


Figure 2: Derivation of NbS Suitability Maps from Base Maps in Kota Tinggi

RESULTS AND DISCUSSION

Result shows that a total area of 126,798 ha out of 342,259 ha is suitable to be allocated with NbS as it meets all criteria needed. NbS-specific criteria were then combined with general suitability maps (Figure 3) to develop the specific NbS suitability maps. Using NbS for upstream storage can help reduce the amount of runoff that flows downstream by establishing retention ponds. In flatter areas, floodplain restoration provides more conveyance area, which makes it more effective. Regions with an area of less than 10 ha were omitted from the suitability map due to their inability to provide adequate storage volume for effective flood attenuation (Mubeen et al., 2021)

General Suitability Map

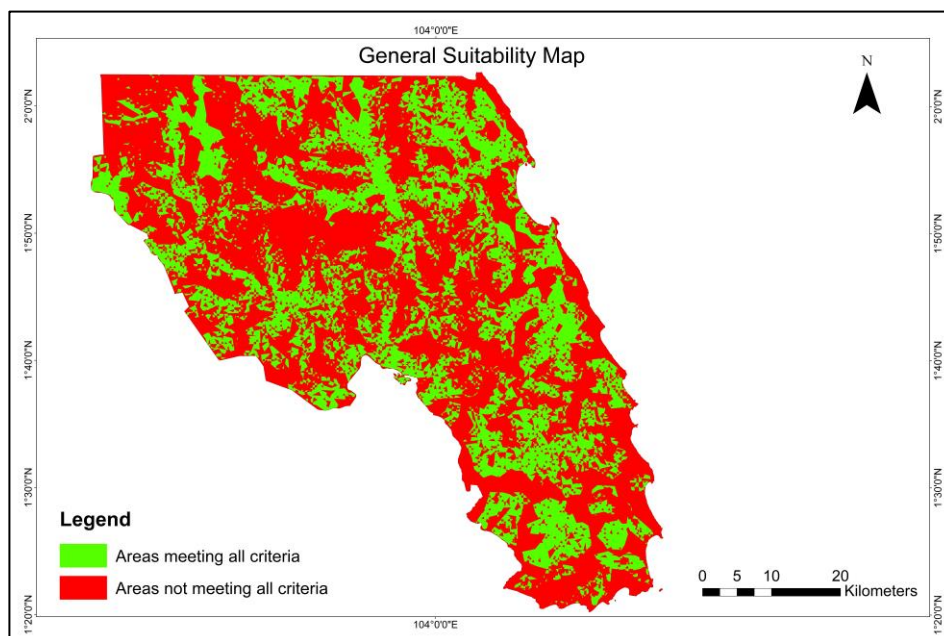


Figure 3: General Suitability Map for NbS allocation

Table 2: Total area for NbS implementation

	Total Area (ha)
Area meeting all criteria	126,798
Area not meeting all criteria	215,461

NbS Suitability Map

Figure 4 shows a combined area of 126,798 ha, where 107,929 ha or 89.67% of the total area that fulfilled all the criteria can be utilized for floodplain restoration and a total area of 12,419 ha, or 10.33% are considered suitable for the development of retention ponds as NbS.

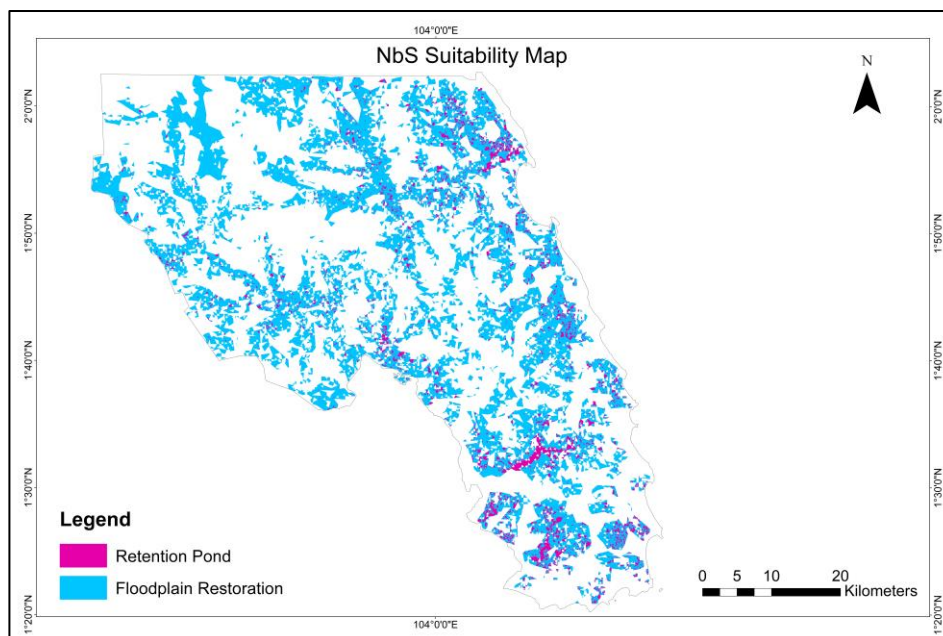


Figure 4: Suitability maps for floodplain restoration and retention ponds in Kota Tinggi

Table 3: Total area of suitable NbS location

	Total Area (Ha)	%
Floodplain Restoration	107,929	89.67
Retention Pond	12,419	10.33

Floodplain restoration was found to be particularly effective in low-lying and flatter regions, which not only helps in reducing flood risk but also in providing habitat for native species, improving water quality, and enhancing ecosystem connectivity across the region. Integrating floodplain restoration across 107,929 hectares (89.67% of the total suitable area) can have extensive ecological benefits by creating green buffer zones along waterways, which can improve biodiversity and boost ecosystem resilience (Nilsson et al., 2018). This high suitability aligns with Kota Tinggi’s geographical characteristics, especially its relatively flat areas and extensive low-lying zones (Yeganeh & Sabri, 2014) that naturally lend themselves to floodwater conveyance and storage. Floodplain restoration in these areas can absorb large quantities of runoff during heavy rainfall, slowing the flow rate and reducing peak discharge in downstream areas (Mubeen et al., 2021). This natural storage capacity not only aids in flood mitigation but also supports ecological health by creating habitats that can enhance local biodiversity. Given the increased urbanization and agricultural

development in Kota Tinggi (Kang & Kanniah, 2022), this NbS approach helps retain critical floodplains that might be at risk of degradation or development.

Retention ponds, while covering a smaller area (10.33%), play a crucial role in upstream storage by capturing runoff and allowing gradual water release. The strategic placement of these ponds can intercept and store excess runoff from highland areas, thus mitigating downstream flood risks, especially in urban and agricultural zones prone to high runoff (Griffiths et al., 2024). In Kota Tinggi, this is particularly relevant as upstream runoff can intensify flooding downstream, impacting communities, agriculture and infrastructure in the district's central and coastal regions (Anuar et al., 2022). The retention ponds act as a buffer, capturing stormwater and gradually releasing it to reduce strain on downstream areas (Griffiths et al., 2024).

CONCLUSION

A suitability analysis was conducted in Kota Tinggi, Johor to map out suitability of the chosen NbS to be implemented in the area. The creation of the NbS suitability map provides spatial information to guide the selection of optimal locations for implementing NbS interventions of retention ponds and floodplain restoration. According to the findings, a significant area within Kota Tinggi (126,798 ha) was identified as generally suitable for NbS implementation based on slope, distance from rivers, land use, and distance from roads. Floodplain restoration emerged as the more preferable NbS option, with a potential application area of 107,929 ha (89.67% of the total suitable area). This is likely due to the prevalence of flatter areas in Kota Tinggi, which are more effective for floodplain restoration. Retention ponds were found to be suitable for a smaller area with 12,419 ha (10.33% of the total suitable area), potentially due to their requirement for upstream storage capacity. With over 120,000 hectares identified as suitable for NbS, Kota Tinggi has significant potential to utilize these natural infrastructure solutions to enhance flood resilience and manage flood risks that have been a problem for decades (Anuar et al., 2022).

However, involving stakeholders in choosing the specific NbS to be implemented as well as prioritizing specific areas for NbS implementation based on other additional factors such as flood risk, community needs, as well as cost-effectiveness would allow for more accurate details on the NbS choice and placement. Public engagement is also needed to ensure that chosen NbS solutions integrate well with the local environment and social context. These findings highlight the promise of NbS for mitigating flood risk in Kota Tinggi. Implementing NbS offers a more sustainable and potentially more cost-effective approach compared to traditional grey infrastructure solutions (Di Pirro et al., 2023). Additionally, NbS can provide ecological benefits such as improved water quality and habitat creation. By effectively utilizing NbS, Kota Tinggi can build a more resilient future in the face of increasing flood risk due to climate change.

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ASSESSING ENVIRONMENTAL NOISE POLLUTION AROUND PUBLIC HOSPITALS IN SELANGOR, MALAYSIA: IMPLICATIONS FOR URBAN PLANNING

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Abstract

Environmental noise is a major concern, particularly in the vicinity of hospitals, which are designated as sensitive areas. There are many complaints about the outside noise, which makes their time in the hospital uncomfortable. Numerous factors, such as expanding urbanisation, industrial activity, traffic, and building, contribute to environmental noise pollution. To avoid having a significant negative effect on users, it is crucial to investigate the sources and measure the level of environmental noise. To date, no data has been recorded on environmental noise around public hospitals in Malaysia. The aim of this study is to assess the current environmental noise pollution surrounding selected hospitals and explore potential improvements that contribute to future urban planning. This study integrates a field measurement at three public hospitals in the Klang Valley (Hospital Shah Alam, Hospital Tengku Ampuan Rahimah and Hospital Sungai Buloh), employing quantitative data collection via a sound level meter with a data logger to identify the various environmental noise sources surrounding public hospitals in the Klang Valley. The findings indicate that in one case study, the average readings failed to meet the DOE standard, categorising it as environmental noise pollution. Considering the results obtained, all three case studies' environments require significant improvements that can be addressed through strategic urban planning, such as enforcing zoning regulations that restrict noise-emitting activities in the surrounding areas.

Keywords: Environmental noise, noise pollution, urban planning, public hospital, field measurement

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INTRODUCTION

Environmental pollution encompasses various forms, including a significant concern: environmental noise. Noise is by definition, "worthless sound" or "noise that is undesirable to the receiver" (Wallis et al., 2019). Most of the noise pollution comes from the outside of the building. Due to the concentration of people, businesses, and activities like transportation, it is higher in cities. The World Health Organisation claims that long exposure to noise levels above 70 dB (A) has a serious negative impact on human health and can cause a variety of irreversible health issues, including hearing impairment. Those who live nearby may find this noise stressful. Noise pollution usually interferes with human activities and the balance and comfort of life, especially in hospital areas (Bhatia, 2014).

Hospital systems have been under increasing pressure to improve performance. Almost all the infrastructure and human resources in this healthcare sector are provided by the government, making it one of the largest in Malaysia's services department. Doctors, nurses, pharmacists, dentists, and other allied healthcare workers are employed and deployed by the Minister of Health to various healthcare facilities across the country, ranging from rural clinics to district hospitals to tertiary specialist hospitals (Quek, 2013). Compared to other public or commercial structures, hospitals present a unique and complex set of challenges. In Malaysia, both public and commercial primary health care services are available (World Health Organization, 2013). Given the complexities and unique challenges that hospitals face, it is crucial to consider various environmental factors that can impact patient care and overall well-being. One such factor is noise pollution, which has become an increasingly recognised health risk over time. An unwelcome sound is referred to as environmental noise, and it is a pollutant in the environment that needs to be controlled.

Continuous noise that exceeds certain thresholds can have detrimental health effects (Hashim Lim et al., 2023). Hospitals are regarded as noise-sensitive structures due to the presence of hospitalised patients and the activities that occur within them (Montes-González et al., 2019). Noise can originate both internally and externally in hospital environments. According to Jue and Nathan-Roberts (2019), most of the noise that disturbs patients is produced by personnel and machines. Meanwhile, environmental noise pollution can be attributed to transportation, industrial sites, and various other sources. Significant efforts have been made to eliminate traffic pollution at its origin. Despite the fact that vehicles are significantly quieter now than they were ten years ago, the effect of this improvement has been negated, and the level of annoyance has continued to rise due to the rise in traffic volume (Fahmi et al., 2023). The development of quieter automobiles may have provided a temporary solution to the problem, but it has not been completely resolved (Vos & Beek, 2019). According to the

findings of these investigations, noise exposure affects a variety of physiological processes. It is crucial to measure environmental noise to prevent severe consequences for users. However, there has been no research on environmental noise near the hospitals in Selangor. Therefore, this study aims to assess the current environmental noise pollution surrounding selected hospitals and explore potential improvements that contribute to future urban planning.

Table 1: Noise Level Standard by WHO and Selected Countries

Noise Level Limit	Noise level, Leq dBA	
	Daytime	Night-time
WHO	55	45
Malaysia (DOE Low Density)	55	50
Germany (Noise level guidelines)	45	35
Australia (Recommended outdoor background noise level)	45	35
Japan (Environmental quality standards)	45	35
Korea (Environmental quality goal)	50	45
Philippines (Environmental quality noise standards)	50	40
Iran (Residential area)	55	45
(Commercial area)	65	55
(Industrial area)	75	65

Source: Segaran et.al, (2020)

Table 2: Second Schedule, Recommended Permissible Sound Level (LAeq) by Receiving Land Use for Existing Built-Up Areas

Receiving Land Use Category	LAeq Day	LAeq Night
Low Density Residential, Noise Sensitive Receptors, Institutional (School, Hospital, Worship)	60 dBA	55 dBA
Suburban and Urban Residential, Mixed Development	65 dBA	60 dBA
Commercial business zone	70 dBA	65 dBA
Industrial zones	75 dBA	75 dBA

Source: DOE (2019)

Components of Environmental Noise Measurement

Measuring environmental noise levels is critical for determining where noise problems exist. This section describes the components that are included in the environmental measurement in this study.

Instrument: Sound Level Meter with Data Logger

Sound level meters serve as indispensable tools for quantifying diverse forms of noise pollution, encompassing industrial, environmental, mining, and aircraft noise assessments. According to the Department of Environment (DOE) guidelines from 2019, handheld deployment of sound level meters facilitates immediate spot readings, while prolonged monitoring necessitates their installation on tripods. Enhancing measurement accuracy, an extension cable coupled with a pre-amplifier allows the microphone to be positioned at elevated distances from the sound level meter body. However, the standard microphones accompanying general-purpose sound level meters lack water-resistant properties, rendering them unsuitable for prolonged outdoor use due to their vulnerability to humidity-induced drift. For sustained all-weather monitoring, specialised microphones are recommended (DOE, 2019).

Duration: Short-Term Sampling

Continuous sampling of instantaneous sound pressure levels over a specified duration constitutes an essential method for short-term noise measurement, aiding in the identification of noise sources and their impact on local communities (Svantek, 2024). Typically, measurements conducted for shorter durations, such as 30 minutes or an hour at specific times of the day, offer valuable insights into prevailing noise levels. However, these assessments, when not extended throughout the full day and night, provide only an approximate indication of typical noise levels, contingent upon minimal temporal fluctuations. It is imperative to acknowledge that despite their utility, LAeq values derived from such short-term measurements inherently encompass uncertainties and inherent inaccuracies, as highlighted by the Department of Environment (DOE, 2019). These inevitable limitations necessitate cautious interpretation of the acquired data, acknowledging the potential variability and imprecision inherent in the estimations of environmental noise levels.

Introduction to Hospital in Malaysia

Malaysia has the best healthcare system in the world and some of the hospitals have the lowest medical fees for treatment. Malaysian public health services are administered centrally by the Ministry of Health through its central, state, and district offices (World Health Organization, 2013).

Categories of Hospital

Public hospitals in Malaysia are divided into five categories, which are small district hospitals, larger district hospitals with resident specialists, state-level general hospitals with resident specialists, national hospitals, and specialist

hospitals or institutions. The primary role of public hospitals in the system is to provide secondary care to the population (World Health Organization, 2013).

Type of Healthcare Facilities and Services

This frequently includes the option of selecting the sort of health care facility to use. Healthcare facilities and services are primarily classified as Primary, Secondary, Tertiary, and Quaternary healthcare. Table 3 shows the different forms of healthcare being delivered between secondary and tertiary services.

Table 3: Second Schedule, Recommended Permissible Sound Level (LAeq) by Receiving Land Use for Existing Built-Up Areas

	Secondary	Tertiary
Function & Responsibility	Specialist treatment: Provide specific expert care	Hospitalization treatment: Care for hospitalized patients
Healthcare Services	Treat specific systems of the body; specific disease/condition.	<ul style="list-style-type: none"> ● Requires highly specialized equipment and expertise ● Complex treatments and procedures
Care Providers	<ul style="list-style-type: none"> ● Cardiologists - heart ● Endocrinologists - hormone systems, diabetes, thyroid ● Oncologists- cancers 	Advanced diagnostic centres, specialized intensive care units and modern medical facilities

Source: Malaysia Secondary Healthcare Ecosystem –27 Advisory (n.d.)

Source of Environmental Noise around the Hospital

Environmental noise near hospitals, as explained by Helmi et al. (2021), occurs from diverse external factors, including road traffic, construction activities, and residential and commercial zones. This pervasive noise, prevalent in densely populated areas, is intrinsically linked to the forces of industrialisation, transportation, and ongoing urbanisation (Magiera & Solecka, 2021). Within hospital premises, Wallis et al. (2019) identify internal sources contributing to environmental noise, encompassing equipment, pager alerts, staff conversations, and interactions among patients. Jue and Nathan-Roberts (2019) concur with this assessment, underscoring that a substantial proportion of disruptive noise experienced by patients originates from both healthcare staff and operational machinery. Table 4 presents a comprehensive literature review-derived list of potential sources of environmental noise surrounding public hospitals in Selangor. This list provides an understanding of the complex nature of noise in healthcare settings.

Table 4: Possible Sources of Environmental Noise around Public Hospital in Selangor

Variables	Jue & Nathan- Roberts (2019)	Helmi et al. (2021)	De Vos & Van Beek (2019)	Magiera & Solecka (2021)	Frequency
Traffic Noise	/	/	/	/	4
Constructio n Activity	/	/	/	/	4
Residential		/		/	2
Commercial			/	/	2

Sources: Authors (2024)

RESEARCH METHODOLOGY

This study adopts a quantitative approach, employing field measurements conducted as case studies across three public hospital buildings in Selangor. Specifically focusing on a state-level general hospital and two district hospitals renowned for their secondary and tertiary care services, the selection criteria for these case studies were thoroughly tailored to suit the study's objectives. Each case study represents distinct environmental noise sources, as depicted in Figures 1, 2, and 3, allowing for a comprehensive analysis of varied noise origins.

To ensure methodological consistency, sound level meters (SLMs) were strategically positioned on tripods, situating the microphone at an elevation ranging from 1.2 to 1.5 meters above the ground. The measurement sites were carefully chosen within a 500-meter radius of the case studies, maintaining a minimum distance of 3.5 meters from any walls, buildings, or sound-absorbing structures. Prior to data collection, SLMs were calibrated to record noise levels during the day, using the "A-weighted" scale and "fast" time response settings, adhering to standardised measurement protocols. This thorough technique is intended to collect and analyse the environmental noise levels unique to each case study, demonstrating differences due to various noise sources within hospital grounds.



Figure 1: Environmental Noise Source Points around Hospital Shah Alam
Source: Authors (2024)



Figure 2: Environmental Noise Source Points around Hospital Tengku Ampuan Rahimah
Source: Authors (2024)



Figure 3: Environmental Noise Source Points around Hospital Sungai Buloh
 Source: Authors (2024)

The noise level was measured during each hospital’s visiting hours, which are approximately 12:30 p.m. to 2:00 p.m. and 4:30 p.m. to 7:30 p.m., with a 15-minute interval between each reading as shown in the following Table 5. During the field measurement, the noise level is measured three times to obtain a noise average, thereby increasing the accuracy of the data collected as shown in Table 6. This data analysis provides highly beneficial data for identifying noise sources and areas that are likely to be exposed to harmful noise levels.

Table 5: Details of Data Collection

Location	Visiting Time	Date	Environmental Noise Source	Remarks
Hospital Shah Alam	12.30 p.m – 2.00 p.m.	11/4/23	Residential Iridium 7/35	SA1
		12/4/23	Commercial Area Seksyen 7	SA2
	4.30 p.m. – 7.00 p.m.	5/5/23	Klinik Kesihatan	SA3
		8/5/23	Traffic Noise	SA4
Hospital Tengku Ampuan Rahimah	12.30 p.m – 2.00 p.m.	6/5/23	LRT3 Construction Site	AR1
		7/5/23	Taman Petaling Indah	AR2
	4.30 p.m. – 7.30 p.m.	10/5/23	Traffic Noise	AR3

Location	Visiting Time	Date	Environmental Noise Source	Remarks
Hospital Sungai	12.30 p.m – 2.00 p.m.	12/5/23	Construction Site	SB1
Buloh	4.30 p.m. – 7.00 p.m.	17/5/23	Danau Seri Apartment	SB2
		20/5/23	Traffic Noise	SB3

Source: Authors (2024)

Table 6: Sample of Measured Data over the Field Measurement Period at Hospital Shah Alam

Time	Reading (dB)				Remarks
	R1	R2	R3	Average (dBA)	
12:45	56.0	55.0	55.8	55.6	
13:00	61.9	57.9	58.7	59.5	
13:15	59.7	55.0	55.8	56.8	
13:30	62.3	60.6	59.8	60.9	
13:45	62.1	58.9	57.0	59.3	
14:00	64.9	65.0	61.7	63.9	Car horn
16:45	64.8	62.4	65.4	64.2	Motorbike
17:00	56.2	54.5	54.6	55.1	
17:15	52.5	53.7	51.0	52.4	
17:30	61.9	60.9	63.6	62.1	Lorry
17:45	60.0	63.0	61.5	61.5	Bus
18:00	54.5	54.0	54.8	54.4	
18:15	74.7	72.0	70.3	72.3	Ambulance siren
18:30	56.7	57.9	59.6	58.1	
18:45	58.4	56.7	56.4	57.2	
19:00	58.3	54.7	57.8	56.9	
Average: 64.9					

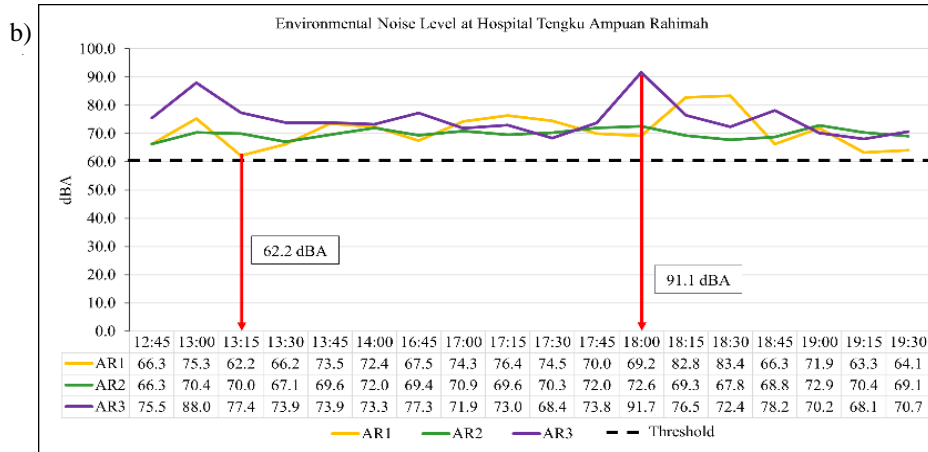
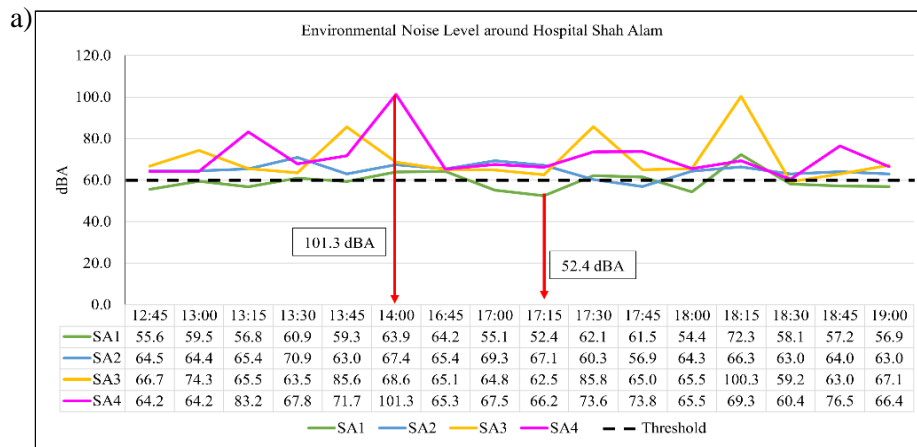
Source: Authors (2024)

This study adopts a descriptive analysis methodology to interpret, illustrate, and summarise field-measured data points, aiming to distinguish frequent patterns aligning with all significant data collected. Employing sound level meters for data collection, the gathered information is graphically represented to establish cases where environmental noise levels surpass the thresholds established by DOE. Through this analytical approach, the study aims to assess the current environmental noise pollution surrounding selected hospitals that contribute to environmental noise pollution, facilitating a detailed analysis and discussion based on the collected information from the field measurements conducted.

RESULT AND DISCUSSION

This section shows the result of the noise measurement level taken during the field measurements in line graph form. The data collection process revealed various sources of environmental noise around the hospitals. In the following

figures, each line denotes the different source points while the dotted line represents the threshold for the hospital environment, which is 60 dBA as stated in the Second Schedule since hospitals are noise-sensitive structures, it is important to look up at the guideline by DOE to ensure patient satisfaction while staying in hospitals. From that graph line, it can be clearly seen the highest and lowest values of environmental noise around the hospital in each case study.



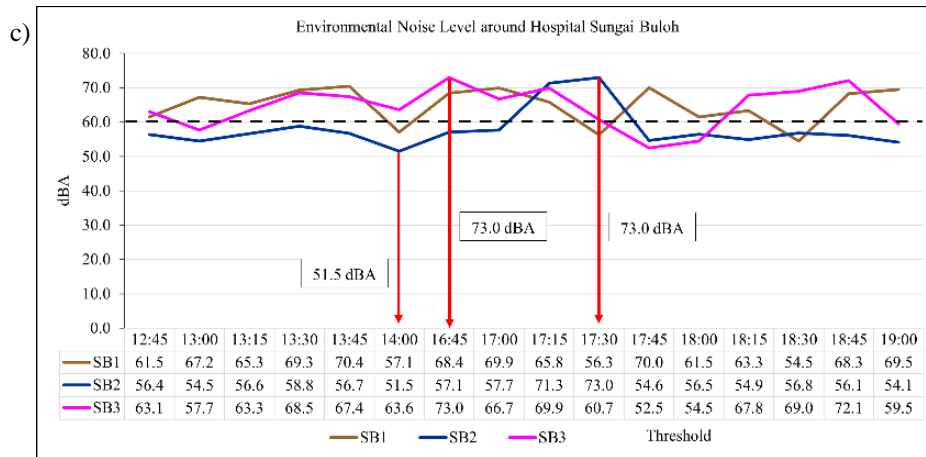


Figure 4: Result obtain during the field measurement case study; a) Hospital Shah Alam, b) Hospital Tengku Ampuan Rahimah, and c) Hospital Sungai Buloh
Source: Authors (2024)

Beginning with observations near Hospital Shah Alam (a), at 14:00 there is the highest environmental noise level with 101.3 dBA. This peak noise level was primarily attributable to ambulance sirens and horns, highlighting their significant impact on the acoustic environment. This aligns with residents' perceptions that vehicle and construction activities are major noise contributors in Seksyen 7, Shah Alam (Abdullah et al., 2024). Notably, this increase in noise coincided with the end of the lunch break and visiting hours, which contributed to traffic congestion and increased noise emissions along the main road. At 17:15, SA1 recorded the lowest noise level in the residential area, measuring 52.4 dBA, which may be attributed to decreased activity near the residential area. Only the residential area at Jalan Iridium 7/35 (SA1), which measured 59.9 dBA, was able to maintain noise levels below the threshold limit. However, the noise levels in the other monitored areas, SA2, SA3, and SA4, exceeded the DOE threshold, registering at 64.9 dBA, 70.2 dBA, and 71.1 dBA, respectively

Moving on to the findings concerning Hospital Tengku Ampuan Rahimah (b), AR3 recorded the maximum noise level of 91.7 dBA at 18:00. Again, ambulance sirens emerged as the predominant source, which was exacerbated by the peak traffic hour and the presence of numerous traffic signals, which impeded the ambulances' ability to move quickly. This congestion resulted in a prolonged siren duration of approximately one minute, which exacerbated noise propagation in the vicinity. At 13:15, AR1, which was situated on a construction site, registered the lowest noise level at 62.2 decibels. This decibel reduction coincided with the temporary cessation of construction activities during

lunchtime. Upon assessment for adherence to the DOE noise threshold, it became evident that all examined sources in the vicinity of Hospital Tengku Ampuan Rahimah, namely AR1, AR2, and AR3, exceeded the designated threshold, with respective measurements of 71.1 dBA, 69.9 dBA, and 75.2 dBA.

SB2 and SB3 exhibited the maximum noise levels at Hospital Sungai Buloh (c) at 17:30 and 16:45, respectively, registering 73.0 dBA. At 14:00, however, SB2 exhibited the lowest noise level, measuring 51.4 dBA. The hospital's location, adjacent to a highway exit and outfitted with multiple main gates, appears to have contributed to effective traffic management, resulting in traffic that is consistently manageable even during peak hours. Only SB2, which measured 57.9 dBA, remained compliant with the DOE's noise limits. SB1 and SB3 measured 65.5 dBA and 64.6 dBA, respectively, which were marginally above and below the threshold. Collectively, these findings highlight the complex relationship between sources and their temporal variations in influencing the acoustic environment around these healthcare institutions, with implications for both patient well-being and urban planning strategies.

Since hospitals are noise-sensitive structures, it is important to look up the guidelines set by DOE to ensure patient satisfaction while staying in hospitals. To further analyse whether the case study exceeds the threshold is categorised as environmental noise pollution, Table 7 shows the data summary of the environmental noise level for every point of source around the case study.

Table 7: Data Summary of Environmental Noise Level for Every Point of Sources around the Case Study

No	Case Study	Location	Noise Level (dBA)		
			Minimum	Maximum	Average
1	Hospital Shah Alam	SA1	52.4	72.3	59.4
		SA2	56.9	70.9	64.9
		SA3	59.2	100.3	70.2
		SA4	60.4	101.3	71.1
2	Hospital Tengku Ampuan Rahimah	AR1	62.2	83.4	71.1
		AR2	66.3	72.9	69.9
		AR3	70.7	91.1	75.2
3	Hospital Sungai Buloh	SB1	54.5	70.4	65.5
		SB2	51.5	73.0	57.9
		SB3	54.5	73.0	64.6

Source: Authors (2024)

The data summary reveals that only two specific points, SA1 and SB2, managed to meet the DOE standard of less than 60 dBA, recording levels of 59.4 dBA and 57.9 dBA, respectively. Notably, these points, both situated in residential areas, shared a common source of environmental noise. These residential areas were equipped with security guards at their main road entrances,

requiring a residential card for access. A contrasting scenario was observed in AR2, another residential area, which registered a higher noise reading of 69.9 dBA due to the absence of security guards at its main access road. Additionally, AR2's proximity to the hospital's rear gate, a popular parking spot, contributed to its noise level. This phenomenon stemmed from inadequate parking provisions within the hospital premises, as supported by Ariffin (2022), who highlighted insufficient parking spaces in hospital blueprints. Consequently, visitors had to park some distance away, occasionally on roadside stretches.

The most substantial recorded environmental noise was at AR3, marked by a reading of 75.2 dBA, classifying it as a form of environmental noise pollution. This noise stemmed from traffic on the main road adjacent to Hospital Tengku Ampuan Rahimah. The consistent congestion on this road compounded noise levels, particularly during peak visiting hours, coinciding with lunch and the day's end. Over the course of the measurement period, the hospital's ambulance made around 33 trips, often navigating through traffic lights, leading to unavoidable delays. This pattern extended to SA4, where noise levels reached 71.1 dBA around Hospital Shah Alam. The drivers' tendency to inappropriately honk their horns after traffic lights turned green, in violation of the Noise Pollution (Regulation and Control) Rules (2000), played a role in this issue. These rules stipulate that within 100 meters of hospitals, educational institutions, and courts, horn use should be limited to situations involving imminent danger. Drivers should refrain from prolonged and frequent horn usage, particularly within designated silent zones.

In summation, the case study focusing on Hospital Tengku Ampuan Rahimah, denoted as (b), experienced the highest environmental noise levels. These noise levels emanated from three distinct sources, collectively contributing to the notable noise pollution around the hospital premises.

CONCLUSION

This study has been able to assess the current environmental noise pollution surrounding selected public hospitals in Selangor. The field measurement case study was drawn to a conclusion from the analysed data. The data collection phase identifies different sources of environmental noise around the hospital premises. These noise source points were meticulously monitored and analysed, with some recorded noise levels surpassing the prescribed 60 dBA limit. Overall, the data analysis indicated that most of the source points around the hospitals exceeded the recommended threshold for environmental noise, emphasising the need for measures to mitigate noise levels.

Aiming to recommend an approach to reducing environmental noise around public hospitals, the authors extended the study, recommending some strategies that can be used to improve the hospitals' surroundings, such as enforcing zoning

regulations that restrict noise-emitting activities in the surrounding areas. This approach could include planning green spaces, quieter streets, silence zones, and placing noise-sensitive facilities like hospitals in areas away from major highways or industrial zones. Apart from that, dedicated ambulance lanes or rerouting traffic away from the hospital zone would help minimise traffic congestion and reduce noise levels. Lastly, there is potential for urban planners to collaborate with local governments to increase public awareness about noise pollution regulations. Future research could expand to evaluate the effectiveness of various noise reduction methods, including zoning regulations and sound-absorbing materials, in different hospital environments.

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A STUDY OF COMPLAINT TRENDS AND STRATEGIC IMPROVEMENTS: A FOUR-YEAR ANALYSIS OF SIX MALAYSIAN MUNICIPALITIES

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Abstract

The primary aim of the study is to analyse the pattern of complaints received by the COB related to strata living across six municipalities categorised under category 2 over a four-year period. Additionally, the study examines the municipality with the highest number of complaints over four years, aiming to propose effective strategies, such as enhancing a clear understanding of SMA Act 2013 communication channels and enhanced dispute resolution mechanisms, to reduce complaint rates. By utilising a desk study analysis approach, the research emphasises the importance of clear legal provisions, policies, and guidelines, recognising the human factor's influence. The analysis spans 2016 to 2019, focusing on six municipalities under category 2. The study employs descriptive analysis and graphical representation to illustrate complaint trends over the specified years. This research provides insights into the patterns of complaints across municipalities and categories, offering valuable information for targeted improvements and strategic planning.

Keywords: Strata Living, Complaints, Commissioner of Building and Strata Management

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INTRODUCTION

A strata building typically consists of parcels and common property, as defined by the Strata Titles Act 1985 and the Strata Management Act 2013. Common property includes shared areas such as corridors and lifts. Residents pay a service charge for maintenance, while the Management Corporation oversees facility management for sustainable development. In the intricate tapestry of urban living, strata residential communities stand as vibrant hubs of shared spaces and communal responsibilities. Strata properties encompass various types of housing, including flats, condominiums, townhouses, and even landed homes within gated and guarded (G&G) neighbourhoods, all falling under the category of residential strata properties (Ali et al., 2023).

At the heart of these living arrangements lies the pivotal concept of harmonious living, a principle that transcends the mere physicality of the structures to profoundly impact the well-being of its inhabitants. The synergy of positive social interactions, a supportive environment, and a sense of connectedness crafts an environment where residents find comfort and connection. Shared spaces, whether communal gardens or recreational areas, become not just physical entities but catalysts for fostering vibrant social ties (DelSesto, 2015). Harmonious living extends beyond the superficial, creating a supportive environment where neighbours evolve into an extended support system. Residents, embedded in a community that genuinely cares, experience a heightened sense of security and well-being.

This comfort is not confined to physical spaces; it becomes a psychological refuge, cultivating a profound connectedness among neighbours. Cooperation and mutual understanding, integral to harmonious living, ensure that residents feel at ease within their living environment (Ruopeng Huang et al., 2023). The reduction of conflict, positive social interactions, and a supportive atmosphere contribute significantly to the mental and emotional well-being of residents. This harmonious synergy serves as a buffer against the stressors inherent in communal living, fostering lower levels of stress, anxiety, and feelings of isolation. Consequently, harmonious strata communities become bastions of mental and emotional health. As threads of positive interactions, a supportive environment, and enhanced well-being intertwine, they create a tapestry of a healthier and happier community. Thus, harmonious living in strata residential communities emerges not merely as a necessity but as a cornerstone for building sustainable, thriving, and interconnected urban spaces where individuals do not just coexist but flourish together.

RESEARCH BACKGROUND

Attaining harmonious living in strata residential communities demands the combined efforts of every individual involved. It is a collective endeavour where

the commitment and contributions of each resident play a vital role in creating a positive and cohesive living environment (Lucky et al., 2023). In essence, achieving harmony within strata residential settings requires active engagement and cooperation of everyone in the community. Strata residential developments in Malaysia constitute intricate ecosystems where various stakeholders, governed by the Strata Management Act 2013, intertwine to shape the living experience (Mazliza et al., 2015). Khalid et al. (2017) emphasised that fostering a harmonious atmosphere within these communities necessitates collaborative efforts and active engagement from all stakeholders, including the Joint Management Body (JMB), Management Corporation (MC), developers, unit owners, strata management agents, and the Commissioner of Buildings (COB). The MC holds the responsibility for overseeing funding, maintenance, and management activities within the strata property. Comprised of parcel owners, the MC ensures that all facilities are maintained in good working order. Section 21(2) of Act 757 outlines the general powers of both the MC and JMB, which include collecting charges and contributions to the sinking fund from parcel owners based on allocated share units, performing maintenance and management tasks for the buildings, and recovering any expenses incurred by the JMB from parcel owners.

Nevertheless, Malaysia's present property management approach reveals numerous issues that affect all stakeholders, including developers, property managers, owners, and residents of high-rise residential complexes (Azian et al., 2020). The issues revealed include lift breakdown, insufficient parking, cleanliness, garbage management, inadequate public facilities, and safety. Additionally, strata buildings commonly encounter various issues, such as physical property defects, limited or no direct control by property managers over management funds (as these are often held by either the developer or the MC), parcel owners' refusal to pay maintenance fees due to unrectified defects or unfulfilled facility promises by developers, owners' refusal to pay fees when units cannot be rented out, developers' non-payment of fees for unsold units, poor quality of management and maintenance services, and other legal and social challenges (Shuhaimi et al., 2022).

Hence, the primary aim of this study is to analyse the patterns of complaints received by the Commissioner of Buildings (COB) related to strata living across six municipalities categorised under Category 2. The secondary objective of this study is to analyse the municipality that has received the highest number of complaints over four years (2015- 2019), which involves analysing data trends and patterns to identify areas of concern. The study is constrained to a four-year timeframe due to inadequate data availability for the year 2020 and beyond. Based on the findings, the study aims to propose effective strategies to reduce the number of complaints received by the municipality with the highest

complaint rate. These strategies may include improved communication channels, enhanced dispute-resolution mechanisms, and proactive community engagement initiatives.

THE CATEGORIES OF COMPLAINTS FACED BY COMMISSIONER OF BUILDINGS COB

The COB is tasked with enforcing the regulations outlined in the Strata Management Act 2013. The Department of Building Commissioner carries out six key functions, which include conducting building inventories within the relevant local area, ensuring the establishment of JMBs for developments involving stratified planning, resolving disputes between developers and purchasers related to JMB establishment and account maintenance, monitoring developer actions on repair defects, enforcing laws stipulated in the Strata Management Act 2013, and providing periodic education on administrative management, audited accounts, financial provisions, and various other topics related to JMB/MC management.

The Commissioner of Buildings (COB) faces complaints across six distinct categories. The first category encompasses meeting and selection issues, involving disputes or challenges arising during residents' meetings or the selection of management committees. The second category relates to administration and management matters, encompassing concerns about the building's administration, financial management, decision-making processes, and regulatory compliance. The third category, rRepair and mMaintenance issues, pertains to complaints regarding the maintenance of common areas, building defects, or issues concerning the overall condition of the property as reported by the building owners. Following this, the fourth category of, Financing issues, deals with complaints related to financial matters, including disputes over service charges, sinking fund usage, and other concerns in financial management. The fifth category revolves around aAdvising sServices provided by the COB. Complaints in this category are directed at the advice or services offered by management committees or related entities, seeking suitable and necessary solutions for the specific issues raised. Lastly, the sixth category of g, Governance of COB, encompasses concerns about the governance, processes, or decisions made by the Commissioner of Buildings or similar regulatory bodies in handling related issues.

Multiple studies have contended and concluded that while strata law grants extensive powers to management bodies, it falls short of promoting effective governance. The introduced legislation lacks enforceable standards for good governance. Additionally, discrepancies exist between the responsibilities of management bodies and the role of residents in facilitating smooth management and maintenance operations.

METHODOLOGY

This study conducted a desk study analysis approach to collect information relevant to judging the feasibility of the project (Genske, 2003). In order to get an overview of the preliminary study about strata living, data was taken from the Ministry of Housing and Local Government (KPKT) website, which is freely available online. As for content analysis, most importantly, reference to earlier literature studies is made where previous research has, to a certain extent, acknowledged that there are various stakeholders involved in strata management. To live in harmony, each of the parties must share a clear vision towards this goal. However, there are problems in achieving this goal, such as lack of clear provisions in the law, lack of policies, lack of guidelines and some human factors. The existence of problems is observable from an analysis of the statistics of complaints lodged with the COB in Malaysia. The primary objective of this study is to analyse the pattern of complaints received by the COB from 2016 to 2019, considering the data available via the KPKT website and the similar types of strata buildings, years built, and sizes of buildings. The analysis involves categorising the complaints based on their nature and the respective year in which they were reported. Subsequently, the results are organised according to the Local Authorities area category 2 (10,000 – 50,000 lot for each Local Authorities. This category was chosen because it has the greatest number of buildings that represent 6 municipals in Malaysia. However, due to a lack of secondary data, one municipality has been excluded from the list. The analysis is centred on six municipalities: Majlis Bandaraya Melaka Bersejarah (MBMB), Majlis Perbandaran Nilai (MPN), Majlis Perbandaran Port Dickson (MPPD), Majlis Bandaraya Ipoh (MBI), Majlis Bandaraya Sepang (MBS), and Majlis Daerah Hulu Selangor (MDHS). Descriptive analysis is employed to present the secondary data, utilising a graphical representation to illustrate the number of complaints over the specified years (2016-2019). Data beyond these range years are not available for these 6 municipals. Due to the difficulty in obtaining data, the study did not develop a detailed social network of residents in the real world and compare it with the results obtained (Huang et al., 2023). Therefore, this study undertook ready data, and the analysis was made based on that. Lastly, due to resource and time constraints, the study did not conduct surveys in more cities to further enhance the result. Instead, the research team constructed the model based on a careful selection of five sample cities that met the research needs.

RESULTS AND DISCUSSION

The COB report trend is a crucial reference for developers, managing cooperatives, and unit owners who share facilities under strata acts. This paper specifically concentrates on complaints received by COB from 2016 to 2019, a period preceding the outbreak of the COVID-19 virus in Malaysia. Report during

COVID-19 is not applicable as it is not available on the KPKT website. One of the reasons that can be justified is that the result beyond 2019 may be different, where most houses are fully occupied 24 hours a day and seven days a week due to Covid-19 Movement Control Order (MCO). In order to ensure that this study can become a basis for future studies on non-MCO situations, the data from 2016 to 2019 are chosen. The analysis of these complaints encompasses six categories: (i) meeting and selection, (ii) administration and management, (iii) repair and maintenance, (iv) financing issues, (v) advising services, and (vi) the COB's governance. This pattern is based on the four years from 2016 to 2019.

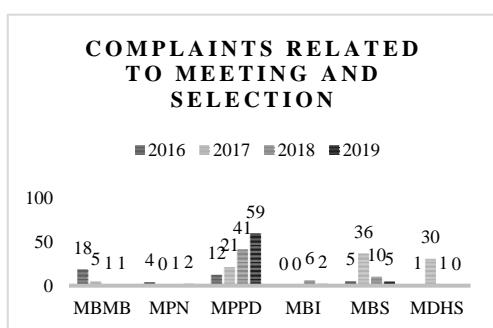


Figure 1: Complaints related to Meeting and Selection
Source: Yearly Report of COB 2016-2019

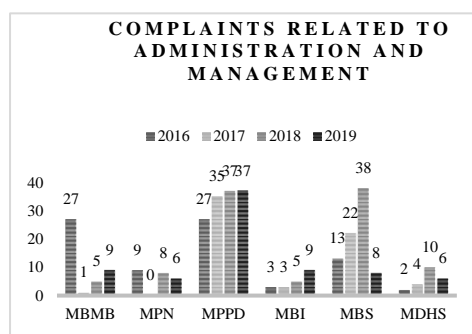


Figure 2: Complaints related to Administration and Management
Source: Yearly Report of COB 2016-2019

Figure 1 illustrates that the municipal entity with the highest number of complaints related to meeting and selection within the four years is Majlis Perbandaran Port Dickson, Negeri Sembilan. Conversely, Majlis Bandaraya Ipoh has the least number of complaints concerning meeting and selection during this timeframe. Figure 2, in the case of complaints related to administration and management, Majlis Perbandaran Port Dickson exhibits the highest number of complaints compared to other municipalities in category 2. The total number of complaints within this category is 136, constituting a significant portion of the overall municipal complaints in category 2, which amounts to 324 over the four years.

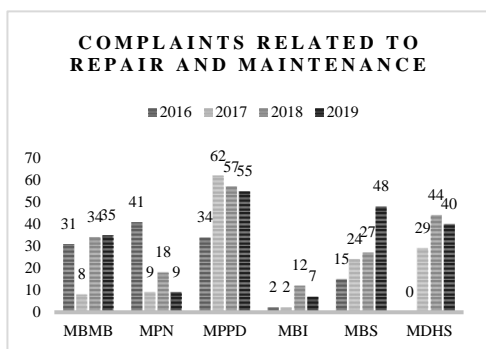


Figure 3: Complaints related to Repair and Maintenance
 Source: Yearly Report of COB 2016-2019

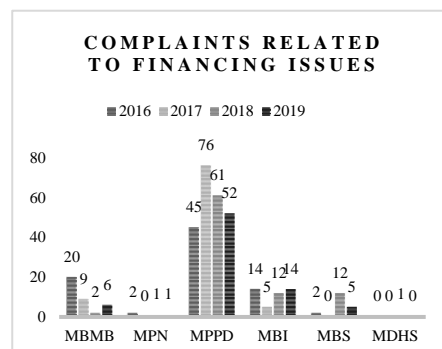


Figure 4: Complaints related to Financing Issues
 Source: Yearly Report of COB 2016-2019

Figure 3, within this category of complaints, the overall municipal entities exhibit a relatively balanced distribution of complaints. Notably, Majlis Bandaraya Ipoh stands out with the least number of complaints, totalling 23 out of the 643 complaints reported in this category. Data in Figure 4 indicates that Majlis Daerah Hulu Selangor has consistently received only one complaint over the four years, signalling a positive trend regarding financing issues within this municipality. In contrast, Majlis Perbandaran Port Dickson records the highest number of complaints related to financing issues, with 234 out of a total of 340 complaints in this category. Financial issues are crucial in managing strata building.

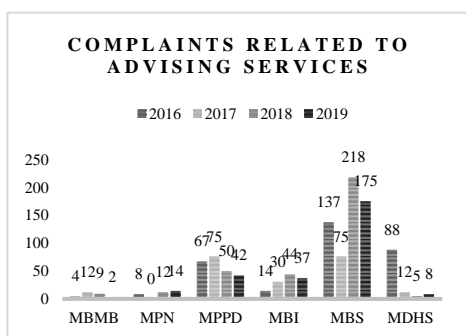


Figure 5: Complaints related to Advising Services
 Source: Yearly Report of COB 2016-2019

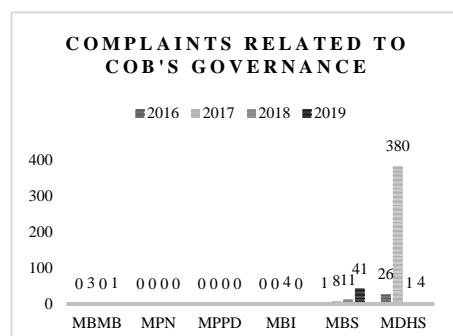


Figure 6: Complaints related to COB Governance
 Source: Yearly Report of COB 2016-2019

The financial aspect is important to ensure an extended building lifespan and to maintain its value (Khalid MS et al., 2017). Figure 5 shows the category of complaints related to advising services. The data reveals a distinct pattern, with Majlis Bandaraya Sepang receiving the highest number of complaints among the six municipalities. Specifically, Majlis Bandaraya Sepang recorded a total of 605 complaints out of 1138 within the four years. By referring to Figure 6, four municipalities appear to have a relatively low number of complaints related to COB's governance, suggesting that the functions of COB are generally well-managed in these areas. Notably, Majlis Daerah Hulu Selangor experienced a significant number of complaints related to governance in 2017. However, no complaints were recorded for the subsequent years, indicating a potential improvement in the municipal's actions related to governance. The pattern of complaints with the highest numbers faced by the municipal for 4 years (2016-2019) is shown in Table 1.

Table 1: The types of complaints with the highest number of complaints

Types of complaints	Total number of complaints (2016-2019)	The municipal with the highest number of complaints	Total number of complaints based on municipal
Meeting and Selection	261	MPPD	133 (51%)
Administration and Management	324	MPPD	136 (42%)
Repair and Maintenance	643	MPPD	208 (32%)
Financing Issues	340	MPPD	234 (69%)
Advising Services	1138	MBS	605 (53%)
COB's Governance	480	MDHS	411 (86%)

There are six types of complaints recorded with three municipals, namely Majlis Perbandaran Port Dickson (four types of complaints), Majlis Bandaraya Sepang (one type of complaint) and Majlis Daerah Hulu Selangor (one type of complaint). The municipality with the highest number of complaints in this category is Majlis Perbandaran Port Dickson, Negeri Sembilan. During 2016-2019, there was a total of 261 complaints in the first category on meeting and selection. For this category, Majlis Perbandaran Port Dickson received 133 complaints, which constitutes 51% of the total complaints. In the second category of administration and complaint, a total of 324 complaints were recorded from 2016 to 2019. Majlis Perbandaran Port Dickson, Negeri Sembilan, stands out with the highest number of complaints in this category as well. Specifically, this municipality received 136 complaints, accounting for 42% of the total complaints. In the third category of complaints on repair and maintenance, a total of 643 complaints were received from 2016 to 2019. Majlis Perbandaran Port

Dickson, Negeri Sembilan, received the highest number of complaints in this category, where 208 complaints were recorded, making up 32% of the total complaints. In the fourth category of financing issues, a total of 340 complaints were reported from 2016 to 2019. Majlis Perbandaran Port Dickson, Negeri Sembilan again led this category. The municipality received 234 complaints, constituting 69% of the total complaints. In the fifth category regarding advising service, the highest number of complaints, totalling 1138, was recorded by Majlis Bandaraya Sepang, Selangor. This municipality received 605 complaints, making up 53% of the total complaints. In the sixth category of COB governance, a total of 480 complaints were registered. Majlis Daerah Hulu Selangor, Selangor received the highest number of complaints. This municipality recorded 411 complaints, constituting a significant 86% of the total complaints in this category. Raising the level of awareness about the laws and legislation among residents in shared properties will increase their understanding of the importance of cooperation and tolerance in shared living (Khalid MS et al., 2017). These can significantly reduce complaints, especially regarding administrative and management issues. For complaints regarding repair and maintenance, among the strategies are setting out a program of fixed schedule for regular maintenance, making life easier for the owners by creating an online complaint form, considering future maintenance while preparing the project planning, providing training for the management team chosen and impose fines on owners for late payment of maintenance fee (Abas D.N. et al., 2021).

FINDINGS

This research found six aspects that the COB should take action to reduce the number of complaints by proposing strategies.

Consistent Municipal Dominance

MPPD consistently emerge as the municipality with the highest number of complaints across multiple categories: Meeting and Selection, Administration and Management, Maintenance and Defects, and Financing Issues. The future establishment of a strategic framework of roles and involvement of joint property management in strata buildings is expected to assist the designer in improving overall building quality by consolidating efforts on a few major issues or problems that arise during operation and maintenance stages and gathering existing knowledge from the property or facilities managers (Abas D.N. et al., 2021).

Diverse Concerns

The types of complaints are diverse, covering areas such as meeting and selection, administration and management, maintenance and defects, financing issues,

advising services, and COB's governance. These complaints can be efficiently tackled with an up-to-date database of occupants. It is crucial to obtain complete information about residents' social networks in order to develop a complete social network structure (Huang et al., 2023). This social network structure can develop a pattern of complaints.

Varied Municipal Performance

Different municipalities excel in managing specific types of complaints. For instance, MBS leads in Advising Services, while MDHS dominates in COB's Governance. COB, as an institution, should play a more proactive role in helping JMBs and other parties involved in the maintenance and management of high-rise properties. On the other hand, JMBs must also better understand the duties and powers as are legally provided and figure out the best approach to deal with the various challenges (Khalid M.S, 2017)

High Percentage of Municipal Contribution

In several categories, a substantial percentage of total complaints is attributed to a single municipality. Notably, in financing issues, MPPD accounts for 69% of the total complaints. There is a need to lay out strict enforcement by the authority, i.e. COB and compliance by all parties involved in the provision of Act 575 for the strata management to be improved (Rabe et al., 2021)

Potential Areas for Improvement

The findings suggest potential areas for improvement, particularly in the municipalities that consistently receive a high number of complaints. Addressing the concerns raised in these categories could lead to enhanced satisfaction and reduced grievances. Proactive measures should be taken into consideration, such as having a technical course as well as streamlining the management to be more efficient. Developing the Term of Reference (TOR) and design standard has the potential to be adopted by governmental agencies and be incorporated into their existing codes and standards (Abas D.N. et al., 2021).

Significance of Advising Services

Advising Services emerges as a category with a significantly high number of total complaints. This situation signals the importance of paying attention to this aspect and working towards improving advising services to meet community needs. In conclusion, this research provides insights into the patterns of complaints across municipalities and categories, offering valuable information for targeted improvements and strategic planning. The review and amendment of Act 757 are also necessary to be more comprehensive and dynamic to cater for any issue which may occur due to the fast development (Rabe et al., 2021)

CONCLUSION

Strata living in Malaysia has emerged as a popular urban lifestyle, yet it comes with its own set of challenges (Abas et al., 2018). This study explores the specific facets of financial management, communication, decision-making, defects and repairs, administration, and regulation within the context of strata living in Malaysia. Financial responsibilities are a cornerstone of strata living, as unit owners contribute to common expenses. The JMBs take a prominent role in budgeting, financial planning, and transparent reporting. The Strata Management Act 2013 should strategically delineate the financial obligations of unit owners, ensuring a systematic approach to fund management and making known this enforcement. Effective communication is pivotal for harmonious strata living. Raising the level of awareness about the laws and legislation among residents in shared properties will increase their understanding of the importance of cooperation and tolerance in shared living (Khalid M.S. et al., 2017). Utilising various channels such as official notices, newsletters, online platforms, and community meetings, the JMBs facilitate transparent communication. Informed residents contribute to a sense of community and understanding of decisions, maintenance schedules, and overall updates. Decision strata communities operate through well-defined decision-making protocols outlined in the Strata Management Act 2013. The JMBs, comprising developers and unit owners, should actively engage in decisions related to property management, rule enforcement, and community well-being. General meetings provide a platform for resident consultation on key decisions (Khalid, 2017). Addressing defects and repairs is a collaborative effort involving developers, JMBs, and unit owners. Developers handle initial defects during the liability period, while JMBs coordinate defect identification and unit owners contribute to maintenance funds for repairs. The Strata Management Act 2013 offers guidelines for a systematic approach to defect resolution. Administrative functions evolve, starting with the JMBs' role in day-to-day operations, rule enforcement, and maintenance coordination. Transitioning to an MC is a significant administrative step outlined in the Strata Management Act 2013. The MC assumes greater responsibilities, overseeing common property management and financial matters. Regulatory compliance is paramount in strata living, with the Strata Management Act 2013 serving as the regulatory framework. The COB oversees compliance, intervening in cases of non-compliance. Adherence to regulations encompasses by-law enforcement, transparent financial reporting, and ensuring administrative and maintenance practices align with legal requirements. In conclusion, strata living in Malaysia demand a nuanced approach to financial management, effective communication, decision-making, defect resolution, administration, and regulatory compliance. The collaboration between unit owners, JMBs, and the

COB is important to ensure a holistic and harmonious living environment within the vibrant landscape of strata communities.

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ASSESSING JOB-HOUSING BALANCE AMONG LOW-INCOME HOUSEHOLDS IN PENANG ISLAND, MALAYSIA

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Abstract

The balance between the geographical proximity of job and housing locations will have a significant impact on commuting patterns to the workplace. The key determinants for attaining job-housing equilibrium are the geographic placement, proximity, and travel time between an individual's domicile and place of employment. The absence of a balance between employment availability and housing can significantly harm the quality of life and overall welfare of those in low-income categories. The objective of this study is to assess the balance between work and residential areas for economically disadvantaged households in two distinct districts on Penang Island, Malaysia. A quantitative methodology employed to choose 306 respondents from low-income groups in the northeast and southwest areas to complete the questionnaire. The binary logistic regression analysis indicated that, despite the diverse economic sectors and distinct land uses and built environments, the job-housing balance in both the northeast and southwest areas is comparable. The study revealed that the transport system is the crucial factor in addressing the disparity between job opportunities and affordable housing for low-income individuals. In order to enhance their job accessibility, they require transportation that is both cost-effective, highly efficient, and sufficiently suitable. Hence, policymakers ought to intensify their strategies to ensure the provision of adequate, cost-effective, and proficient transport infrastructures to cater to the needs of this specific demographic across various geographical settings.

Keywords: Location; Distance; Commuting time; Job-housing balance

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INTRODUCTION

The excessive process of urbanisation in urban development significantly affects the changes in the characteristics and typology of outlying areas. This state is defined by alterations in land utilisation that arise as new areas of settlement are established (Syafri et al., 2024). Therefore, when selecting a place to live, it is crucial to take into account the presence of well-developed transit systems and road infrastructure of superior quality (Rosli et al., 2024). Generally, the most desirable choice for residential selecting is a place with an amazing transit network that promotes access to employment chances. In addition, the selection of a home location is impacted not only by the financial capacity of a household, but also by the geographical and spatial qualities of a given residential neighbourhood (Wee & Cao, 2020). Urban inhabitants often opt for residential communities in suburban places that offer positive community qualities. They typically rely on public transit, such as commuter services, for their mobility demands (Jones Lang Lasalle IP Ins., 2020). The ability to obtain employment is the most crucial aspect that a residential area provides in order to connect individuals with the economic foundation of their households. Hence, it is crucial to prioritise enhancing the efficiency of mobility in spatial planning and policies across all nations, with the aim of optimising accessibility levels (Kompil et al., 2019).

Since the 1960s, researchers in the fields of urban economics and sociology have examined the effects of limited job accessibility on workers, particularly those without personal transportation (e.g., Kain, 1968; Wachs and Kumagai, 1973). Several research conducted in various US metropolitan areas and selected EU cities have found that limited access to both private automobiles and public transit hinders employment accessibility. Notable studies on this topic include those by Cervero et al. (2002), Kawabata (2003), Korsu and Wenglenski (2010), Matas et al. (2010), and Sanchez et al. (2004). Nevertheless, there is a scarcity of research regarding the topic of job-housing balance among low-income workers, particularly in developing nations where the public transport system necessitates substantial enhancements and synchronised development due to its insufficient capacity to efficiently connect individuals between their residence and place of work. Hence, the objective of this study is to assess the balance between work and residential locations among socioeconomically disadvantaged households in Penang Island, Malaysia.

LITERATURE REVIEW

The Significance of Location in the Job-Housing Balance

An efficient transport and mobility infrastructure is a crucial element of the eleventh Sustainable Development Goals (SDGs), with the objective of ensuring that cities worldwide are sustainable and capable of providing a high standard of living for their inhabitants (Kompil et al., 2019). The European Union has

implemented a sustainable urban mobility policy in its member countries. This policy aims to ensure that cities and regions have a high level of sustainable mobility and provide equal access to all community facilities. Hence, it is crucial to prioritise the enhancement of mobility efficiency in the spatial planning and policy of every country in the continent. This will help mitigate social and regional disparities and alleviate the financial burden of transport for all individuals (Kompil et al., 2019).

There are two primary factors that underpin mobility: location and distance. Location is intricately linked to the act of travelling inside a certain area, use vehicles and the available transportation infrastructure to reach that particular place (Rodrigue, 2017). Regarding this matter, a site that is characterised by higher productivity, competitiveness, and appeal is one that offers a diverse range of amenities and is conveniently accessible, as opposed to a remote area that is deficient in terms of facilities (Papa & Coppola, 2012). Distance refers to the extent of trip required to connect two specific sites using available vehicles and transportation infrastructure (Rodrigue, 2017).

The housing location is a crucial factor that influences both the cost of housing and the residents' quality of life. Some households are willing to compromise on factors such as distance, travel time to work, and availability of services and facilities in order to obtain a more affordable house (Khazanah Research Institute, 2019; Yusoh et al., 2022). However, this circumstance has indirectly exacerbated traffic congestion (Osman & Md Saini, 2019), as a consequence of which, the majority of citizens are more inclined to utilise their personal vehicles for transportation. Conversely, a residential neighbourhood will gain more value and attract the attention of the local community as a desirable place to live if it offers comprehensive, convenient, and inexpensive public transportation options (The Relocation Bureau, 2017).

The selection of a housing location as a place to live depends on the requirements and talents of individuals, and can be guided by many qualities of the house's location. These features typically rely on socio-demographic factors and individual mobility choices (Zhao et al., 2017). Nevertheless, it is undeniable that an ideal residential location, which offers convenient access to essential amenities, is the aspiration of every individual (Boussauw et al., 2012). Hence, the choice to possess a residence necessitates the household to create a crucial assessment that encompasses several elements, such as the household's amount of availability to diverse amenities (Geurs & van Wee, 2004). Hence, the convenience of transportation from the residential area is a crucial factor that must be given priority by every household when selecting the desired site for their home.

Spatial Mismatch and Job-Housing Balance

Spatial mismatch refers to the disparity between the location of job opportunities and the availability of suitable housing. It is a concept that examines the imbalance between where people live and where they work. Several ideas exist that explain the relationship between housing and employment. The theory and models that align with the foundation of this work are the spatial mismatch theory. The work market's economic advantages necessitate a close correlation between housing and the accessibility to job opportunities from the dwelling location (Haddad & Barufi, 2017). Nevertheless, the degree to which individuals residing in a particular location, particularly those from the low-income group employed in urban areas, may conveniently access employment possibilities within a desirable distance from their place of residence undoubtedly varies. In Singapore, the relocation of low-income individuals to new urban settlements outside the city centre, as part of the job decentralisation process, has led to challenges such as limited resources and increased commuting time to reach employment opportunities. This is due to the spatial mismatch between the residential areas and job locations (Lau, 2011). The introduction of the 'hukou' system in China has limited migration from rural to urban areas, resulting in a spatial mismatch between housing and employment in rural areas. This has led to a scarcity of employment prospects in these regions (Bimpou et al., 2020). The 'hukou' system, which limits access to essential resources like housing, medication, and education, has led to the neglect of millions of children in rural areas. Their parents who moved to the city for survival (Jamaluddin, 2015) have left behind these children.

Kain's (1968) study on the geographical mismatch between residential areas and job chances has revealed that the inability of black individuals to access low-skilled job opportunities from their place of residence has resulted in a significant unemployment issue (Zeng et al., 2020). Spatial mismatch refers to the situation where low-income households face challenges in accessing suitable employment opportunities due to the location of their housing (Kain, 1968). In 1968, John F. Kain introduced the Spatial Mismatch Theory, which highlights the impact of residential segregation on job prospects for black individuals, resulting from their geographically dispersed population (Ihlanfeldt, 1992). The decentralisation of employment has exacerbated the issue by augmenting the unemployment rate among black individuals, who already face constraints in accessing essential amenities, particularly public transport facilities (Gobillon et al., 2007) (Gobillon, Selod, & Zenou, 2007). The notion of geographical mismatch has been extensively utilised as a framework in numerous studies examining social and economic spatial mismatch (Wei et al., 2013).

RESEARCH METHODOLOGY

Primary Data Collection

This study is a deductive study that entails the collection of primary data through the distribution of a questionnaire to 306 respondents from the low-income group in the northeast and southwest districts of Penang, Malaysia. In Malaysia, the government created a national poverty data bank called eKasih to compile information on the population living in poverty, both in rural and urban areas across the country. Therefore, it enables the Malaysian government to efficiently devise and execute strategic poverty initiatives for the intended demographic. Hence, the population size of the low-income group residing in the northeast and southwest districts of Penang was acquired from the eKasih database for the year 2016. The data indicates that a total of 1546 households with low income were registered under eKasih for the two districts (Department of Social Welfare, 2016). This figure is significantly large for this investigation. Therefore, the sample size was decreased using a suitable ratio to accurately represent the actual population to conduct this study, as indicated by the Morgan table (see Figure 1). According to the Morgan table, the appropriate sample size to accurately represent the total population size is 306 respondents. Consequently, a total of 306 participants who possessed appropriate attributes were chosen to respond to the questionnaire, as indicated in Table 1.

Table 1. Morgan Sampling Table
(Modified from: Krejcie & Morgan, 1970 in KENPRO, 2012)

Sample	Population	Sample	Population
278	1000	302	1400
285	1100	306	1500
291	1200	310	1600
297	1300	313	1700

Study Area

The study areas chosen for this research are the southwest and northeast districts of Penang state, Malaysia (refer to Figure 1). The study area is located inside the island state of Penang. Since the 1970s, the primary economic drivers in the study region have been the manufacturing and service sectors, making it an industrial state over the previous 50 years (Bernama, 2021). The service and manufacturing sector have the highest contribution percentages compared to other sectors. Specifically, the service sector contributes 51.4% and the manufacturing sector contributes 42.8%. In contrast, the construction industry contributes 2.8%, agriculture contributes 2.2%, and the mining and quarrying sector contributes 0.2%. The service industry in the state of Penang experienced a growth rate of 5.5 percent in 2019, although the manufacturing sector only grew by 2.7 percent (Department of Statistics Malaysia, 2019). However, in 2021, the manufacturing sector in the state of Penang attracted the biggest amount of foreign direct

investment (FDI) in Malaysia, totaling RM74.4 billion. This investment accounted for 98% of the total investment in the manufacturing sector (National Security Council, 2022). The influx of international investors into this state is closely linked to the availability of robust supply chains, highly skilled workforce, and the investor-friendly stance of the State Government (Kerajaan Negeri Pulau Pinang, 2018).

Essentially, the northeast and southwest districts are entirely distinct from each other. The services sector in the northeast district is highly concentrated due to the presence of major government administrative offices in this area. Conversely, the economy of the southwest district is characterized by a higher level of activity in the manufacturing sector, primarily due to the presence of a substantial industrial zone.

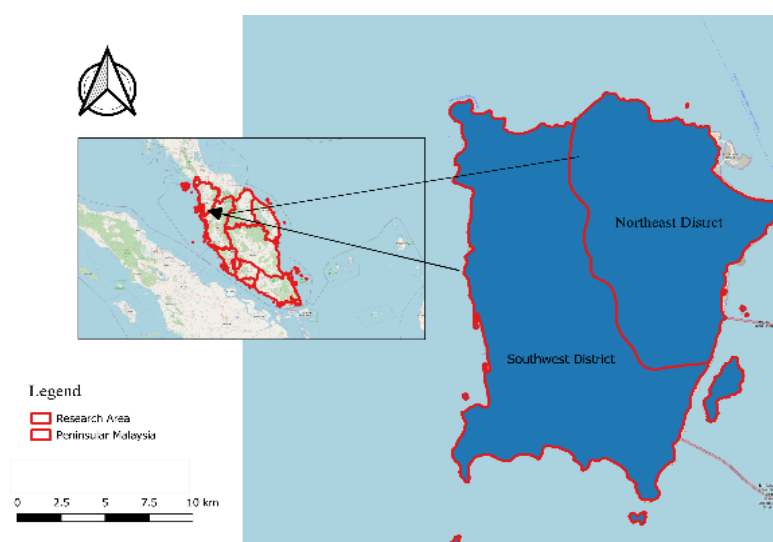


Figure 1. Study Area in Penang Island, Malaysia

Statistical Analysis

The analysis primarily utilised descriptive statistics and cross-tabulation techniques to project data on demographic characteristics, dwelling type, vehicle type, distances, and commuting time. Subsequently, the data will be utilised to perform multinomial logistic regression analysis to assess the job-housing balance between the low-income group in the northeast and southwest districts. For this regression analysis, the independent variables with respective coding had been used, namely, housing type (HT), vehicle type (VT), distance to the city centre (DCC), distance to supermarket (DS), distance to workplace (DW) and time taken for commuting between home and workplace (TC).

ANALYSIS

Table 2 displays the initial demographic profile of the responders. The survey predominantly comprises respondents of Malay ethnicity. Generally, most of the participants are employed in the manufacturing and services industry. According to the predicted statistics, a majority of 37.58% of respondents from the northeast district and 54.25% of respondents from the southwest district have a monthly family income of less than RM2,500.00. This data illustrates that a significant proportion of individuals in the low-income bracket are experiencing financial hardship. The poor income necessitates the allocation of funds towards the escalating and exorbitant expenses associated with living in Penang Island, such as food, transportation, gas, and other basic necessities. Furthermore, the value closely approximates the national poverty line, which stands at a monthly household income of RM2,208.00 according to the World Bank in 2023.

Table 2. Demographic Characteristics of the Respondents

Demographic Characteristics	Northeast District		Southwest District	
	Total	Percentage (%)	Total	Percentage (%)
Ethnicity				
Malay	109	35.62	147	48.04
Chinese	8	2.61	7	2.29
Indian	13	4.25	22	7.19
Job				
Manufacturing sector	46	15.03	91	29.74
Services sector	77	25.16	76	24.84
Other sectors	7	2.28	9	2.95
Household Income				
Less than RM2,500	115	37.58	166	54.25
RM2,500-RM3,169	13	4.25	8	2.62
RM3,170-RM3969	2	0.65	2	0.65

The northeast district has the highest concentration of low-income individuals, with 21.57% residing in low-cost flats. In contrast, the southwest district has the highest proportion of low-income individuals living in detached houses, accounting for 30.39%.

Specifically, the northeast district has a majority of 19.28% or 59 respondents who live at a distance of 6.0 to 10.0 km from the city core. Meanwhile, 25.82% or 79 respondents in the southwest district live 20.0 to 30.0 km away from the city centre. Approximately 22.55% of low-income households have convenient access to supermarkets located at a distance of 0.5 to 5.0 km from their residences. This is significant as supermarkets are crucial food providers for these individuals. However, a significant proportion of low-income households in the southwest districts, specifically 23.20%, must travel a distance of 11.0 to 20.0 km in order to reach the nearest supermarkets. This data illustrates that a majority of low-income households dwelling in the core zone have convenient access to supermarkets for their daily necessities, in contrast to those

whose homes are located distant from the core zone. Regarding workplace accessibility, the majority of low-income households in the northeast district have a commute distance of less than 15.0 km. In contrast, the majority of low-income households in the southwest district have a travel distance ranging from 16.0 to 30.0 km.

The majority of residents in the northeast area have a commute time of less than 30 minutes, whereas in the southeast district, the average commute time ranges from around 31 to 60 minutes. Evidently, a majority of low-income households in the southwest region had to travel greater distances and spend more time commuting to their workplaces.

Table 3. Job-housing Balance Independent Variables

Housing Type (HT)	Low-cost Flat	Medium-cost Apartment	Terrace House	Detached House
Northeast	21.57%	3.59%	7.52%	9.80%
Southwest	14.05%	2.29%	10.78%	30.39%
Distance to City Centre (DCC)	(0.5-5.0) km	(6.0-10.0) km	(11.0-20.0) km	(20.0-30.0) km
Northeast	13.07%	19.28%	8.17%	1.96%
Southwest	1.63%	8.50%	21.57%	25.82%
Distance to Supermarkets (DS)	(0.5-5.0) km	(6.0-10.0) km	(11.0-20.0) km	(20.0-30.0) km
Northeast	22.55%	15.69%	3.27%	0.98%
Southwest	10.46%	18.03%	23.20%	5.56%
Distance to Workplace (DW)	< 15.0 km	(16.0-30.0) km	(31.0-45.0) km	(46.0-60.0) km
Northeast	26.80%	8.17%	5.23%	2.29%
Southwest	17.97%	32.68%	4.90%	1.96%
Vehicle Type (VT)	Public Bus	Motorcycle	Car	Employer's Vehicle
Northeast	1.63%	29.08%	8.82%	2.94%
Southwest	3.92%	42.81%	8.50%	2.29%
Time Taken for Commuting from Home to the Workplace (TC)	<30 minutes	31-60 minutes	61-90 minutes	91-120 minutes
Northeast	24.84%	14.05%	3.27%	0.33%
Southwest	26.80%	27.45%	2.29%	0.98%

Comparison of Job-Housing Balance between Two Districts

Throughout this section, a binary logistic regression analysis is conducted utilizing all independent variables related to job-housing balance, specifically HT, VT, DCC, DS, DW, and TC. This analysis has been conducted by treating the district of the study area as the dependent variable, with DW and TC selected as independent variables. DW is the first indicator and TC is the second indicator. The purpose is to determine which district has the strongest relationship between

the distance between houses and workplace, travel time factors, and the balance of home location and mobility to the workplace for respondents. The dependent variable is encoded in binary format, where the northeast district is denoted by 0 and the southwest district is denoted by 1 for the purpose of this analysis. To obtain clear and easily understandable results, it is necessary to input the indicators individually in a step-by-step manner during this study.

Based on Table 4, the results indicated that the regression model was statistically significant prior to the inclusion of the indicator. This was evidenced by a p-value of 0.009, which is below the threshold of 0.05 ($p < 0.05$). The degree of freedom (df) must be greater than the significance level. The degrees of freedom (df) value for this study is 1, which is greater than the significant value, even before including the indicator. Hence, this regression model is appropriate for forecasting respondents from a certain district, where the correlation between the distance factor between home and workplace and the trip time component has the greatest impact on the equilibrium between the respondent's residential location and their mobility to the workplace.

Table 4. Variables in the Equation

		B	S.E.	Wal d	d f	Sig.	Exp(B)
Step 0	Constant	0.30	0.116	6.86	1	0.00	1.354
		3		2		9	

Subsequently, the initial indicator, denoted as DW, is incorporated into the regression model. In order to predict the district where the respondent is from, which takes into account both home location and job mobility, the chi-square value obtained must exceed the significant value after entering the indicator. Based on the data in Table 5, the chi-square value obtained is 244.397, which exceeds the significant value of 0.009 stated in Table 4. Furthermore, the df value must exceed the df value prior to the inclusion of the DW indication. Table 5 shows that the degrees of freedom (df) value increases to 47 when the Durbin-Watson (DW) indicator is included, which is higher than the previous df value. Thus, it can be inferred that the independent variable DW, representing the distance between the respondent's residence and employment, serves as an indication that helps elucidate the fluctuations in the dependent variable of this research.

Table 5. First Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
C8	<i>Step</i>	244.397	47	.000
	<i>Block</i>	244.397	47	.000
	<i>Model</i>	244.397	47	.000

Next, the regression model incorporates the TC indicator, and the corresponding outcomes are presented in Table 6. After including the TC indication, the chi-square value and df value both exhibit an increase compared to the prior value. Specifically, the chi-square value is 266.575 and the df value is 65. Thus, it can be inferred that the TC indicator, representing the travel time needed to commute between home and workplace for the participants, has the ability to impact and clarify the differences in the dependent variable of this research.

Table 6. Second Omnibus Tests of Model Coefficients

		<i>Chi-square</i>	<i>df</i>	<i>Sig.</i>
TC	<i>Step</i>	266.575	65	.000
	<i>Block</i>	266.575	65	.000
	<i>Model</i>	266.575	65	.000

Additionally, it is necessary to examine the R^2 value given in Table 7 to determine the extent to which the DW and TC indicators in the regression model of this study can impact the dependent variable by identifying various variations or modifications. Table 7 provides information on two approaches, Cox & Snell and Nagelkerke, which are used in binary logistic regression analysis to calculate the R^2 value. Typically, these two approaches yield distinct outcomes, however they serve the same purpose, which is to elucidate the extent to which an indicator can impact the dependent variable in this regression model. The significance of R^2 for each of these strategies will be evident when the value falls below 1. Given that the Nagelkerke R^2 method is a modified version of the Cox & Snell R^2 method, the R^2 value mentioned in this study specifically refers to the one calculated using the Nagelkerke R^2 method. The R^2 value for the regression model in this study is 0.781, indicating that 78.1% of the variation or change in the dependent variable can be attributed to the DW and TC indicators. This discovery demonstrates that the DW and TC indicators have a significant impact on the dependent variable, with a percentage above 50%. Thus, it can be inferred that the DW and TC indicators are reliable predictors of the equilibrium between residential location and commuting to work across various geographies.

Table 7. Model Summary

<i>Step</i>	<i>-2 Log likelihood</i>	<i>Cox & Snell R Square</i>	<i>Nagelkerke R Square</i>
1	150.690a	0.582	0.781

According to the binary logistic regression model, the categorization of the dependent variable will establish the district's balance of location and mobility to the workplace among respondents using the DW and TC indicators. The results presented in Table 8 demonstrate that respondents from both the northeast and

southwest districts have an equal balance of home location and mobility to the workplace. This is supported by a 91.5% accuracy rate, indicating that there is no disparity in terms of distance from home to workplace and mobility to the workplace. This suggests that all challenges and problems related to the distance between home and office, as well as commuting to work, are the same for both districts. There are no distinct issues or cases that can separate the mobility situation between the two. Thus, it can be inferred that the spatial and physical mobility in both districts are comparable, as all respondents commute to their workplaces in a scenario and environment where no significant distinctions can be observed.

Table 8. Dependent Variable Classification Table Binary Logistic Regression Model

District	Prediction		Accuracy Percentage
	District		
	Northeast	Southwest	
Northeast	119	11	91.5%
Southwest	15	161	91.5%

In contrast to these study findings, Delmelle et al. (2021) discovered that the built environment does indeed have an impact on achieving a balance between job and housing. Their research revealed that polycentricity has the potential to enhance job accessibility, particularly for disadvantaged populations. In their study, Delmelle et al. (2021) examined work accessibility from residential areas in Charlotte, the largest city in North Carolina, United States. The researchers discovered that there is no notable disparity in employment rates among various neighbourhoods. Nevertheless, it was discovered that the degree of accessibility among low-income households does really influence the growth of their household income. However, the diverse and multi-centred urban structure established by Charlotte played a role in mitigating the spatial disparity between low-income workers and low-paying employment opportunities.

On the other hand, Bastiaanssen et al. (2022) found in their study conducted in Great Britain that efficient and sufficient public transport is crucial for achieving a balance between job and housing locations, as well as providing excellent job accessibility for low-educated groups and low-income neighbourhoods, regardless of whether they are in metropolitan areas or smaller cities and towns. Their research demonstrates that transit contributes to achieving a balance between employment and housing. According to the findings from this study, 29.08% of the low-income group in the northeast district and 42.81% in the southwest district choose motorbikes as their mode of transportation to commute to work (see Table 3). Therefore, it is demonstrated that the choice of mobility for commuting to work contributes to bridging the gap between employment and housing.

CONCLUSION

The study's findings concluded that variations in land use, constructed surroundings, and economic sector types do not impact the balance between employment opportunities and housing location for low-income demographics. The transit system has a crucial role in connecting low-income groups with both job opportunities and affordable housing. Acquiring the most cost-effective and highly effective means of transportation is the optimal decision for connecting those with limited financial resources to employment opportunities. Therefore, regardless of whether one resides in urban, suburban, or rural locations, transportation is of utmost significance in maintaining a proper equilibrium between employment and housing. Hence, policymakers had to enhance their approaches in order to furnish low-income demographics in various areas with cost-effective, proficient, and sufficient transportation infrastructures. Consequently, the level of work accessibility inside this group will augment, leading to economic benefits for them.

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BUILDING INFORMATION MODELLING AND MONTE CARLO SIMULATION APPLICATION: ENHANCEMENT MITIGATING RISK OF CONTRACTOR'S SELECTION IN THE CONSTRUCTION PROJECT

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Abstract

Low-bid selection can significantly impact construction delivery, leading to delays, substandard quality, and cost overruns if pricing risks are not considered. This research, however, provides a solution that empowers Quantity Surveyors (QS) to act. They can implement BIM to ensure the accuracy of the prepared pre-tender estimate. Furthermore, the application of Monte Carlo (MC) simulation, using probability distribution, can provide a range of tender prices that can be accepted by the client, thereby mitigating the risk of pricing error by the contractor. As demonstrated in this research, the combination of BIM and MC simulation offers a powerful tool for the construction industry. A case study method through document analysis has been chosen to investigate the patterns of tender prices the bidders offer for a bridge construction project. Then, using a pre-tender estimate as a starting point, MC simulates thousands of probable tender prices in a random sequence based on normal distribution. The outcomes indicate that the clients could avoid the high risk of choosing a contractor based on the lowest tender price in a construction project by using Monte Carlo. Therefore, the research shows that applications of Building Information Modelling and Monte Carlo simulation are not just beneficial but crucial for judgment for clients in the construction industry, and it is up to the stakeholders to implement these findings.

Keywords: Building Information Modelling, Monte Carlo Simulation, Estimate, Bid, Risk Evaluation, Case Study

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INTRODUCTION

The main objective of the tender evaluation is to determine the most economical bid to award the most suitable contractor. The importance of averting project implementation failure is due to the contractor's inability to undertake the work given (Halil, 2007). Even though the government has implemented various guidelines, there is currently a limited practical example of how quantity surveyors (QS) can model the accuracy of the tender price offered. In most cases, a bidder can be awarded using traditional evaluation but not perform acceptably well even with the favourable score they received during the tender evaluation process (Chen et al., 2016; Eke, Elgy, & Wedawatta, 2019). In this case, there is a large disparity between the predicted qualified bidder and actual performance.

Building information modelling (BIM) is a comprehensive information management and analysis application that is becoming increasingly essential in the scope of QS services (Halil, 2020). BIM is a process that fundamentally changes the role of computation by creating a database of the building object in the design, construction, operation, and maintenance (Nawari & Kuenstle, 2015). With the BIM application, 3-D measurement is conducted, and the quantity is obtained directly from visual drawings and transferred simultaneously to the Bill of Quantities format. This will significantly reduce the process from taking off, and there is a lesser probability of human error (Suhot, 2023). The quantity extracted from the drawing model is more accurate than the traditional method. In addition, QS can reduce the risk of producing an inaccurate bill of quantities, which might affect contractors' bidding prices and the QS pre-tender estimate (Olatunji & Sher, 2015).

Monte Carlo (MC) simulation predicts the probability of outcomes of an uncertain event and can be used to model the tender prices. Using MC simulation, the clients have an extra precaution to award the lowest tender if the price offered is not within the acceptable range in the simulation (Brokbals, Wapelhorst, & Čadež, 2019). As a cost advisor to the client, this new approach can improve QS cost advice because a reasonable tender price for the construction project can be determined (Traynor & Mahmoodian, 2019). This method can be applied after the tender evaluation procedure has been carried out, especially in the second stage. This ensures the tender price recommendation is according to the market price and QS's pre-tender estimate. Therefore, the MC simulation is crucial in ensuring the awarded contractor can fulfil the client's needs to complete the project according to the current market cost, time, and quality. Therefore, this research intends to model the realistic tender price in the 2nd stage of tender evaluation. This paper presents the MC simulation model that can evaluate the risk of each submitted tender price based on thousands of bid price simulations; thus, a realistic tender price can be proposed.

LITERATURE REVIEW

Quantity Extraction Using Building Information Modelling

With digitalisation technology, physical data in the form of drawings and plans no longer needs to be printed and dispatched to the respective parties. Data sharing that normally took 2 or 3 days would be accessible via email and cloud sharing (Suhot, 2023). This will empower all consultants to provide faster deliverables in terms of design, estimates, Bill of Quantities (BQ), tender documents, etc (Suhot, 2023). Figure 1 shows Building Information Modelling (BIM)'s AutoCAD Drawing and 3-D Model.

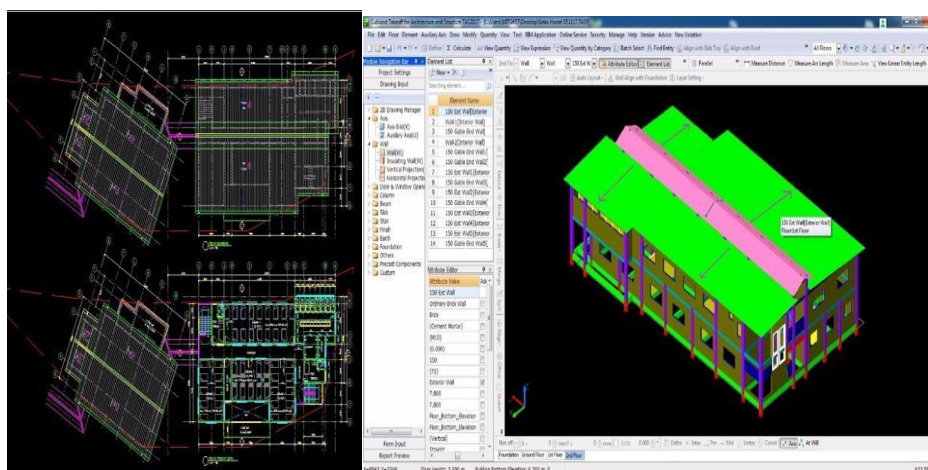


Figure 1: BIM's AutoCAD Drawing and 3-D Model
Source: MiTG (2023)

With digitalisation and 3-D modelling, building components can be rapidly adjusted during the design stage. This will ensure faster cost advice and better value-for-money design for the client. With rapid adjustment and re-use of 3-D models, working intensity is reduced and significantly increased the efficiency of team collaboration (Ali et al., 2018; Nederveen, & Hertogh, 2017). Also, with 3-D modelling, identification of design discrepancies would be easier compared to the current scrutiny of 2-D drawings and will minimise post-contract problems and cost overruns (Honnappa & Padala, 2022). Using BIM, construction quantities can be measured by adhering to the current Standard Methods of Measurement. Several software applications can be used, such as Cubic Cost.

Normally, the BIM applications have a library of descriptions, and the bills of quantities are highly organised and uniform. Depending on the level of

the design phase, the description in the bill quantities can be brief or detailed. During the completion of tender drawings, the description items should be clear and straightforward to understand and this will remove ambiguity and less error in pricing by the contractor (Joe Tidd, 2009; Suhot, 2023). Furthermore, putting the bills of quantities, specifications, and drawing together on one platform by online or physical disk, will reduce errors due to cross-referencing multiple documents currently faced by the contractors (Khosrowshahi & Arayici, 2012). Quantity Surveyor normally measure the cost in the tender price comprising material cost, labour cost, plant cost, overheads, profits and contingencies. All the costs inserted in the bill of quantities should be considered to the current market price. Failure to price according to the current market price would impact the evaluation process either the tender price is accepted or rejected for further process of tender evaluation.

Tender Price

Tender price is a crucial element for the Quantity Surveyor to evaluate in the bidding process. This price is submitted as part of a competitive bidding process, known as tender (Kissi, 2017; Halil, 2007). The tender price is a key factor the clients consider when selecting the winning bid. Kissi (2017) argues that price is a vital variable to consider by the client such as profitability, market condition, product and quality.

Lowest Tender Price VS Lowest Tender Price from the Competitive Tender Price

The lowest tender price always becomes a debate in the construction sector. Most of the researchers revealed that selecting the contractor from the lowest tender contribute to the project delay and cost overrun. Understanding how the Quantity Surveyor selects the contractor in the construction project is crucial. Normally, Quantity Surveyor will recommend to the client a suitable contractor based on the lowest tender price offered by the contractor from the competitive price. The competitive price was determined after the process of tender evaluation process. Public Work Department in Malaysia exercises a good approach in the tender evaluation process to determine a suitable competitive tender price using the cut-off method (Halil, 2007). Through normal distribution curve, outliers that offer the tender price too low and too high will be removed for further evaluation. From this stage, the bidders failed to produce a reasonable tender offer based on the current market price. Therefore, the price recommended to the client is normally the lowest from the competitive tender price. The research was conducted to identify which range of competitive tender prices the client will award the project to the bidders. Monte Carlo will guide the client on which tender price should be awarded to the contractor. Therefore, it will guide the client on which tender price should be awarded to an appropriate contractor in the construction project.

Predicting Tender Prices using Monte Carlo Simulation

Monte Carlo Simulation is a statistical technique that generates random variables for modelling risk or uncertainty in the research (Brokbals et al., 2019). This technique suits and benefits various clients, such as the public and private sector, in evaluating a realistic budget for the proposed project (Halil et al. 2020). The Monte Carlo technique is simply a way of sampling from a distribution to provide a range of solutions that QS can use to advise the client. In this case, it provides the forecast of cost for the sample it has chosen (Shaffie & Jaaman, 2016). During the evaluation phase, Monte Carlo simulation techniques can determine an appropriate tender price for the proposed project. Even though tender evaluation exercises in the federal government department may use the “cut-off method” known as the less-than-average bid method in the academic (Awwad & Ammouy, 2019), this paper proposes another approach using Monte Carlo, which is crucial for decision-making for tender selection during the pre-contract stage.

Applying the Monte Carlo simulation, the client and QS can justify the project tender price based on the identified risk in selecting an appropriate contractor. This ensures that the right price contractor will be selected accordingly and recommended to the client in the tender report. In this case, MC simulation can solve incomplete information using the probability function, allowing decision-makers to understand better risk and uncertainty (Shaffie & Jaaman, 2016). Therefore, by using Monte Carlo, the contractor's incompetence in the construction project could be avoided by the client. In addition, the client could avoid the risk of selecting an inaccurate tender price for their construction project. The benefits of BIM and MC simulation are crucial in the tendering phase, ensuring accuracy on the quantity take-off and predicting the tender price for the construction project. Therefore, decision-making to select an appropriate contractor at a reasonable cost for construction projects can be obtained (Halil et al., 2022).

Selection of Tenderers

In the construction industry, tender selection is a process of selecting a contractor from a list of several tenderers in whom the employer has the confidence to execute the construction contract based on the following criteria (Halil, 2007);

- a. A competitive tender price,
- b. Suitable construction period,
- c. Experience track record,
- d. Financial commitment,
- e. Technical knowledge.

In recommending a contractor, QS must consider the employer satisfaction requirement, namely, procuring the highest quality construction product and the best value for money (Eke et al., 2019). Based on the above explanation, BIM and Monte Carlo Simulation employed by QS will reduce the inappropriate selection of contractors for construction projects. Regarding accuracy, quantity, and price, BIM and Monte Carlo simulation can simulate the decision-making process for clients and QS at the tendering stage. Therefore, the risk of the client appointing an inappropriate contractor and the mistake of quantity calculation in the tender document could be avoided by using these software applications in construction projects.

Risk Evaluation During Process of Decision-making

During the tender evaluation, choosing the right contractor is crucial to be awarded in the construction project. Therefore, the recommended list of contractors is crucial for the client. Explicitly considering risk during tender evaluation is crucial for the client to select the best price for the contractor. By using MC, the best price for the tender awarded is forecasted. Samuel (2013) mentioned in his research that a rigorous methodology is based on key performance indicators and risk analysis for predicting the significant potential contract risks at the tender evaluation stage. A final bidder is selected for the award based on the lowest risk rather than the lowest tender price.

Using MC simulation, a probabilistic model can predict the significant potential contract risks at the tender evaluation stage (Brokbals et al., 2019). A better and more reliable system of tender evaluation is needed to predict the future performance of an awarded contractor, theoretically reducing risk, time, cost overruns, and quality defects.

RESEARCH METHOD

In this research, the method adopted is a case study approach. Creswell and Creswell (2018) describe the approach as exploring events that have occurred in the past. The selected case-study project is 'Bridge Construction', a bridge construction located in Selangor. However, the project's full name is not revealed for confidential reasons. The authors have investigated the pattern of tender prices from the project document. The document analysis for a case study should not be underestimated because it provides accurate information which cannot be collected through observations and interviews (Piaw, 2012). The following are the steps of the method adopted;

1. Compute the initial investigation (Document Analysis).
2. Determine correlations.
 - a. Between Estimate Line Items
 - b. Between Risk Drivers
 - c. Between line items and risks
3. Build a model.
4. Run MC Simulation.
5. Analyse the result.

The availability of sufficiently large data plays a significant role in correctly determining the most suitable forecasting techniques. A major advantage associated with large data collection is the ability to provide the forecaster with a fairly large selection of forecasting techniques (Lazim, 2020).

This study's MC simulation predicts the estimated range and gives confidence for the project development (Halil et al., 2020). The analysis of the tender price pattern was explored to determine an appropriate tender price for the contractor award in the construction project.

RESULTS AND DISCUSSION

This project uses open tendering. A total of thirty (30) numbers of contractors participated in this tender. After the process of tender evaluation, only eight (8) contractors are recommended to the client. The process of tender evaluation using the cut-off method. Halil (2007) describes the cut-off method implemented by Public Works Department as a tool to analyse the tender price according to deviation from the mean weighted by 1.18. The formula for the cut-off method (1) is as follows:

$$\begin{aligned}
 \text{cut off price} &= \text{Mean} - 1.18 * \text{Standard deviation} \\
 &= \frac{1}{2} \sum_{i=1}^n x_i - \left\{ 1.18 * \left[\frac{1}{N-1} \sum_{i=1}^n (x_i - \bar{x})^2 \right]^{\frac{1}{2}} \right\} \dots\dots\dots (1)
 \end{aligned}$$

Table 1 shows the list of the final recommended tenderers and their prices based on the case study.

Table 1: The list of the sampling

List of Contractors	Tender Price (MYR)
A	24,600,000.00
B	24,668,232.00
C	25,978,855.00
D	26,351,000.00
E	27,158,693.00
F	27,376,572.00
G	27,523,794.00
H	28,000,000.00

Source: Authors (2024)

From the above Table 1, the critical question is how to identify the best tender price from eight (8) contractors proposed to the client? Here, MC can help the final decision-making process for the client, to identify the best tender prices. In this case, the analysis was carried out using an MC simulation to identify the possible range of tender prices.

i) A sample of one

The sample of tender price data is evaluated, and an attempt should be made to imagine the distribution of the parent population to get an idea of the price from the sample population. The estimated price could have come from anywhere in the distribution of the parent population. The sample mean provides evidence concerning the value of a population mean based on (2). In this case, the population mean can be assumed to follow normal distribution as an approximation. However, a few other distributions can be used, such as Weibull, Lognormal and Gamma (Ballesteros-Pérez et al., 2021). In this study, it is assumed that the sampling distribution of the sample mean is a normal distribution for samples (any size) drawn from a normal population and is approximately normal for large samples drawn from any population. The sampling distribution has a formula as follows;

(2) $mean\ sample = \mu\bar{x} = \mu \dots\dots\dots$

$sample\ variance = \sigma\bar{x} = \frac{\sigma}{\sqrt{n}} \dots\dots\dots$ (3)

Where:

μ and σ = the mean and variance of the population from which random n samples are generated.

Under the critical value approach, the significance level α is predetermined. The value of α corresponds to the total area of the critical region. In this case, it can be the other region of confidence interval (95%), which may decide the minimum and maximum value of the tender price range.

ii) Result

The result shown in Figure 2 indicates 1000 trials = n random samples using MC simulation to forecast the most appropriate tender prices that can be considered by the client. Table 2 shows the most suitable tender price at RM26,254,635.04, assuming the average price is the equilibrium market price. However, the range of competitive tender prices of RM 23.38 million (minimum) to 29.34 million (maximum), the client can be advised of the decision - based on the result indicated by the MC simulation. There will be a risk for the client if choosing a price below or higher than the confidence level. Using MC, the client can evaluate the best tender price that should be awarded to the contractor in the construction project. Samuel (2013) indicates that awarding contracts solely on the lowest price could lead to the overall project risk while selecting a price higher than the limit may affect the client's budget. Therefore, MC guides the client in identifying the best tender price from the final list of contractors in the construction project (Brokbals et al., 2019).

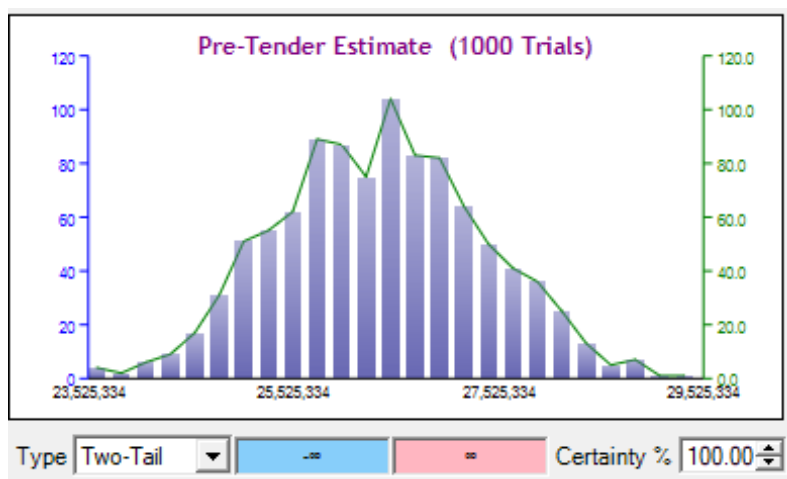


Figure 2: The distribution of the MC simulation
Source: Authors (2024)

Table 2: The outputs of the MC simulation

Statistics	Result
Number of Trials	1000
Mean	26,254,635.0360
Median	26,269,281.0679
Standard Deviation	991,375.2618
Variance	982,824,909,680.4960
Coefficient of Variation	0.0378
Maximum	29,338,444.9742
Minimum	23,370,158.4235
Range	5,968,286.5507
Skewness	0.0574
Kurtosis	-0.2450

Source: Authors (2024)

CONCLUSION

The finding reveals that selection and risk identification using Monte Carlo simulation establishes the best price offered evaluated and the confidence price level. Therefore, risky decision-making can be avoided when selecting the lowest or highest bidder. Preparing tender estimates using BIM and tender evaluation analysis with Monte Carlo simulation is crucial for the Quantity Surveyor and client in construction projects. During the tender evaluation process, the price is the primary factor of influence in the contract award. In this case, the evaluation of tender price risk, which is through MC simulation, is crucial. Building Information Modelling can measure the quantity of construction work accurately. Meanwhile, Monte Carlo Simulation can simulate the price range, which equates to the risk of the tender price selection during the process of tender evaluation exercise at the pre-tender stage. Innovation in Building Innovation Modelling and Monte Carlo simulation offer the best practices when providing the Quantity Surveyor's scope of services. From the study, turning risk into opportunity relies on an analytical method. Monte Carlo simulation can fulfil a key role in increasing the quality of decision-making and help the client make better decisions to award the project to the contractor in the construction project.

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Faridah Muhamad Halil, Mohd Azrai Azman, Siti Nor Azniza Ahmad Sekak, Nasyairi Mat Nasir & Nor Syakillah Romeli
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DIGITAL TRANSFORMATION IN OCCUPATIONAL SAFETY EDUCATION: FORMULATING COMPONENTS OF VIRTUAL REALITY IN TVET HOSPITALITY PROGRAMS BY USING TPACK THEORY

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Abstract

Technical and Vocational and Educational Training (TVET) hospitality programs are related to practical training in culinary programs. Graduates are expected to implement safer and healthier practices in commercial kitchens, making them pioneers in adopting correct work attitudes during their education. This study recommends a tool for safer and healthier workplaces using Virtual Reality (VR) as a transformative tool in Malaysia's TVET hospitality programs, aligning with IR 5.0 principles to enhance human capital for the foodservice industry. Malaysia's TVET sector faces challenges in integrating industries and fostering workplace culture. The two-fold objectives of this study are: 1) to formulate a VR-based kitchen safety framework for kitchen safety in TVET's hospitality programs and 2) to validate a VR-based kitchen safety framework for kitchen safety in TVET's hospitality programs. This study employs a Design and Development Research (DRR) approach, using qualitative methods with industry experts—kitchen educators/trainers, Safety and Health officers (SHO), Instructional Designers (ID), and IT experts in VR—to develop and validate a VR-based kitchen safety framework. The results of Fuzzy Delphi from industry experts yielded six components: virtual automation with technological knowledge, content knowledge, content determination, coaching content and virtual assessment, and pedagogical expertise. Twenty industry and academic professionals consensually agreed that the ranks position of six constructs and validated the framework. The study emphasizes the importance of VR development by suggesting ideas for identifying and incorporating the necessary parts for VR development into the framework.

Keywords: Fuzzy Delphi; Kitchen Safety; Technical and Vocational Education and Training (TVET); Technology, Pedagogy, and Content Knowledge (TPACK); Virtual Reality (VR)

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INTRODUCTION

Virtual Reality (VR) has been widely used across diverse fields, including education, revealing the potential for expansion in training institutes to support workplace safety (Saad et al., 2023; Smutny, 2022). Safe kitchen environments are crucial due to hazards from heavy equipment like mixers and slicers in busy settings, especially in the food and beverage industry (Kabir, 2019). The study aims to develop and validate a VR-based kitchen safety framework for Technical and Vocational Education and Training (TVET) hospitality programs. This study proposes a robust framework for safety-focused VR as a transformative educational tool in TVET hospitality programs, aligning with Industry Revolution (IR) 5.0 to enhance human capital upskilling as per the National Tourism Policy (Ahmad, 2023).

LITERATURE REVIEW

Technical and Vocational Education and Training in Malaysia

TVET hospitality programs were selected for this study for several reasons. Graduates are expected to implement safer and healthier practices in commercial kitchens, making them pioneers in adopting correct work attitudes during their education. Over 500 public TVET institutions now offer diverse programs at all education levels, including Vocational College (KV), Giatmara, Mara High Skill College, Polytechnics, Community Colleges, and Malaysian Technical University Network (MTUN). Despite a nascent partnership strategy with industries, the Malaysian TVET landscape needs help fostering students' work culture understanding (Subri et al., 2022). Ensuring relevant curricula and educational programs is crucial to align skills with the evolving job market, particularly in food preparation sectors such as hotels, restaurants, catering businesses, and cruise ships (Zikri, 2023).

Using Technology in Kitchen Safety, Related Training Using Virtual Reality

Technology support in commercial kitchens focuses on using VR to develop sophisticated culinary skills and safety management among users (Smith, 2020). VR serves as a primary tool for kitchen safety, preparing individuals for future workplaces by reducing occupational accidents and illnesses. Despite efforts in Malaysian higher education, enhancing worker awareness of Occupational Safety and Health (OSH) has shown limited results (Jaafar et al., 2022). Studies indicate that learners using immersive head-mounted displays demonstrate higher engagement, increased time investment in learning tasks, and improved cognitive, psychomotor, and affective skills (Lähtevänoja et al., 2022; Yoo et al., 2023). VR technology's immersive nature and demand for concentration make it a contemporary instructional tool that enhances problem-solving abilities

(Paszkievicz et al., 2022; Saad et al., 2024). VR environments enriched with computer game mechanics effectively familiarize students with digital circuits.

Technology, Pedagogy, and Content Knowledge Theory (TPACK)

Technology, Pedagogy, and Content Knowledge (TPACK) theory has been recognized for overcoming teaching challenges through effective instructional strategies (Gómez et al., 2019). However, there remains a gap in research on its application in TVET programs (Pecina & Andriuniunas, 2023). Abas et al. (2023) employed the Fuzzy Delphi method to identify seven strategies for promoting VR as a learning tool, supported by consensus among experts. Jamil et al. (2023) used a similar approach to affirm digital policy in TVET, involving curriculum developers and lecturers. Chen and Chan (2024) found that five digital teaching methods—blended learning, standards-based learning (SBL), game-based learning (GBL), flipped classrooms, and precision teaching—are effective with reliable connectivity. However, research focused explicitly on safety-based VR pedagogy remains unexplored.

RESEARCH METHODOLOGY

This study used a design and development research (DRR) approach with purposive sampling to meet its objectives (Richey & Klein, 2019). Twelve industry experts were involved as Sim et al. (2018) mentioned, at least five participants are needed for interviews. This study includes four (4) each from kitchen usage educators/trainers in TVET institutions, and two (2) safety and health officers (SHO), two (2) Instructional Designers (ID), and (4) Information Technology (IT) experts in VR. Semi-structured interviews guided by Mohammad (2020) were conducted, and their opinions were thematically analyzed. The resulting themes and components were evaluated using 7-point Likert scales and pre-tested before distribution to other industry experts for the Fuzzy Delphi method. The 7-point Likert scale is suitable for measuring experts' agreement levels, ensuring accurate data collection (Ismail et al., 2019). In this second stage FDM surveys typically need 10–50 experts (Yusof et al., 2022). There are two types of questionnaires of fuzzy Delphi, which require ten (10) experts, from four (4) IDs in Technology and Six (6) ID from TVET trainers, to validate the items that focus on the framework's content, along with ten (10) IT experts responsible for validating the VR components.

ANALYSIS RESULTS

Table 1 shows the participants' profiles. The demographic findings suggest that participants were experienced professionals. These professionals are characterized as individuals with industry information and technology and possess adequate skills in developing VR. Despite some having less than five

years of experience, the IT experts were meticulously selected for their VR application development expertise.

Table1: Demographic Profile

	Gender	Age	Occupation	Education	Experience	Formulation	Validation
SHO							
1	Female	47	Lecturer and SHO	PhD	14 years	/	
2	Male	44	SHO	Bachelor's Degree	15 years and above	/	
ID							
3	Male	40	Lecturer Technology Instructional	PhD	15 years and above	/	/
4	Male	42	Lecturer Technology Instructional	PhD	15 years and above	/	/
5	Female	48	Lecturer Technology Instructional	PhD	10-14 years		/
6	Male	46	Lecturer Technology Instructional	PhD	15 years and above		/
7	Male	44	TVET Trainer	Diploma	15 years and above	/	/
8	Female	34	TVET Trainer	Diploma	5-9 years	/	/
9	Female	50	TVET Trainer	Diploma	15 years and above	/	/
10	Male	43	TVET Trainer	PhD	10-14 years	/	/
11	Female	47	TVET Trainer	Diploma	15 years and above		/
13	Female	49	TVET senior trainer	Diploma	15 years and above		/
IT							
14	Male	29	programmer	Master's degree	4 years	/	/
15	Male	30	PhD student and programmer	Master's degree	3 and ½ years	/	/
16	Female	29	Lecturer and Programmer	Master's degree	2 years	/	/
17	Male	27	Programmer	Bachelor's degree	2 years	/	/
18	Male	28	Software engineer, developing data platform	Master's degree	7 years		/
19	Female	51	Lecturer	PhD	15 years and above		/
20	Female	53	Lecturer	Master's degree	15 years and above		/
11	Male	55	Lecturer	Bachelor's degree	15 years and above		/
22	Male	46	Lecturer	PhD	15 years and above		/
23	Female	43	Lecturer	PhD	15 years and above		/

To validate a framework, this study organized the data based on the TPACK theory to establish supportive strategies for kitchen safety education. The data from the thematic analysis are converted into statement format and organized into a questionnaire employing a 7-point Likert scale to assess experts' consensus. The items shown are combined and reformed to develop the essential components of the framework.

A: Technological Knowledge

Technology knowledge demonstrates a deep understanding of integrating technology into kitchen safety lessons using VR technology. Based on the information, Table 1 shows the criteria needed to develop VR and combine it with the education suggested by the IT informants.

Table 2: Technological Knowledge Elements

<i>Construct 1: Virtual Automation</i>	
Item / Element	
A1	Providing users with suitable VR gadgets
A2	Equipping virtual environment with motion controllers to enable trainees to interact effectively in the environment
A3	Using essential sensory equipment
A4	Equipping motion controllers to enable trainees to interact with the virtual environment effectively
A5	Having high-quality audio is crucial to creating an immersive VR experience.
A6	Creating an immersive VR experience by having high-quality audio
A7	Programming immersive and interactive virtual environments for training (e.g., Unity, Unreal) by utilizing the free development software for VR development application
A8	Creating content for interactive virtual environments for training by utilizing paid content-management services for VR development application
A9	Monitoring the movement of VR gadgets and controllers by utilizing tracking systems like external sensors or inside-out tracking cameras
A10	Enhancing trainees' training experience through tactile sensations by equipping VR training with haptic feedback
A11	Enhancing the reality of training experience by equipping gloves, vests, or hand controllers with haptic feedback capabilities

B: Content Knowledge

The content knowledge assessment component's elements are derived from informants' information. ID experts have recommended this instructional design, which is suitable for inclusion in VR content. The goal is to enhance students' comprehension of safety education using VR. Table 3 outlines the elements within the content knowledge, which consists of four constructs: introduction, content delivery, learning activities, and tools.

Table 3: Content Knowledge Elements

<i>Constructs 2: Content Determination</i>	
Item / Element	
1	Stakeholder Description [Identify the problem statement by analyzing the existing issue]
2	Stakeholder Description [Determine learning objectives by stakeholder interest.]
3	Stakeholder Description [Determine the target audience (Food handler)]
4	Stakeholder Description [Determine the primary job description, which entails identifying the principal duties and obligations.]
5	Stakeholder Description [Determine language selection]
6	Principle [Using Addie Model principle for effective learning approach]
7	Principle [Using Addie Model principle DESCUM (reference for TVET curriculum development)]
8	Item B: Principle [Using Addie Model principle Using MERRILL (principle of instructions)]
<i>Constructs 3: Coaching content</i>	
Item / Element	
9	Kitchen activity specifications [Kitchen activity specification involves identifying job description]
10	Kitchen activity specifications [Kitchen activity specification involves identifying equipment]
11	Kitchen activity specifications [Kitchen activity specification involves identifying Hygiene]
12	Kitchen activity specifications [Kitchen activity specification involves identifying type of hazards (Physical Hazards, Ergonomics, Chemical Hazards, Biological Hazards)]
	Kitchen activity specifications [Kitchen activity specification involves identifying the type of accidents]
14	Kitchen activity specifications [Kitchen activity specification involves identifying Kitchen Rules]
15	Kitchen activity specifications [Kitchen activity specification involves identifying Behaviour or Etiquette in the kitchen]
<i>Constructs 4: Virtual Assessment</i>	
Item / Element	
16	Identifying Rules of equipment
17	Identifying working processes
18	Example working process, Worker falling from a slippery wet or oily floor
19	Example working process, Injuries from exposure to exposed sharp tools
20	Example working process, Injuries from exposure to hot stuff
21	Recognize risk ingredients [Example chemical ingredients]
22	Recognize risk activity in kitchen [ex: Tools dropped when workers collide with each while working in the small space of a commercial kitchen area]
23	Recognize risk activity in kitchen [lift heavy things]
24	Recognize risk activity in kitchen [Obstruction on the ground (bins and boxes)]
25	Recognize risk activity in kitchen [Gas accumulation and vapor cloud formation]
26	Recognize risk activity in kitchen [Injuries caused by falling tools and utensils]

C: Pedagogical Knowledge

The final development phase is pedagogical knowledge, where IT informants identify essential components of VR as an educational tool. VR enhances teaching methods within this framework. Table 4 in the VR framework lists criteria for effective student use, categorized into K-UX and machine learning constructs. Overall, experts strongly agree on elements related to VR-based safety training, with most items meeting the instructional design framework's acceptance criteria.

Table 4: Pedagogical Knowledge Elements

<i>Constructs 5: K-UX (Kitchen user experience)</i>	
C1	Incorporating a trainee's ability to spot hazards when exploring the virtual kitchen actively
C2	Encouraging trainees to utilize virtual controllers or gestures to identify possible risks
C3	Allowing trainees to experience the sensation of holding kitchen equipment and utensils
C4	Allowing trainees to perceive the sensation of cutting cooking ingredients in the kitchen
C5	Incorporating interactive elements like the sound system
C6	Incorporating interactive elements like videos
C7	Incorporating interactive elements like 3D animations
C8	Integrating communication tools that allow trainees to interact and communicate more effectively with facilitators and fellow trainees
C9	Incorporating text instructions alongside audio communication tools
C10	Designing an intuitive and user-friendly interface to facilitate navigation within the VR environment
C11	Developing an intuitive menu system enabling trainees to access various training program modules or sections
C12	Implementing user-friendly navigation controls so that trainees can move quickly in the virtual kitchen
C13	Setting up a section that gives trainees access to safety guidelines, procedures, and relevant information
C14	Integrating a voice command function to allow trainees to interact through spoken instructions within the VR environment
C15	Incorporating user-friendly features that permit trainees to pause or exit the VR training environment
C16	Prioritizing the trainee's comfort and safety throughout the experience
<i>Constructs 6: Machine Learning</i>	
D1	Using visual cues such as highlighting potential hazards with colors, arrows, or other attention-grabbing elements
D2	Implementing interactive prompts to guide trainees on what action to take when facing a hazard
D3	Using prompts to appear as text, voice instruction, or interactive objects within the VR environment
D4	Offering real-time feedback, such as positive reinforcements in the form of congratulatory messages or sounds
D5	Implementing a scoring system that tracks a trainees' hazard identification and response
D6	Including guided walkthroughs or tutorials for specific hazards or safety procedures

D7	Allowing repeated practice in VR
D8	Implementing an assessment section to accurately evaluate an employee's competence in identifying workplace hazards
D9	Incorporating a timed hazard identification test in VR safety training
D10	Simulating activities like following recipes and preparing ingredients to add substantial value to VR safety training
D11	Simulating real-world kitchen challenges, especially in emergencies, to add substantial value to VR safety training]
D12	Collecting trainees' feedback on the usability of the virtual kitchen for continuous improvement of VR safety training
D13	Simulating real-world kitchen challenges, especially in emergencies, to add substantial value to VR safety training

Table 5 displays each construct's position for the second objective, as Fuzzy Delphi suggested. This holds the rank list, suggesting which construct needs to be prioritized or considered most and least important among other items listed.

Table 5: Ranking of construct

<i>Construct</i>	<i>Average experts' consensus percentage of all items</i>	<i>Rank</i>
<i>Virtual Automation</i>	<i>91%</i>	<i>2</i>
<i>K-UX (kitchen user experience)</i>	<i>95%</i>	<i>1</i>
<i>Machine Learning</i>	<i>88.5%</i>	<i>6</i>
<i>Content Determination</i>	<i>90.9%</i>	<i>3</i>
<i>Coaching Content</i>	<i>90.91%</i>	<i>4</i>
<i>Virtual Assessment</i>	<i>90.91%</i>	<i>5</i>

Accordingly, Fig. 1 illustrates VR-based kitchen safety framework for kitchen safety in TVET's hospitality programs for this study.

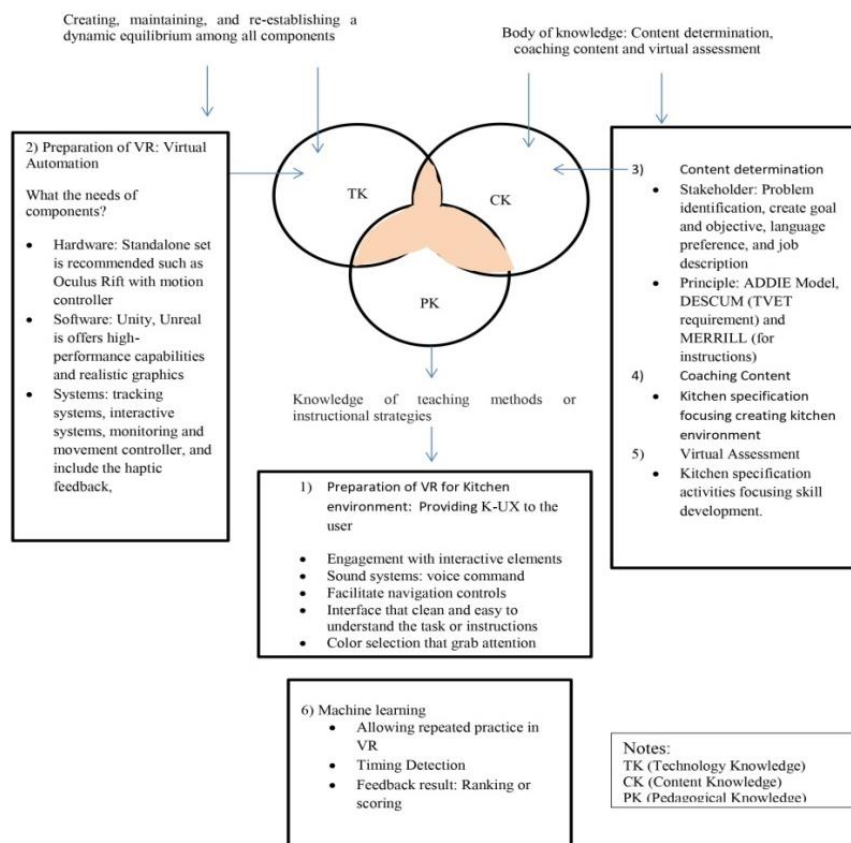


Figure 1: VR kitchen safety framework

DISCUSSIONS

The study finds that integrating TPACK in VR enhances the teaching and learning experience in TVET programs by organizing quality content. It highlights the effective delivery of safety knowledge through VR, agreed upon by industry and academic professionals. This approach focuses on skill development, which is crucial for TVET, and prepares students to accomplish real-life tasks using VR. Virtual automation is a key component for developing VR that supports technological knowledge, which involves preparing hardware and software like sensory equipment, motion controllers, high-quality audio, and development software such as Unity or Unreal. These tools help create immersive and interactive VR-based kitchen programs that promote active learning and safety awareness among trainees, aligning with the findings of Saad et al. (2023), Lee et al. (2023), and Jeinie and Nor (2022).

The VR-based safety knowledge component can help the Malaysian government enhance its TVET system by focusing on kitchen activities that identify risks and hazards and address training gaps noted by (Saad, 2023). The second component, content knowledge, involves content determination, coaching, and virtual assessment to ensure VR content meets industry requirements. This aligns with Kathirveloo and Puteh (2014), aiding students in organizing and adjusting topics to attract interest. Suitable content knowledge for a VR-based kitchen framework structures educational content, emphasizes skill development, and incorporates safety assessments.

Finally, pedagogical knowledge supports content knowledge in VR systems. K-UX defines interactive instruction systems, while machine learning provides feedback and guidance with various assessment tools. These findings align with Shulman's (1986) concept of creating effective educational environments through comprehension, alteration, instruction, assessment, and reflection. VR offers trainees an interactive, immersive safety education experience tailored to their learning needs and skill levels. The VR mechanisms developed in this study have created a TVET framework that addresses organizational issues hindering students' understanding of work culture, as Subri et al. (2022) noted.

CONCLUSIONS

In a nutshell, Malaysia's TVET curriculum must incorporate industry practices to ensure a seamless transition to employment. This study significantly contributes to the Department of Occupational Safety and Health, TVET institutions, and all stakeholders. Integrating TPACK in VR enhances the teaching and learning experience in TVET programs by organizing quality content and delivering effective safety knowledge, ensuring students are well-prepared for real-life tasks. Additionally, the VR mechanisms developed create a comprehensive TVET framework that addresses organizational issues and promotes active learning and safety awareness, aligning with industry and academic standards.

A limitation of the study is the scarcity of VR expertise in Malaysia, particularly in the hospitality industry. Future research should focus on developing a prototype of safety-based VR educational tools to evaluate the readiness and effectiveness of TVET hospitality program students and staff.

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DECISION-MAKING FOR TREE REMOVAL IN URBAN DEVELOPMENT: INSIGHTS FROM LOCAL AUTHORITIES IN MALAYSIA

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Abstract

The decision to remove trees in development areas can avoid various risks caused by problem trees, but also involves the risk of losing valuable trees. This paper aims to investigate decision-making practices in relation to existing trees in development areas and identify the factors that influence those decisions. Data were collected through semi-structured interviews with landscape architects from selected local authorities and analysed using thematic analysis. Only local authorities requiring a tree preservation survey for landscape plan applications and landscape architects participated in this study. The results show that all factors influencing tree removal decisions are interrelated and vary according to the circumstances. Lack of authoritative resources and spatial constraints have affected the rationality of tree retention decisions and led to tree removal. This study contributes to urban tree retention theory and may improve tree preservation and management strategies. Future research should explore the perspectives of other construction professionals to refine each of the results and conclusions.

Keywords: decision-making, tree removal, tree retention, development, local authority

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INTRODUCTION

Urban tree management involves operational and day-to-day decisions, such as where to protect, retain, or plant trees. Strategic decisions, influenced by institutional requirements or top-down policies, such as local authority targets for tree canopy cover or tree diversity, are crucial for urban tree management (Ordóñez et al., 2019). As trees improve quality of life, especially in urban areas, many cities struggle to balance their ambitious tree canopy cover with urban development pressures. As cities grow, more trees are removed for construction projects. The removal of trees in new developments can have significant environmental and social impacts, such as soil erosion, increased temperatures, and reduced biodiversity. However, retaining problematic trees also contributes to nuisance and potential hazards as they require periodic inspections, pruning or removal, and replacement with suitable species. To improve our decision-making, it is important to understand the various situational factors and constraints that influence these decisions. This paper therefore examines tree removal decision-making practice in development areas and identifies the factors that influence this decision.

LITERATURE REVIEW

Decision making and bounded rationality

Decision-making is one of the steps in the problem-solving process. It involves evaluating different options and choosing the best course of action based on available information and desired outcomes. As different factors and different outcomes get involved in the decision-making process, it can be complex and challenging (Taherdoost & Madanchian, 2024). Bounded rationality is often used to describe the limitations that individuals face when making decisions. This concept posits that decision-making by individuals is subject to limitations that restrict the full exercise of rationality. Consequently, rational individuals will opt for a satisfactory decision rather than one that is optimal (Simon, 1987). In this study, the decision to retain and remove trees in a development area is complex and involves several factors, and some of the factors can influence the rationality of decision-making.

Factors influencing the decision to retain and remove trees in development areas

The size of trees is an important predictor of their retention or removal. Studies have shown that small trees are preferentially removed while larger trees are retained (Guo et al., 2018; Morgenroth et al., 2017). Ordóñez et al. (2023) emphasised the need to preserve old, ageing trees for as long as possible. Roman et al. (2022) also recommended that efforts should be made to retain large, healthy trees, especially if they do not interfere with the construction of new buildings. Morton (2006) argues that selecting a tree in good health and with a long-life

expectancy is the optimal choice for retention on a building site. However, Gilbert (1996) argued that young trees and rare species that have significant landscape value should be prioritised for retention. Furthermore, planting trees in unsuitable locations may indirectly lead to their removal due to the safety risks posed (Klobucar et al., 2021) and the inability to retain every tree due to limited space and other constraints on the site involved (Croeser et al., 2020; Guo et al., 2018, 2019; Morgenroth et al., 2017). Government regulations to protect trees also have an impact on the retention of trees. To date, there is no law on tree designation or regulatory approval for the removal of private trees in Malaysia. And although the Tree Preservation Order has been in force for over two decades, there are still shortcomings in terms of implementation and enforcement (Nik Mohamed Sukri et al., 2017). According to Ordóñez-Barona et al. (2021), the most innovative mechanisms for retaining trees in development areas involve a combination of multiple regulations and the implementation of financial incentives. Kronenberg (2014) found that current regulations do not prioritise urban greenery, and this directly causes the retention of trees in cities to face major challenges due to a lack of funding, inadequate management, and oversight of tree care.

Other important factors influencing tree-related decisions in development areas are the availability of tree data, such as the number and condition of trees, and specialised tools such as sonic tomographs (Ibrahim et al., 2019). Studies have also shown that negative attitudes towards trees and individual preferences influence the removal of healthy trees. Some people think trees are a problem because they provide shade, cause allergies, and need labour to clean up fallen leaves (Kronenberg, 2014). Kirkpatrick, Davison and Daniels (2013) found that society does not actively support or prioritise the greening of cities because other needs, such as the development of grey infrastructure, are seen as more pressing. Due to the high cost of tree removal, especially large trees, some residents and communities retain unwanted trees, including dead or dying trees (Conway, 2016). Higher property value is also associated with greater tree retention, suggesting that property value is a strong predictor of tree presence (Morgenroth et al., 2017).

METHODOLOGY

Study Sample

The present study included a sample of eight landscape architecture professionals. Five participants are directors, deputy directors, and heads of departments; one works at the One Stop Centre (OSC). Table 1 shows the demographic characteristics of the participants. Participants were selected using a purposive sample. This study included local authorities that require tree retention reports for landscape plan applications. The participating local authorities include Kuala Lumpur City Hall (KLCH), Petaling Jaya City Council (PJCC), Ipoh City Council (ICC), Subang Jaya City Council (SJCC), Malacca

Historical City Council (MHCC), Seremban City Council (SCC), Johor Bahru City Council (JBCC), and Pasir Gudang City Council (PGCC). The head of the Landscape Department recommended the participants based on their experience and knowledge of tree retention and removal in the development area.

Table 1: Demographic profile of the semi-structured interview’s participants

Local Authority	Unit/ Department	Position
1 KLCH	City Planning Department	Landscape Architect
2 PJCC	Department of Landscape and Urban Greenery	Landscape Director
3 SJCC	Landscape Department	Head of Department
4 ICC	Park and Landscape Department	Assist. Senior Director
5 SCC	Park and Landscape Department	Landscape Architect
6 HMCC	Landscape Department	Head of Department
7 JBCC	Landscape Department	Landscape Architect
8 PGCC	Engineering and Landscape Department	Head of Department

Procedure and Data Analysis

Interviews allow this study to obtain rich data on tree retention and removal decision practices directly from local authorities. As decision-makers, their insights and perspectives are crucial in understanding the factors that influence tree removal (Silverman, 2006). A letter was sent via email to seek permission to conduct an interview with landscape architects in selected municipalities. Interviews were conducted from March 2022 to September 2022 using face-to-face interviews or video conferencing, depending on the preference and convenience of the participants. Each interview lasted approximately one hour, and participants were asked the following questions: (i) "What decisions are typically made—retention or removal of trees?" and (ii) "What is the rationale behind the decision?". The aim of these questions was to identify the type of decision practices they applied and the factors influencing the decision. The transcribed interviews were analysed using thematic analysis and ATLAS.ti version 9 to generate themes (factors) and subthemes.

RESULTS AND DISCUSSION

Decision-making practice regarding existing trees in development areas

As shown in Table 2, all of the study participants consistently and clearly responded to the interview questions, claiming that tree removal is a common decision in development areas.

Table 2: Interview excerpts about typical decisions regarding existing trees in development areas

P	Code	Excerpts
1	1:45 p 7	...usually, trees will be cut down.
2	2:66 p 11	...many are in the tree removal category.
3	3:24 p 3	...they cut down trees.
4	4:17 p 3	...so far, it has not been retained.
5	5:19 p	...we have no sweet memories; we usually cut them down.
6	6:2 p 3	...the common decision is to remove and replace them.
7	7:29 p 4	...the common decision is to remove a tree.
8	8:5 p 1	...usually, we will give permission to cut down.

(P= Participant)

Upon being queried about the rationale behind the removal of trees in the development area, most participants expressed that they were compelled to grant the developer permission to remove the existing trees in the development area, citing a lack of alternative options. The participants highlighted the efforts made by landscape architects to retain trees, as well as the limitations they face in terms of decision-making opportunities. This study confirms previous findings related to development activities, which lead to the loss of urban tree due to the removal of existing trees (Brunner & Cozens, 2013; Clark et al., 2020; Croeser et al., 2020; Guo et al., 2018). However, this study found that decision making can be a complex process, especially when it involves multiple stakeholders and factors. The tendency to remove trees is higher because there are more factors influencing the decision to remove trees in the development area than the factors influencing their retention.

Factors influencing of tree removal decision in development areas

Figure 1 shows that six factors influence tree removal decisions in development areas. The selection, planting, and maintenance history are social-related factors, focusing on previous tree planting trends and their maintenance practices that led to present-day issues. Unsuitable species selection and planting can result in "maintenance burden" and "risk of failure and nuisance". This indirectly affects the decision to remove trees, as this poses a risk of disturbance and safety, e.g., falling branches and trees obstructing views or damaging the built structure. The unhealthy condition of trees is a result of inadequate maintenance procedures, and this indirectly influences the decision to remove a tree.

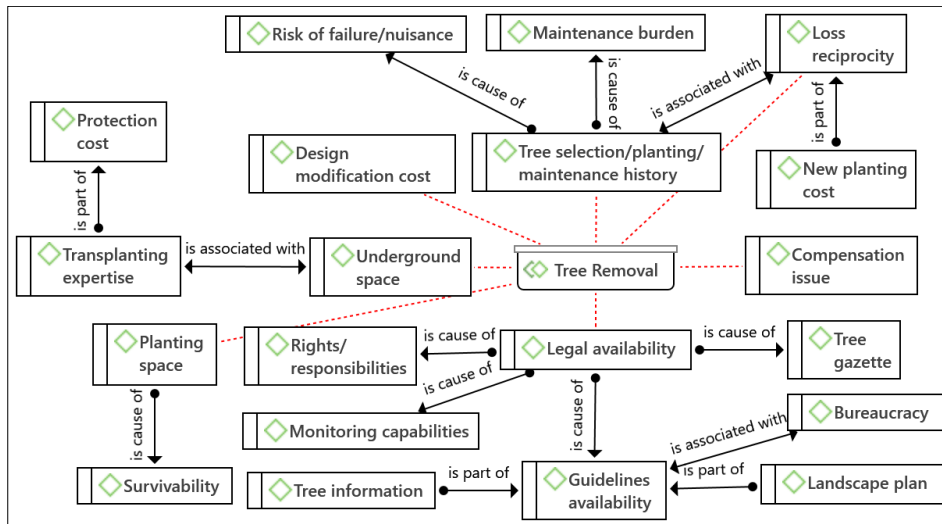


Figure 1: Factors associated with tree removal decisions in development areas

This study supports previous research on environmental disturbance caused by improper tree planting and species selection (Brunner & Cozens, 2013). The findings of the study by Conway (2016) show that trees are removed several years after planting because they have just realised the inappropriateness of the trees. To minimise the negative impact and maximise the positive effect, Vogt et al. (2017) recommended that tree removal be done optimally and in accordance with the location.

Retaining unsuitable trees also requires high maintenance by local authorities. Granting the developer permission to remove the trees enables the local authorities to reduce removal and maintenance cost, while also allowing them to gain benefits of planting new trees. Furthermore, to avoid creating new compensation issues, local authorities are more likely to approve tree removal applications. For developers, since the cost of removing trees is cheaper than retaining them, they are more inclined to remove trees. The implementation of structural and design alterations for retaining trees will also incur significant expenses. Additionally, developers may perceive tree removal as a way to minimise potential obstacles and delays during construction. Retaining trees by transplant also makes it difficult for the developer and adds significant costs to the construction process. Financial constraints on transplanting trees are the main reason trees are removed by developers. The process of transplanting trees can be expensive, as it involves not only the cost of uprooting and transporting trees, but also the expenses associated with ensuring their survival in the new location. Additionally, developers may lack the necessary knowledge and skills to successfully transplant trees, leading them to opt for removing them instead. Furthermore, the size and age of the tree also play a significant role in the decision

to transplant or remove it. Larger and older trees are often more difficult to transplant successfully, as their root systems are more extensive and established. Consistent with the findings, tree removal can offer advantages by allowing for the correction of past planting mistakes through the replacement of new and better trees. Tree removal is also driven by profit returns in addition to minimising risk. According to Nik Mohamed Sukri et al. (2022), removing trees can provide more benefits in enhancing the sustainability of urban forests. However, (Conway, 2016) and (Guo et al., 2019) found that property owners often choose to retain trees due to the significant cost involved in their removal. Similarly, Guo et al. (2019) observed a similar trend, where the financial burden of tree removal influenced the decision to retain them intact. These findings contrast with the results of the current study, highlighting divergent perspectives on tree retention and its associated costs.

The constraints on retaining the trees through transplanting are primarily due to the limited space and the presence of underground utility cables. The relocation of trees belonging to the local authorities is not possible due to their location in the road reserve, which runs parallel to utility cables and pipes. The excavation of trees also poses a significant threat to both the infrastructure and the safety of individuals. In addition, transplanting a large tree within a confined area will pose challenges in preparing the root ball. Proper preparation of root balls of sufficient size is essential for the survival of the tree after transplanting. Previous studies have shown that spatial factors, such as tree protection zones affect tree preservation, for example Suchocka et al. (2019), which found insufficient tree protection due to construction space shape, and Despot dan Gerhold (2003), where they found limited space to be the main barrier to tree protection in development areas.

Most of the restrictions that apply to retaining trees are related to the local authorities as decision-makers. Difficulties include the designation of existing trees and the limited ability to monitor urban trees, especially on private land. This is because local authorities do not have the right or authority to do so due to existing laws and policies. In addition, there are limitations due to cumbersome and complicated procedures for both sides, i.e., local authorities and developers, to retain trees. Local authorities have to take the initiative in certain situations to persuade various parties to retain trees, especially when it comes to trees on private land. If the developer wants to retain the tree after the development order (DO) has been approved, there are also problems, as the DO application must be amended and resubmitted. This process can be time-consuming and may cause delays in development projects. Furthermore, developers may face financial constraints in modifying their plans to accommodate the retention of trees, making it more challenging to retain them.

Power directly influences the decision-making trend (Suliman et al., 2021). This finding is in line with previous studies that show institutional

constraints on retaining trees in development areas. Among those constraints are the lack of emphasis on urban greening in current regulations (Kronenberg, 2014), ineffectiveness of current penalties and fines (Clark et al., 2020; Ibrahim et al., 2019), as well as the restricted regulation of trees in private areas (Brunner & Cozens, 2013). Besides enforcing tree removal penalties, permits, and zoning planning for private areas, Ordóñez-Barona et al. (2021) suggest that decisions must be made collectively and incorporate many rules. This approach is important to ensure that the decision-making process is fair and inclusive, taking into account the perspectives and interests of various stakeholders.

This study discovered that all factors influencing tree removal decisions are interrelated, emphasising the importance of considering multiple factors when making decisions. The reasons for the decision vary according to the circumstances. The level of tree health, risk, and maintenance burden associated with a history of inappropriate species selection and planting are all direct influences on the decision to remove trees in development areas. Removing problematic trees by developers in situations involving trees requires local authorities to maximise utility by addressing the issues they pose, such as potential damage to infrastructure or safety hazards. This approach not only saves costs for the local authority in terms of maintenance and potential liabilities, but it also allows for the opportunity to replace the removed tree with a new one that is better suited for the development project. Additionally, developers can ensure that the replacement tree is carefully selected and planted in a suitable location, further enhancing the overall aesthetic and environmental benefits of the area. This study additionally discovered some factors that not only limit the effectiveness of tree retention decision-making, but also lead to tree removal. There is the lack of authority for local authorities that limits their ability to retain trees in private areas, time constraints, procedures, and limited resources that contribute to the difficulty of making rational tree retention decisions, as well as limited space for tree growth or potential conflicts with existing infrastructure, which further complicate the decision-making process.

CONCLUSION

Tree removal is a common decision in development areas. The study highlights the interconnected factors influencing tree removal decisions, emphasising the importance of considering multiple factors. Lack of authority and spatial constraint complicate the decision-making process and lead to tree removal. These findings enhance the management of urban trees and contribute to literature on tree retention and decision-making. Future research could incorporate existing and recent viewpoints with other stakeholders.

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EVALUATING THE IMPACT OF DESIGN FAILURE ON THE PERAK TENGAH DISTRICT MOSQUE, PERAK, MALAYSIA

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Abstract

This study investigates how building structural defects affect maintenance management in mosques in the Perak Tengah District. As well as offering suggestions for improving maintenance effectiveness, it draws attention to the fundamental design defects that cause issues with maintenance. A literature study, semi-structured interviews, observation, and a survey were used to collect the data. According to the goal of this study, inadequate site supervision, an inadequate cover of reinforcing concrete, poor structural design, noncompliance with specifications, improperly placed or applied paint, and a failure to specify suitable materials are the main design flaws that lead to maintenance issues. These defects result in increased maintenance expenses, job loads, the labour force, and the frequency of maintenance. Based on the study, all departments should collaborate and employ weather-resistant materials to improve job standards and building upkeep.

Keywords: building design failures, maintenance management, mosque design failures, defects, design flaws, maintenance expenses

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INTRODUCTION

The research focuses on common mosque building defects in the Perak Tengah District, emphasise the importance of maintenance management and the impact of design on building longevity and performance. Furthermore, it addresses the challenges of maintaining mosques and the need for further study and international collaboration to resolve these issues. As illustrated by the analysis of defects in Singapore’s wet building zones, the main causes of the problems are poor material selection, construction, maintenance, and design. A few possible keywords regarding this matter include maintenance management, mosque structures, international forums, and design flaws.

Table 1. Citations related to design failure in maintenance management

Citation	Related Keywords
Ortiz et al., (2020)	Poor design, building defects, construction, inadequate maintenance, unsatisfactory building performance, user discomfort, safety hazards, effective maintenance
Hauashdh et al., (2022)	Building design, building lifecycle, building defect, construction, maintenance, potential issues, continuous monitoring, effective maintenance
Alabdulkarim et al., (2013)	Maintenance management, a well-structured maintenance plan, a dedicated maintenance team, building safety, extending lifespan, reducing costs, and preserving value.
Kay Leng, S. T., et al. (2023)	Inadequate maintenance can lead to a number of factors, including vegetation growth, soil erosion, wear and tear, and weathering
Hassanain et al., (2021)	Building defects, maintenance management, and effective maintenance practices
Sarbini et al., (2021)	Poor maintenance management practices, a lack of skilled workers, inadequate budget allocation, and building defects

Source: Authors (2024)

Table 1 shows that building issues can arise from poor design, construction, or inadequate maintenance. Ortiz et al. (2020) highlight the need for proper maintenance to prevent defects and ensure safety. Alabdulkarim et al. (2013) stress that good maintenance management is crucial for safety, longevity, cost reduction, and value retention, recommending a detailed schedule and dedicated workforce. According to Kay Leng, S. T., et al. (2023) inadequate maintenance can lead to a number of factors, including vegetation growth, soil erosion, wear and tear, and weathering. Hauashdh et al. (2022) note defects can occur at any stage, making early issue resolution and continuous inspection vital. Hassanain et al. (2021) attribute 30% of defects to maintenance management issues, emphasising effective practices. Sarbini et al. (2021) identify budget, skilled labour, and management problems as the main defect causes.

Building defects can result from poor design, construction, or inadequate maintenance. This highlights the importance of efficient maintenance to prevent defects, ensure building performance, and avoid safety risks. Effective maintenance management is crucial for preserving a building's value, extending its lifespan, and ensuring safety. Defects can occur at any stage, so early issue resolution and continuous monitoring are vital. Maintenance management problems cause 30% of building defects, showing the importance of good practices. Insufficient maintenance funds, a lack of skilled staff, and poor management are the main defects, underscoring the need for excellent maintenance management.

LITERATURE REVIEW

This research aims to provide an overview of the current literature on building flaws and maintenance. It explores the types and importance of building maintenance, architectural design mistakes, their causes, and their impact on building upkeep. The study also examines various building flaws, using previous research from different universities. The main goals are to understand the issues related to building flaws and maintenance and to contribute to existing knowledge in the field. The collected data will form the basis for the study's design.

The Concept of Building Maintenance

Building maintenance involves various tasks to ensure a building, its components, and its systems operate effectively and serve their intended purpose throughout their lifespan. Hassanain et al. (2021) state that it includes maintaining physical conditions, services, and surroundings to meet users' needs. Maintenance types include preventive, corrective, and predictive maintenance. Preventive maintenance involves scheduled tasks to detect issues early. Corrective maintenance addresses problems as they occur by repairing or replacing faulty parts. Predictive maintenance uses data and analytics to foresee and prevent issues before they arise (Alghanmi et al., 2022). Building maintenance is crucial for prolonging a structure's life, reducing repair costs, and ensuring occupant safety. Several articles, including those by Alabdulkarim et al. (2013), discuss building upkeep. The British Standard BS 3811 also provides guidelines for building maintenance.

Types of Maintenance

Referring to Figure 1, BS 3811 information is used to give building maintenance guidelines that include a wide range of subjects, such as structural elements, finishes, services, and equipment.

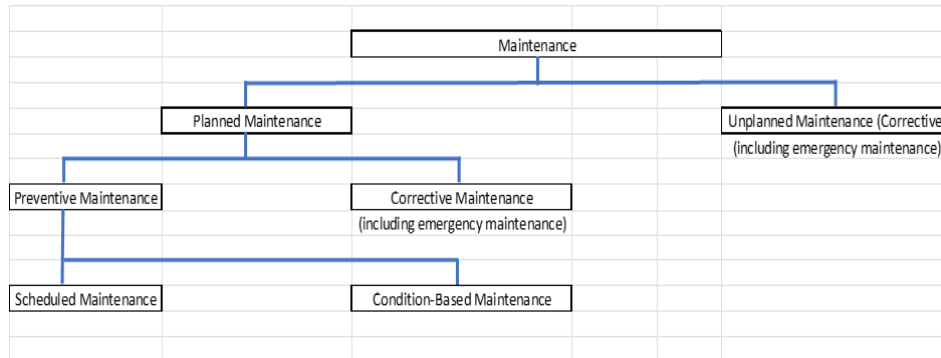


Figure 1. Relationship between various forms of maintenance
 Source: BS 3811 (1984)

It explains the various types of upkeep, including:

1. Reactive maintenance: repairing faults and failures as they occur.
2. Planned maintenance: scheduled routine maintenance to prevent failures and prolong the life of building components.
3. Preventive maintenance: activities to prevent the deterioration of building components.
4. Condition-based maintenance: maintenance is based on monitoring the condition of building components.
5. Predictive maintenance: maintenance is based on predicting when failures are likely to occur.

BS 3811 highlights the importance of a systematic approach to building maintenance and suggests using maintenance management systems to ensure that maintenance tasks are completed effectively and efficiently. A framework model can help illustrate the relationship between several types of maintenance. This paradigm allows for scheduled, preventive, condition-based, and predictive maintenance, with reactive maintenance at the bottom of the hierarchy. The model can also demonstrate how to integrate various maintenance chores to produce a comprehensive maintenance schedule that ensures the building's long-term functionality and safety.

Building Defects

A building defect is defined as any flaw or malfunction in the design, construction, or maintenance of a structure that reduces its usability, safety, or aesthetic appeal. Table 2 shows the types of architectural faults found in a previous investigation.

Table 2. Citations related to types of building defects

Citation	Types of Building Defects
Ismail et al. (2016)	Maintenance management problems
Othman et al. 2015)	Water leakage, faulty plumbing, and poor ventilation in wet areas
Riadh, D., & Mohamed Osman, M. (2021).	Housing policies are currently poorly structured.
Mohd-Noor et al. (2016)	Structural cracks, water leakage, and electrical faults in mosques
Olanrewaju & Lee (2022)	Poor workmanship, inadequate supervision, and a lack of maintenance in Malaysia
Alriwaimi & Akasah (2014, February)	Faulty factors in building maintenance during the design stage

Source: Authors (2024)

Structures develop defects due to various reasons. Structural problems affect components like the foundation, beams, and columns and can result from poor planning and policies, workmanship, or materials. Figures 2, 3, 4, and 5 illustrate these defects. Water-related issues stem from infiltration, leakage, or flooding linked to waterproofing, plumbing, or drainage flaws. Electrical faults involve wiring, fixtures, and appliances and are potentially dangerous. Other issues include problems with finishes, doors, windows, and external factors like noise and air quality. Research shows defects arise from poor design, construction, maintenance, and a lack of control. Maintenance management errors cause 30% of construction faults. Effective maintenance practices that address issues early can extend a building's life and prevent costly repairs.



Figure 2. Defect: water leaking
Source: Authors (2024)



Figure 3. Defect: peeling of paint (external wall)
Source: Authors (2024)



Figure 4. Defect: stagnant water
 Source: Authors (2024)



Figure 5. Defect: poor ventilation in wet areas
 Source: Authors (2024)

Factors of Building Design That Related Building Maintenance

There are several factors of building design that are related to building maintenance. These factors can be referred to in Table 3 below.

Table 3. Citations related to building design factors

Building design factors	Citation
Materials used in construction	"Buildings constructed with high-quality materials are likely to require less maintenance compared to those made with low-quality materials" (Dahal & Dahal, 2020).
Design and layout of the building	"Mosques with complex designs and layouts may be more challenging to maintain" (Yawer et al., 2023).
Building systems and components	"The design and installation of building systems can affect how easy they are to maintain and repair" (Ismail, 2021).
Building codes and regulations	"Building codes may require regular inspections of building components or systems to ensure their safety and longevity" (Hatem, et al.,2021).
Accessibility and safety	"Mosques that are designed to be accessible to people with disabilities or that have safety features may require more frequent maintenance to ensure these features are functioning properly" (Putri et al., 2022).

Source: Authors (2024)

The above information demonstrates several design-related elements that may affect building upkeep:

1. **Materials:** The materials used in construction affect maintenance needs. Materials like steel and concrete can corrode and deteriorate over time, requiring regular upkeep. Poor material choices can shorten building lifespans and increase maintenance costs.
2. **Layout and Design:** Building design impacts the ease and efficiency of maintenance. Complex architecture or hard-to-reach areas may need

special tools or methods. Designers should consider ease of maintenance to save on future costs.

3. **Building Age:** Older buildings require more maintenance to stay safe and functional. Ageing structures, especially poorly constructed ones, often face more maintenance issues.
4. **Technology:** Using technology can reduce maintenance needs. Smart building systems monitor and maintain existing systems, reducing the need for manual inspections and repairs, saving costs, and improving efficiency.
5. **Construction Quality:** Poor construction quality leads to early breakdowns and higher maintenance costs. Ensuring high construction standards can reduce future maintenance needs.

METHODOLOGY AND SAMPLE CRITERIA

This study employed two methods. First, it conducted literature research and interviews with the mosque management to identify 67 design and construction issues, along with eight (8) implications for building maintenance (see Table 4). Second, it used a survey to assess how these issues affected maintenance. This mixed-methods approach investigated the impacts of poor design on mosque maintenance management. Questionnaires were physically administered, and an interview was also done for clarification. Data analysis provided insights to meet the study's goals, as detailed in the conclusion.

Table 5 shows the criteria selection for the mosques in Seri Iskandar, Perak Tengah District, Perak, all five of which were chosen for the research with the principal's agreement for their management of facility upkeep, design, and style.

Table 4. Design and Construction Flaws & 8 Implications of Flaws Impact on Building Maintenance.

DESIGN & CONSTRUCTION FLAWS	
A	<p>Defects in civil design</p> <ol style="list-style-type: none"> Inadequate provisions for movement. Ignoring aggressive environment and weather condition effects. Ignoring biological effects. Inadequate structural design such as foundation. Ignoring variation in soil conditions. Ignoring the effect of load on structural stability. Exceeding allowable deflection. Ignoring the impacts of wind on the structure. Deficient concrete cover on the reinforcement. Conduits and pipe holes at crucial structures are improperly located.
B	<p>Architectural defects in design</p> <ol style="list-style-type: none"> Narrow stairs, passages & door. Not relating exterior material selection to climatic condition. Specify the finish that has to be completely repaired (such as wallpaper) Not considering the local climatic condition when designing the exterior shape. Deficient joints between finished faces.
C	<p>Design defects in maintenance practicality and adequacy</p> <ol style="list-style-type: none"> No consideration for access or escape for maintenance workers or equipment. Designing for a permanent fix that could be removed for maintenance. Not taking into account the maintenance equipment available while designing. Not considering the maintenance requirements in design.
D	<p>Defects due to consultant firm administration & staff</p> <ol style="list-style-type: none"> Lack of QA/QC program during Design. Poor technical updating or staff training. Hiring unqualified designers. Designers field experience. Designer technical background. Designer unawareness of materials Properties. Misjudgment of climatic condition. Misinterpretation of the intended usage of the user.
E	<p>Defects due to construction drawings</p> <ol style="list-style-type: none"> Lack of references. Conflicting details. Lack of details.
F	<p>Defects due to construction inspection</p> <ol style="list-style-type: none"> Lack of inspection. Unqualified inspector. Proprietor (owner) negligence of the importance of inspection. Weakness of inspection rule in implementing corrective actions during job execution.
G	<p>Defects due to civil construction</p> <ol style="list-style-type: none"> Inaccurate measurement. Damaged formwork. Excavation too close to the building.
H	<p>Defects due to contractor administration</p> <ol style="list-style-type: none"> Not complying with specification. Unable to read the drawing. Inefficient site supervision. Weak interaction with the design firm and the owner. Unqualified supervision. Rapid completion or cheap quality work. Unqualified work force. Multinational construction experience.
I	<p>Defects due to construction materials</p> <ol style="list-style-type: none"> Differential thermal movement in dissimilar material conditions. Material selection that is improper for the current climatic conditions. Use of nondurable material. Use of expired material. Poor material handling & storage.
J	<p>Defections due to construction equipment</p> <ol style="list-style-type: none"> Wrong use of equipment. Inadequate performance of equipment. Lack of required number of equipments.
K	<p>Defects due to specification</p> <ol style="list-style-type: none"> Unclear specification. Not defining adequate materials. Not specifying the QA/QC construction procedure. Not specifying the allowable load limits. Specifying inadequate concrete mix design.
8 IMPLICATIONS OF FLAWS IMPACT ON BUILDING MAINTENANCE	
1	Increase in maintenance budget.
2	Increase work force.
3	Increase in maintenance quality.
4	Increase in maintenance work.
5	Difficulties in maintenance planning.
6	Increase maintenance frequency.
7	Maintenance works become obsolete.
8	Lower maintenance quality.

Source: Mirun, A. et al. (2023).

Table 5. Criteria selection for the case study

Location	Mosque Name	Date of Built	Detail Facilities	Category of Mosque
Perak Tengah (Seri Iskandar), Perak	Masjid Sultan Yussuf Izuddin Shah (MSYIS)	2008	The Masjid Sultan Yussuf Izuddin Shah comprises 8400 square meters. Its serene structure holds a main prayer hall, a covered praying area, a holding room for visitors, and ablution facilities. There is an institution for a folk religious school in two (2) buildings. Open-hall facilities suitable for education ceremonies and weddings	Masjid Daerah/Jajahan
	Masjid Al-Muhajirin, Fecra Nasaruddin (MAMFN)	2007	Masjid Al-Muhajirin, Fecra Nasaruddin, comprises 3350 square meters. Along with the mosque hall, there are also bathrooms for both male and female pilgrims, as well as disabled people. A storage room and a bathroom for the mortuary are also provided. There is a cooking hall and a dining hall for Ahli Qariah's banquet facilities.	Masjid Mukim/Kariah
	Masjid Bandar Universiti, Seri Iskandar (MBUSI)	2018	Masjid Bandar Universiti, Seri Iskandar, comprises 4300 square meters. There is also a large, open prayer room that can fit up to 900 pilgrims. Toilets, ramps, and disabled parking spots are just a few of the facilities that make it easier for disabled pilgrims to pray in the mosque.	Masjid Mukim/Kariah
	Masjid As-Siddiq, Seri Iskandar (MASSI)	2005	Masjid As-Siddiq comprises 3000 square meters. Its serene structure holds a main prayer hall, a covered praying area, a holding room for visitors, and ablution facilities.	Masjid Mukim/Kariah
	Masjid An-Nur, UTP (MANUTP)	2003	Masjid An-Nur is a majestic floating mosque spanning 4000 square meters. Its serene structure holds a main prayer hall, a covered praying area, a holding room for visitors, and ablution facilities.	Masjid Institusi

Source: Authors (2024)

DATA ANALYSIS

Based on interviews with the mosque maintenance management, common building defects and their causes were identified. 11 common reasons for design failures were studied extensively. Table 6 shows that poor collaboration is the

primary issue across five mosques, highlighting the need for effective communication to prevent delays and misunderstandings. MSYIS, MBUIS, and MANUTP lack knowledge in fundamental material science aspects, leading to similar conclusions. MASSI faces unique challenges with complex elements, detailed in Table 7 for this case study.

Table 6. Causes of design failures

No.	Causes	MSYIS	MAMFN	MBUSI	MASSI	MANUTP
1	Poor detailing and jointing				/	
2	Insufficient thickness of concrete cover.	/		/		/
3	Insufficient jointing between finish faces		/		/	
4	Incorrect location of conduits and piping at critical structure locations		/		/	
5	Insufficient length of awning	/			/	
6	Insufficient provision for thermal movement		/		/	
7	Insufficient structural design		/		/	
8	Maintenance access was ignored during the design process	/	/	/	/	/
9	Lack of concern for aggressive environments and weather conditions	/		/		/
10	Lack of consideration for the availability of maintenance tools in the design process	/	/	/	/	/
11	Not relating exterior construction material selection to weather and climatic conditions		/		/	

Source: Authors (2024)

Table 7. Defects related to faulty designs occur in building maintenance

Rank	Code	Question	Mean	Severity Index
1	I2	Material selection that is improper for the current climatic conditions	3.84	95.96
2	F1	Lack of inspection	3.73	93.21
3	A6	Ignoring the effect of load on structural stability	3.68	91.96
4	B4	Not considering the local climatic conditions when designing the exterior shape	3.68	91.96
5	G5	Deficient waterproofing and drainage	3.62	90.46
6	H7	Unqualified work force	3.62	90.46
7	K2	Failure to define suitable materials	3.62	90.46
8	A1	Deficient provisions for movement	3.57	89.21
9	C4	Failure to consider the maintenance requirements in design	3.53	88.24
10	G5	Deficient water proofing and drainage	3.53	88.24

Source: Authors (2024)

After analyse the survey responses, key issues with building maintenance were identified. Table 7 lists the top ten design and construction defects based on severity index and mean scores from the 67 identified issues. Table 6 further details the average severity caused by poor design and construction. The survey pinpointed seven major issues:

1. Inappropriate material selection for weather conditions received an average score of 3.84 with a severity rate of 94.96%.
2. The inspection coverage was inadequate, receiving a score of 3.73 and a severity rating of 93.21%.
3. Ignoring load impact and local weather in exterior design resulted in a score of 3.68 and a severity of 91.98%.
4. Civil errors in waterproofing and drainage, unqualified workforce management, and inadequate material specifications were grouped under specification defects with a severity of 90.46%.
5. Civil design issues affecting movement provisions scored above 3.57 in all eight categories, representing 89.21% of the total severity.
6. Neglecting civil design considerations for maintenance needs, lacking quality assurance or control during design, and inadequate drainage and waterproofing scored 88.24% on the severity index.

These findings highlight critical areas where improvements in design, construction oversight, and material selection could significantly reduce maintenance issues and enhance building longevity.

Table 8. The effects of defects on building maintenance

Rank	Question	Mean	Severity Index
1	Increase in maintenance work	3.59	89.71
2	Increase in the maintenance budget	3.59	89.71
3	Increase workforce	3.59	89.71
4	Increase in maintenance quality	3.53	88.24
5	Maintenance works has become obsolete	3.47	86.76
6	Difficulties in maintenance planning	3.29	82.35
7	Increase maintenance frequency	3.29	82.35
8	Lower maintenance quality	3.18	79.41

Source: Authors (2024)

Table 8 summarise the survey results, detailing the impacts on building maintenance. It ranks eight impacts based on severity indexes and mean scores. The top impact, increasing maintenance workload, budget, and manpower, has a severity index of 89.71% and a mean score of 3.59. This is followed by improved maintenance quality (severity index = 88.24%, mean = 3.53) and obsolete maintenance practices (severity index = 86.76%, mean = 3.47). Other impacts include enhanced maintenance quality (severity index = 86.76%, mean = 3.47), increased maintenance frequency and planning difficulties (severity index = 82.35%, mean = 3.29), and lower maintenance quality (severity index = 79.41%, mean = 3.18). These findings underscore the significant effects of various factors on building upkeep, guiding strategies to improve maintenance efficiency and effectiveness.

FINDINGS

The top 10 flaws that significantly impacted the maintenance building are listed below:

- *Material selection that is improper for the current climatic conditions:* Choosing materials unsuitable for local climates can lead to durability issues and structural problems.
- *Lack of inspection:* Skipping inspections can lead to hidden errors and safety issues, compromising building safety.
- *Ignoring the effect of load on structural stability:* Neglecting to consider varying loads can lead to structural issues endangering occupants.
- *Failure to consider the local climatic conditions when designing the exterior shape:* Designing without climate considerations can increase energy use and maintenance costs.
- *Deficient waterproofing and drainage:* Inadequate systems cause water damage and mould growth.
- *Unqualified workforce:* Inexperienced workers can lead to construction errors and maintenance problems.

- *Failure to define suitable materials*: Unclear material choices can reduce building durability and increase maintenance needs.
- *Deficient provisions for movement*: Design flaws restricting movement can cause structural failures.
- *Failure to consider the maintenance requirements in design*: Neglecting maintenance in design can complicate repairs and inspections.
- *Deficient waterproofing and drainage*: Poor design can lead to water leaks and structural damage.

To address these issues, thorough analysis, expert advice, and corrective actions are necessary. This involves structural assessments, quality control systems, fixing design flaws, ensuring the fulfilment of standards, using suitable materials, and improving overall construction and maintenance practices. Flaws significantly impact maintenance processes and outcomes, which emphasises how crucial they are to building management.

- **Increase in Maintenance Budget**: Building defects can escalate maintenance costs, requiring more resources, materials, and labour.
- **Increase in Maintenance Work**: Defects necessitate repairs, replacements, and corrective actions, increasing the workload for maintenance crews.
- **Increase in Workforce**: Resolving faults may require additional staff or specialised workers, potentially straining existing maintenance teams.
- **Increase in Maintenance Frequency**: Defects disrupt regular maintenance schedules, necessitating more frequent inspections and preventive measures.
- **Increase in Maintenance Quality**: Defects highlight the importance of stringent standards and prompt resolution, prompting improvements in maintenance methods and quality control.
- **Difficulties in Maintenance Planning**: Unforeseen defects can disrupt maintenance plans, requiring adjustments and prioritisation of tasks.
- **Maintenance Work Becomes Obsolete**: Neglecting to address defects can render previous maintenance efforts ineffective, leading to recurring issues and higher long-term costs.
- **Lower Maintenance Quality**: Unresolved defects compromise building performance and longevity, necessitating comprehensive understanding and effective solutions to maintain quality and durability.

CONCLUSION

It's clear how important it is to find problems as soon as possible, carefully consider them, and then fix them when you know how flaws affect building

maintenance. By fixing issues quickly and implementing good maintenance procedures, building owners and maintenance teams can lower the negative effects, improve long-term maintenance results, and ensure the structure will last and work. The last part of the declaration says that people who design buildings should consider how they will be maintained before starting the design process. Future maintenance needs depend on several factors, such as the type of materials used, the layout of the building, its age, how well technology is integrated, and the quality of the construction. By thinking about these things and making designs that are easy to maintain, designers can make structures last longer and save money on ongoing costs. This includes choosing materials that will last, making sure the layout is easy to use, thinking about how the building will age, adding smart technologies, and making sure the quality of the construction is high. When you design with maintenance needs in mind, you save money, make the building work better, and make users happier.

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AN EXAMINATION OF THE RISKS OF HAZARDOUS TREES IN THE CONTEXT OF VANDALISM PREVENTION IN URBAN AREAS

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Abstract

It is essential to protect trees in urban areas, particularly those with defects and pose a hazard, to maintaining the longevity of the green infrastructure and the safety of the neighbourhoods. Defective trees (DTs) and hazardous trees (HTs) are often vandalised. Therefore, it is essential to understand the correlation between the vandalism index (VI) and hazard score (HS) of trees to implement strategies that effectively decrease risks and sustain the long-term health of urban green spaces. This present study aims to quantify the correlation between the HS and VI of trees, identify the unique effects of each element on the urban environment, and develop well-informed mitigation strategies. It also assesses the HSs of trees and quantifies their VIs to provide a comprehensive understanding of the risks associated with both factors in urban landscapes. The results of this present study indicate a positive correlation between the VI and HS of trees and identified tree size as an important element impacting their VI. Time constraints and accessibility, particularly when surveying broad areas, are some of the limitations of this present study as it used conventional methods of tree assessments. Nevertheless, tree managers can utilise its findings to make better management decisions as well as increase user comfort and security in urban settings. Furthermore, implementing these findings will enhance and beautify public areas as well as increase public safety.

Keywords: Green Infrastructure Safety, Hazardous Trees, Tree Vandalism, Urban Tree Risks

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INTRODUCTION

Increased awareness of the risks associated with hazardous trees (HTs) in urban areas, highlighting the damage they might cause to people and property, has led to the need for immediate action to mitigate the related hazards. It is widely accepted that defective trees (DTs) and HTs are closely related. Numerous tree assessments, particularly in tropical regions, confirm this assertion (Chuon et al., 2011; Mojiol, 2018; Sreetheran et al., 2011; Tomao et al., 2015). More specifically, Hamzah et al. (2018) reported that tree vandalism (TV) is the primary cause of DTs and HTs. Despite the risks posed by TV to HTs, not much research has been done on the topic, and it is still not entirely obvious how urban HTs are related to TV. Further investigation is required to fully comprehend these connections. This study is aimed at defining the various effects that each element has on the urban environment, with the objective of quantifying the correlation between TV and urban HTs for mitigation strategies. The study delves into both the hazard score (HS) and vandalism index (VI) of trees and seeks to unravel the dynamics and correlations between these variables. The context and issues of HTs and TV incidences are introduced at the beginning of the article. It then explores the literature that is currently available on HTs and TV. The third section of this article offers comprehensive details on the materials and methods used for the purpose of the study. Proceeding to the fourth section, the paper highlights and evaluates the outcomes of the study. Lastly, it makes suggestions for more research on the subject and provides a summary of the findings.

LITERATURE REVIEW

Hazardous Trees (HTs)

The features that distinguish HTs are a decline, deterioration, or other conditions that impair the stability of the trees and raise the risk of failure. These flaws can show up as cavities, cracks, or damaged root systems, among other things (Li et al., 2022; Tomao et al., 2015; Van Haaften et al., 2015). These trees are very dangerous because they can fail and cause harm to people, property, or even result in fatalities (Fernandes et al., 2018). The identification and classification of hazardous trees (HTs) require extensive evaluations by arborists or tree care specialists using methods like visual inspections, sophisticated diagnostic tools, and risk assessment methodologies (Chau et al., 2020; He et al., 2022). Comprehending the unique characteristics that render a tree potentially dangerous is imperative for efficient management of urban forests, safeguarding the public, and devising focused mitigation approaches.

Hazardous tree (HT) mitigation requires a thorough strategy that takes into account reactive as well as preventive measures. Regular tree inspections, good maintenance techniques, and the removal of high-risk trees before they become a serious hazard, are examples of proactive measures (Davies et al., 2017). Emergency response plans, the immediate removal of identified HTs, and

community awareness initiatives to inform the public about potential risks are examples of reactive strategies (Fors et al., 2018; Pradipta et al., 2018). To create a safer and more resilient urban environment, arborists, local authorities, and community members must work together to effectively manage HTs.

Hazardous trees (HTs) can emerge when people navigate a more complex social environment because of intentional or unintentional TV, which occurs when someone intentionally damages the structural integrity of a tree (Hamzah & Mohd Hussain, 2021; Kirkpatrick et al., 2013). As a result, defects and weaknesses start to show through, endangering not only the stability of the tree but also the safety of nearby humans and wildlife (Abdullah et al., 2018; Hamzah et al., 2023). As such, a thorough comprehension of TV incidences is imperative, especially when it comes to potential HTs. This understanding is crucial for creating preventive strategies, raising community awareness, and devising plans to lessen the many risks connected to the purposeful damage of trees.

Tree Vandalism (TV) Incidents

TV incidents involve intentional or unintentional acts that injure trees, frequently leading to damage to tree parts (Hamzah et al., 2020; Moore, 2013; Nik Mohamed Sukri et al., 2017). This destructive behaviour can take many different forms, such as cutting, carving, or using toxic materials, all of which directly endanger the health of the targeted trees (Figure 1). Tree vandalism (TV) occurs for a variety of reasons; such as acts of frustration, self-expression, or deliberate harm caused by disregard for the environment (Cummins, 2017; Raskin, 2015; Richardson & Shackleton, 2014). To prevent TV, maintain urban green spaces, and promote a sense of community responsibility towards the environment, it is imperative to comprehend the dynamics of such incidences.

Multiple studies have found a positive correlation between the condition of trees and urban TV incidences. Hamzah et al. (2018) identified tree maturity, safety, and HTs as relevant factors. Hamzah, Othman, and Mohd Hussain (2020) used expert consensus to confirm that trees are far more vulnerable to TV when they are in poor condition, such as overgrown and neglected. These requirements need to be addressed and strengthened to promote the health and defence of urban trees against vandalism.



Figure 1: A sample of urban trees that are being vandalised.

Source: Author's inventory

Beyond its immediate aesthetic impact, TV has long-term ecological consequences as well as detrimental effects on the health of urban ecosystems. Damaged trees are more prone to diseases, pests, and environmental stressors, which shorten their lifespan and general health (Cavender & Donnelly, 2019). Furthermore, the ecosystem services offered by mature trees, such as temperature regulation, air purification, and wildlife habitat, are disrupted by their disappearance (Amir et al., 2022). Community involvement, public awareness campaigns, and cooperation between local government and environmental organisations are all part of the efforts to combat TV and foster an appreciation for trees and their vital role in maintaining urban environments.

Understanding the correlation between HTs and TV is crucial for an all-encompassing approach to urban management. The correlation between HTs and intentional injury emphasises the need for a thoughtful strategy for both public safety and tree care. Arborists, urban planners, and community leaders can create focused strategies to identify and reduce the intentional and unintentional factors that lead to HTs by investigating the patterns and motivations behind TV. Maintaining the integrity of urban green spaces can be done more comprehensively and successfully by incorporating this knowledge into larger programmes that support tree health and protect urban ecosystems.

RESEARCH METHODOLOGY

The correlation between HTs and TV incidences was measured quantitatively in this study. The subject of the analysis was the quantitative data that had been

gathered in less than a month in 2023. The HS and VI of trees were assessed using two forms of data collection.

Data was gathered from Malaysia's Kuala Kangsar Urban Park, which is situated in the centre of Kuala Kangsar, the royal town of Perak, close to the Perak River. Covering an area of around 11 hectares, it is the only urban park in Malaysia serving both commercial and recreational purposes. The approximate geographic coordinates of the park are 3° 46' 30" N and 100° 56' 39" E. This urban park was selected as the study area due to its feasibility and appropriateness for examining the primary goal. The main author's familiarity with the city and its neighbourhoods, together with his excellent rapport with tree organisations and the local government, were invaluable in gathering inventory and tree evaluation data for the study.

This study used the most practical tree-hazard assessment method established by the International Society of Arboriculture (ISA). The method recommended by the ISA was essential for identifying and assessing potential HTs in the park (Koeser & Smiley, 2017; Smiley et al., 2017). By employing this method, it was possible to conduct a thorough and standard evaluation, with assurance of the reliability and accuracy of the gathered information. The utilisation of this globally acknowledged methodology enhanced the credibility of the study and permitted significant comparisons to be made with similar research undertakings across the globe.

The tree vandalism model (TVM) by Hamzah et al. (2021) was used to assess TV incidences. The model measures the number of TV incidences across the area, the VI of the trees throughout the area, and the classification of TV incidences. It also accounts for TV incidences resulting from human error, inadequate tree conditions, and a lack of concern for urban trees.

The study employed descriptive statistics to provide an overview and display of the primary elements of the dataset, while a Pearson's correlation analysis was utilised to evaluate the direction and strength of the correlations between the variables. The research methodology flowchart employed in this study is shown in Figure 2.

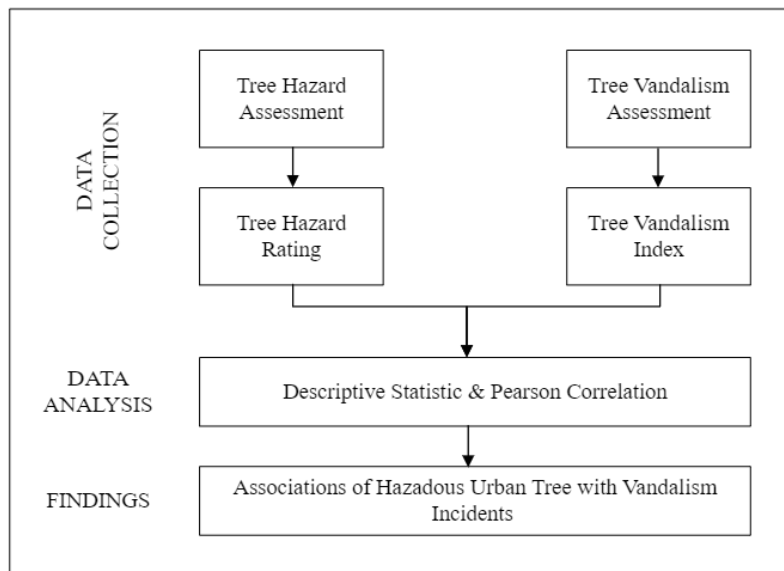


Figure 2: A flowchart of the methodology of this present study.
Source: Author's illustration

RESULT AND DISCUSSION

This present study identified 348 trees in the designated study area, representing a wide variety of 21 different tree species (Table 1). The distribution of the tree species showed that 31.32% of the trees were *Plumeria rubra*, followed by *Polyalthia longifolia* (10.63%), while for each of the remaining tree species, the distribution was less than 7%. The HSs and VIs of the trees, as presented in Table 2, indicated that 47.70% of the trees had low hazard scores, 37.36% had moderate hazard scores, 14.37% had high hazard scores, and 0.57% had extreme hazard scores. The trees with moderate HSs had the highest VI (362.45 points), followed by those with high HSs (306.41 points). Conversely, the trees with extreme HSs had the lowest VI (18.5 index points). The results of the correlation analysis showed that there was a positive correlation ($r = 0.216$) between the VI and HS, which explains why TV incidences are significantly influenced by tree conditions. Figure 3 presents a sample of trees in poor condition that were exposed to TV. This was consistent with the finding of Hamzah et al. (2018) that unhealthy and overgrown trees are more vulnerable to TV. This explains why trees in poor condition have high defect indices in Kota Kinabalu town (Mojjol, 2018) and in the Titiwangsa Recreational Park (Norainiratna et al., 2013). The reason for this susceptibility is the correlation between poor tree conditions and a high HS.

Table 1: The species distribution of the trees in the studied area.

No.	Species	Diameter Breast High (DBH) (m)	Overall Height (OH) (m)	Quantity	Percentage (%)
1	<i>Alstonia scholaris</i>	0.35 to 0.45	18 to 28	21	6.03
2	<i>Bauhinia purpurea</i>	0.32 to 0.34	16 to 13	2	0.57
3	<i>Casuarina equisetifolia</i>	0.32 to 0.54	19 to 26	17	4.89
4	<i>Ficus benjamina</i>	0.30 to 0.39	12 to 18	14	4.02
5	<i>Gymnostoma nobile</i>	0.28	12	1	0.29
6	<i>Hopea odorata</i>	0.33 to 0.45	21 to 26	12	3.45
7	<i>Hura crepitans</i>	0.23 to 0.48	10 to 17	18	5.17
8	<i>Khaya senegalensis</i>	0.48 to 0.62	17 to 24	5	1.44
9	<i>Lagerstroemia floribunda</i>	0.12 to 0.47	12 to 23	24	6.90
10	<i>Melaleuca cajuputi</i>	0.32	16	1	0.29
11	<i>Mimusops elengi</i>	0.32 to 0.41	12 to 16	10	2.87
12	<i>Murraya paniculata</i>	0.08	3.5	1	0.29
13	<i>Peltophorum pterocarpum</i>	0.08 to 0.44	4 to 19	16	4.60
14	<i>Pisonia grandis</i>	0.32 to 0.34	11 to 17	7	2.01
15	<i>Plumeria rubra</i>	0.01 to 0.09	2 to 5	109	31.32
16	<i>Polyalthia longifolia</i>	0.31 to 0.40	17 to 26	37	10.63
17	<i>Samanea saman</i>	0.32 to 3.80	12 to 26	7	2.01
18	<i>Syzygium grande</i>	0.32 to 0.37	13 to 17	10	2.87
19	<i>Syzygium myrtifolium</i>	0.21 to 0.34	11 to 16	20	5.75
20	<i>Tabebuia rosea</i>	0.23 to 0.42	8 to 21	8	2.30
21	<i>Terminalia mantaly</i>	0.30 to 0.33	15 to 21	8	2.30
Total				348	100.00

Source: Author's inventory



Figure 3: The overgrown and HTs vandalised in the studied area.

Source: Author's Inventory

Table 2: The results of the tree HS and VI assessment.

HS	Quantity	Percentage (%)	VI
Low	166	47.70	70.49
Moderate	130	37.36	362.45
High	50	14.37	306.41
Extreme	2	0.57	18.65

* $r = 0.216$

Source: Author's inventory

According to the correlation analysis, the HS, VI, overall height (OH), and diameter breast height (DBH) of the trees were positively correlated with one another (Table 3). Nonetheless, there was a strong correlation ($r = 0.5, < 0.7$) between the VI as well as OH and HS. On the other hand, there was a moderate correlation ($r = 0.3, < 0.5$) between the HS as well as the DBH and VI. The results demonstrated that the size of a tree was a significant factor in the incidences of TV. This was consistent with the studies by Hamzah et al. (2023) and Hamzah et al. (2022), which highlighted how human activities damage tree structures because of the structural and size-appropriateness of trees for supporting other structures. However, Richardson and Shackleton (2014) found that smaller, younger trees are more susceptible to TV than larger ones, which contradicts the

findings of this present study. This discrepancy has to be investigated and explained in more detail by further research.

Table 3: The correlation matrix of tree DBH, OH, HS, and VI.

	<i>OH</i>	<i>DBH</i>	<i>VI</i>	<i>HS</i>
<i>OH</i>	1			
<i>DBH</i>	0.5672	1		
<i>VI</i>	0.5672	1	1	
<i>HS</i>	0.6699	0.3809	0.3809	1

Source: Author's analysis

CONCLUSION

The findings of the present study clarified the dynamics of tree management, wherein the positive correlation between VI and HS was an important finding. According to this correlation, the HS of a tree rises in tandem with the number of TV incidences. This study highlighted a wider influence on the safety and wellbeing of trees, with ramifications that go beyond the specific act of TV. To create comprehensive strategies that not only prevent TV but also improve the general resilience and health of urban tree populations, it is imperative that this positive correlation be recognised and addressed.

The study found that the size of the tree was another important component that was crucial in determining the occurrence of TV. It appears that larger trees are more likely to be vandalised, suggesting possible causes like visibility or symbolic significance. Understanding how tree size affects TV incidences can help urban planning and arboriculture practices. It can also direct efforts to protect larger trees in public areas and encourage a reassessment of TV prevention tactics by considering tree size. This double understanding of the correlation between VI and HS, as well as the influence of tree size, adds significant information to the larger conversation on urban forestry and sustainable tree management.

In addition, the conclusions of this study provide tree managers with useful advice on how to emphasise user comfort and safety in landscapes while making design decisions. Tree managers will be better able to customise their efforts to reduce hazards and improve overall safety if they are aware of the positive correlation between the VI and HS, as well as the importance of tree size in TV incidences. By putting these findings into practice, public spaces will become more functional and enjoyable by fostering the development of both visually beautiful landscapes and secure conditions for people.

The limitations of conventional methods for the gathering of data for tree assessments are acknowledged in this work. Two of the restrictions include time constraints and accessibility to survey large areas. The use of unmanned aerial vehicles (UAVs) can improve accessibility and enable large areas to be surveyed more quickly and efficiently. By overcoming the drawbacks of

conventional techniques, UAVs can provide a more flexible and efficient method of gathering data for better research results.

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THE UTILIZATION OF TRADITIONAL KNOWLEDGE ON THE IMPACT OF CLIMATE CHANGE TOWARDS ISLAND COMMUNITIES' SOCIAL WELL-BEING: THE MEDIATING EFFECT OF ADAPTIVE CAPACITY

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Abstract

Climate change is undeniably one of the greatest issues in Malaysia. Numerous studies have observed unpredictable patterns and extreme weather events. Since traditional knowledge of climate change affects the success of implementation and mitigation options, it is essential to gather information and adaptation. This study investigated the potential of traditional knowledge of island communities in Pulau Redang and Perhentian, Terengganu, Malaysia. Survey questionnaires were used for data collection, and SmartPLS-3 was used for analysis. The findings revealed that traditional knowledge (cultural beliefs, cultural practices, and personality traits) significantly supported the impact of climate change on social well-being. In addition, adaptive capacity mediated the relationship between traditional knowledge (cultural beliefs, cultural practices, and personality traits) and climate change on social well-being in the Pulau Redang and Perhentian island communities. Communities preserve traditional knowledge through cultural practices, beliefs and personality traits passed orally to the next generation.

Keywords: climate change; traditional knowledge; social well-being; culture belief; culture practice; personality traits; adaptive capacity; island community

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INTRODUCTION

Malaysia's Climate Change Action Plan 2021-2025 focuses on resilience and aligns with the World Bank Government's Green, Resilient, and Inclusive Development (GRID) approach. It aims to address the poverty and inequality exacerbated by climate change, impacting key sectors such as agriculture, fishing, and the cultivation of rubber, palm oil, and cocoa (Asian Development Bank, 2021). The Intergovernmental Panel on Climate Change (IPCC, 2022) report highlights the escalating impacts of climate change, affecting billions of people worldwide and displacing vulnerable populations. Around 3.6 billion people are highly exposed to extreme conditions such as droughts, heavy rainfall, and heat, which harm physical and mental health, marking the first inclusion of mental health in IPCC findings (World Health Organization, 2023).

LITERATURE REVIEW

Underpinning Theory

This study applies the Knowledge-Based View (KBV) theory to explore the potential of utilizing traditional knowledge (TK) to address climate change impacts. According to the KBV, creating, transferring, and integrating knowledge is essential for transforming organizational knowledge resources into valuable assets for innovation in products or processes (Cepeda-Carrion et al., 2017). In this context, TK has been passed down through generations and serves as a critical resource for innovation to mitigate the effects of climate change on social and economic well-being. The findings of this study contribute to a growing body of knowledge on climate change adaptation by highlighting the value of TK in fostering resilience and economic stability (Baharuddin et al., 2024). Additionally, this study employs Attribution Theory (AT) to examine how internal and external factors motivate individuals to use TK to mitigate the economic impact of climate change. AT suggests that individuals seek to understand and explain their behavior through internal or external factors (Aronson et al., 2010). External factors in this study included cultural beliefs and practices, influenced by the transmission of knowledge from past generations. Internal factors, such as personality traits and adaptive capacity, influence how individuals apply TK to address climate-related challenges in the modern era shaped by technology.

Climate Change and Its Effect on Social Well-being

The IPCC (2015) warns that by 2050, over one billion people could lose their homes due to worsening storms and rising seas, endangering the Paris Agreement's 1.5 °C warming goal. Rapid climate change highlights the need for urgent planning and funding to help vulnerable coastal communities.

The social dimension of climate change involves the interplay between climate impact and human vulnerability. It disproportionately affects the poorest areas, especially those living in flood-prone or extremely hot areas (Basyir, 2022). In Malaysia, climate action should align with the Sustainable Development Goals (SDGs), particularly SDG 11 (sustainable cities) and SDG 13 (climate action), emphasizing local governance and community involvement (New Straits Times, 2022). The Lancet Countdown on Climate Change and Health reports that are already affecting global populations and may become irreversible (Watts et al., 2017). Indirect mental health effects, particularly in the island and rural communities, may result from infrastructure damage, water scarcity, food insecurity, and conflicts, with broader consequences impacting natural resources, human health, infrastructure, and the environment (Mat et al., 2019; Mat et al., 2020).

Traditional Knowledge (TK)

Traditional knowledge, shaped by indigenous peoples' long-standing interactions with nature, is vital for adapting to climate change (UNESCO, 2017). It helps communities understand the real impacts and devise strategies, with rural and indigenous groups often using local cultural systems and seasonal indicators (Gashler, 2021). This study examines how island communities utilize traditional knowledge, specifically cultural beliefs, practices, and personality traits, to adapt to the social effects of climate change.

Cultural Belief

Cultural beliefs are a shared system of knowledge within a group encompassing beliefs, values, and social norms that shape individual and community understanding and behavior manifesting as collective behavioral patterns transmitted across generations within a society (Hofstede, 1991). Elderly individuals can contribute significantly to society because of their extensive experience and knowledge of cultural heritage in their communities (Ariffin et al., 2023).

Cultural Practice

Sewell (1992) define cultural practices as structured routines encompassing virtual schemas that cannot be reduced to specific exemplifications. Describing practices as embodied habits involves bringing them to the physical or bodily level, encompassing various aspects of life from clothing and diet to speech and artistic tastes. This approach facilitates potential improvisation around cultural themes without excessive deliberation, highlighting how people influence ecosystems through cultural practices, values, and worldviews, underscoring the

importance of drawing inspiration from cultural values and reinforcing them through these practices (Aleksander, 2018).

Personality Traits

Personality traits shapes people's views on environmental issues such as resilience and adaptability, which are crucial for coping with climate challenges. Rothermich et al. (2021) suggested that individuals with personality traits of higher levels of openness and perspective-taking are more likely to exhibit pro-environmental attitudes. Higher levels of openness are associated with a greater likelihood of pro-environmental behavior, reflecting an increased concern for climate change, and people are increasingly willing to act on their worries about global warming (Brick & Lewis, 2014).

Adaptive Capacity

Adaptive capacity is an inherent trait of communities, social-ecological systems, and individuals that are activated in response to opportunities or crises (Engle, 2011). Research on adaptive capacity seeks to understand the interaction between social and biophysical systems to create mechanisms for responding to global environmental changes and enhance the effectiveness of conservation efforts with limited resources (Sexton et al., 2010). Samsuddin et al. (2024) found that adaptive capacity mediates TK and the impacts of climate change. From a socio-cultural perspective, it encompasses institutional features that allow social actors to address both short- and long-term impacts through planned or innovative responses, shaping future social, economic, and environmental outcomes. The proposed research framework is shown in Figure 1.

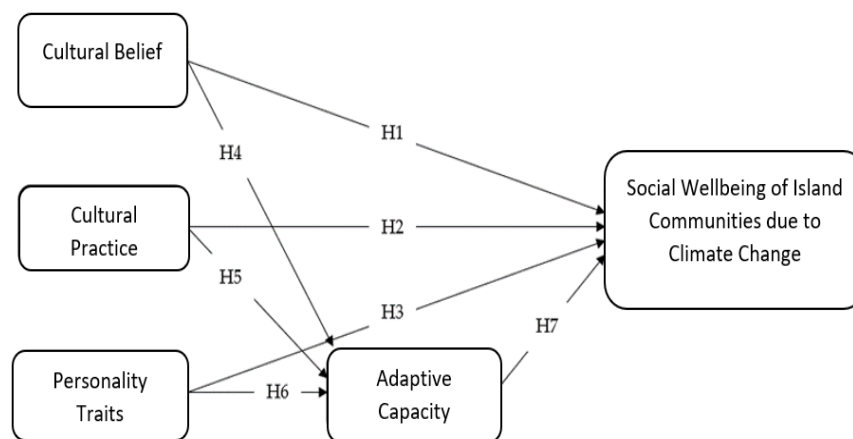


Figure 1: Research Framework

MATERIALS AND METHODS

A quantitative approach is employed in this study. The three primary research purposes were exploratory, descriptive, and hypothesis testing. This study employed a cross-sectional design using a survey to collect personal and social information, as well as beliefs and attitudes. Data collection involved a self-completed questionnaire comprising 43 questions (refer to Table 1)

Table 1: Measurement of all variables/ constructs and sources

Construct	No. of items	Source
Cultural Belief (CB)	8	Joose et al. (2018)
Cultural Practice (CP)	5	Colombi & Smith (2012)
Personality Traits (PT)	7	Issa et al. (2018)
Adaptive Capacity (CP)	7	Hilary (2015)
CC impact on Social Well-being (WB)	8	Semenza (2011)
Demographic data	8	

Source: Adapted

Table 1 presents the measurement constructs and sources. The instrument's Traditional Knowledge (TK), which consists of Cultural Belief (CB), Cultural Practice (CP), and Personality Traits (PT) has been adapted from Joose et al (2018); Colombi & Smith (2012); Issa et.al. (2018). Adaptive Capacity (AC) has been adapted from Hilary, 2015. The Social Well-being (SW) variable has been adapted from Semenza (2011).

Population and Sample

This study was conducted among Pulau Redang and Pulau Perhentian inhabitants in Terengganu, Malaysia, focusing on these two islands because of the potential impact of climate change on their biota. According to the Malaysian Census 2010, the combined population of Pulau Perhentian and Pulau Redang was 4,036. Using a 5% margin of error and 95% confidence interval, a sample size of 354 respondents was recommended (Department of Statistics Malaysia, 2011). However, due to the COVID-19 pandemic, only 224 questionnaires were completed, which aligns with Green's (1991) minimum requirement of 90, calculated using the formula $[50 + 8(5 \text{ constructs}) = 90]$.

Data Collection and Research Instruments

Purposive sampling was employed to select the Pulau Redang and Pulau Perhentian communities for data collection. The final questionnaire was developed by adopting scales from prior research and was pretested and revised before the survey was conducted. A closed-ended format allowed the respondents to choose from five options on a Likert scale to indicate their opinions. This interval scale effectively measured the impact of climate change, with responses

ranging from 1 (strongly disagree) to 5 (strongly agree), thus providing valuable insights into community perceptions.

Data Analysis

This study used general descriptive analysis (e.g., frequency distribution, means, and standard deviations), validity, and reliability tests using the Statistical Package for Social Sciences (SPSS) software, version 25.0, and Smart PLS software to test the hypotheses and address the research questions. The sentences suggest that while a measurement model explains the reliability and validity of constructs, a structural model goes further by conducting bivariate correlation and regression analyses. This study examined the influence of TK's dimensions - cultural beliefs, cultural practices, and personality traits - on the impact of climate change on social well-being, mediated by adaptive capacity.

RESULTS AND DISCUSSION

Descriptive Statistic Analysis

The majority of respondents in this study were female, with 113 (50.4%) identifying as such, while 111 (49.6%) were male. Most participants were in the 18-30 age group, comprising 75 respondents (33.5%), followed by the 31-40 age group (66 respondents, 29.5%). A smaller number fell into the 41-50, above 50, and below 18 age categories, with 50 (22.3%), 28 (12.5%), and 5 (2.2%) respondents, respectively. The predominant occupations were housewives (76 respondents, 33.9%), with equal numbers of self-employed individuals (76), unemployed (20), and private employees (33.9%, 8.9%). Minorities included government employees (12, 5.4%), students (11, 4.9%), and others (4, 1.8%). Most respondents were married (158, 70.5%), 61 were single (27.2%), and 4 (1.8%) were divorced or widowed. The majority identified as Malay, reflecting the questionnaire's collection from Terengganu villages. Educationally, 188 participants (83.9%) had primary or secondary education, while 28 (12.5%) held diplomas or certificates, and only 5 (2.2%) had bachelor's degrees. Most respondents earned less than RM3,000 (218, 83.9%), which is consistent with their demographics of young age, low education level, and primarily being housewives.

Table 2: Results of descriptive analysis.

Constructs	Mean	Standard Deviation	Level
Cultural Belief (CB)	3.4	0.988	Medium
Cultural Practice (CP)	3.47	0.977	Medium
Personality Traits (PT)	3.46	0.969	Medium
Adaptive Capacity (AC)	3.9	1.062	High
Social Well-being (SW)	3.38	0.991	Medium

Descriptive analysis included the mean, standard deviation, and significance level for TK. Table 2 presents the levels of cultural belief (mean = 3.40), cultural practice (mean = 3.47), personality traits (mean = 3.46), and social well-being (mean = 3.38), all of which were categorized as medium. By contrast, the level of adaptive capacity was high, with a mean of 3.90. A high score in adaptive capacity indicates that the community possesses a strong ability to respond to environmental changes and challenges. This suggests that the respondents felt equipped to manage risks associated with climate change, potentially due to prior experience, resources, or knowledge.

Assessment of Measurement Model Construct Validity and Reliability

The measurement model analysis assessed the internal consistency, indicator reliability, convergent validity, and discriminant validity of the reflective model.

Table 3: Results of construct validity and reliability.

Construct	Code	Factor Loading	CR	AVE	Cronbach's Alpha
Cultural Belief	F2	0.71	0.808	0.512	0.682
	F4	0.765			
	F5	0.675			
	F7	0.701			
Cultural Practice	G1	0.616	0.818	0.532	0.704
	G2	0.827			
	G3	0.73			
	G5	0.724			
	H1	0.715			
Personality Traits	H4	0.623	0.845	0.523	0.773
	H5	0.713			
	H6	0.773			
	H7	0.766			
	K1	0.769			
Adaptive Capacity	K2	0.719	0.882	0.6	0.832
	K3	0.824			
	K4	0.811			
	K7	0.744			
Social Well-being	D1	0.786	0.819	0.649	0.741
	D2	0.765			
	D3	0.793			
	D4	0.644			

Table 3 displays the evaluation of the reliability and validity of the measurement model. Following this assessment, nine items (F1, F3, F6, F8, G4, H2, H3, K5, K6, D5, D6, and D7) were eliminated from the recycling constructs due to their low factor loading. Therefore, items with a loading of 0.400 were

removed to achieve AVE. All the other items used in this study had adequate indicator reliability. The items in the analysis were retained because their factor loadings fell within the range of 0.644 to 0.827, all exceeding 0.6. Moreover, Average Variance Extracted (AVE) values for all variables fell within the range of 0.512 to 0.649, indicating the reliability of the measurement model (Ramayah et al., 2016).

The convergent validity of the accepted items, with an AVE greater than 0.5, ranged from 0.512 to 0.649. Cronbach's alpha ranged from 0.808 to 0.882. All constructs met the threshold, as indicated at 0.7, except for cultural belief, which was slightly below at 0.682 (Hair et al., 2019). Said (2018) suggests that a Cronbach's Alpha value between 0.6 and 0.8 is acceptable (Wim et al, 2008). Therefore, these results supported convergent validity and were also valid and reliable for the factor loading, CR, and Cronbach's α criteria, which were above the generally recommended values (Hair et al., 2019; Sarstedt et al., 2019). Discriminant validity was evaluated using the HTMT ratio (Henseler et al., 2015). Some authors suggest a threshold of 0.85 (Kline, 2011). However, Gold et al. (2001) disagreed with this finding and recommended a threshold of 0.90. Therefore, the HTMT criterion should be used for this purpose so that the interpretation of the causal effect in the modelling analysis is not misleading.

Table 4: Results of discriminant validity test using the Heterotrait-Monotrait (HTMT).

Construct	AC	CB	CP	SW	PT
Adaptive Capacity (AC)	0.512				
Cultural Belief (CB)	0.653	0.682			
Cultural Practice (CP)	0.738	0.719	0.802		
Social Well-being (SW)	0.571	0.651	0.802	0.646	
Personality Traits (PT)	0.732	0.637	0.863	0.646	0.646

Table 4 presents the HTMT values for the latent constructs in the overall model, ranging from 0.671 to 0.863, and all values were below the threshold of 0.90. This indicated that the correlation values between constructs demonstrate acceptable discriminant validity. Consequently, the study's measurement model was deemed reliable and valid.

Assessment of Structural Model

The study's structural model investigated the relationships among key constructs, analyzing path coefficients, t-statistics, variance, and p-values. The significance of the paths was assessed using the bootstrapping method with 240 cases and 5000 replicate samples at a 5% significance level. The predictive power of the model was evaluated by hypothesis testing. Table 6 presents a summary of the results of the analysis. The study employed Cohen's (1988) classification for R-

squared, categorizing it as high, moderate, or low with rates of 0.26, 0.13, and 0.02, respectively, to evaluate predictive accuracy.

Table 5: Results of Coefficient determination, effect size, predictive relevance, and impact of predictive relevance).

Construct	R ²	f ²	Q ²	q ²
Adaptive Capacity	0.469	0.3	0.269	0.078
Social Well-being	0.231		0.115	

Table 5 displays the R-squared values for adaptive capacity and social well-being, indicating that approximately 46.9% of the variance in adaptive capacity and 23.1% in social well-being are explained by their respective predictors (cultural belief, cultural practice, personality traits, and adaptive capacity). Following Cohen's (2013) criteria, the R-squared values in this study were considered medium, as they exceeded 0.13. The Q² values for adaptive capacity and social well-being are 0.269 and 0.115, respectively. The fact that these values are greater than zero supports the assertion that the model in this study possesses sufficient predictive ability and relevance for the endogenous construct examined. As per Cohen's (1988) recommendation, f² values exceeding 0.35 are categorized as large effect sizes, those between 0.15 and 0.35 are deemed medium, values between 0.02 and 0.15 are considered small, and any values below 0.02 are classified as having no effect. Researchers have commonly utilized this rating system in Partial Least Squares (PLS) analysis. The study effect size (f²) and the impact of predictive relevance (q²) are categorized as medium.

Hypothesis Testing

The analysis outcomes are detailed in Table 6. It presents the results of hypothesis testing, specifically focusing on the direct effects, to investigate the relationship between dimensions of TK (such as cultural belief, cultural practice, and personality traits) and the effects of climate change on social well-being.

Table 6: Results of hypothesis testing (direct effect)

Path Analysis	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	Sig.	Decision
Cultural Belief -> Social Well-being	0.103	0.031	3.355	0.01	Supported
Cultural Practice -> Social Well-being	0.112	0.039	2.849	0.04	Supported
Personality Traits -> Social Well-being	0.175	0.038	4.643	0.00	Supported

Table 6 displays the path between cultural beliefs and social well-being demonstrating a significant positive relationship (Std. beta = 0.103, t = 3.355, p-value < 0.01), indicating that H1 is supported. Cultural practice had a significant positive relationship with social well-being (Std. beta= 0.112, t= 2.849, p-value <0.04), indicating that H2 is supported. The path from personality traits has a significantly positive relationship with social well-being (Std. beta = 0.175, t = 4.643, p-value < 0.00), indicating that H3 is supported. In addition, the mediation analysis results are detailed in Table 7.

Table 7: Results of hypothesis testing (mediating effect)

Path Analysis	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	Sig.	Decision
Cultural Belief -> Adaptive Capacity -> Social Well-being	0.103	0.031	3.355	0.001	Supported
Cultural Practice -> Adaptive Capacity -> Social Well-being	0.112	0.039	2.849	0.004	Supported
Personality Traits-> Adaptive Capacity -> Social Well-being	0.175	0.038	4.643	0.000	Supported

Table 7 shows that the indirect effect of cultural beliefs on economic well-being through adaptive capacity is statistically significant, with a medium effect size (Std. beta= 0.083, t= 3.366, p-value <0.00). The bias-corrected confidence interval (CI) further confirmed this significance, as it did not

encompass 0, with the lower level (LL = 0.038) and upper level (UL = 0.134) both falling outside this range. Thus, H4 is supported.

On the other hand, the indirect effect of cultural practice was also statistically significant, with a small effect size of the coefficient path from the subjective norm to economic well-being (Std. beta= 0.061, $t = 2.295$, $P < 0.02$). The bias-corrected CI, with the lower level (LL = 0.018) and upper level (UL = 0.122), did not encompass 0. This observation supports the confirmation of H5.

The path from adaptability between personality traits and economic well-being was statistically significant, with a medium effect size of the coefficient path from the subjective norm to economic well-being (Std. beta = 0.87, $t = 2.564$, $p\text{-value} < 0.01$). The bias-corrected CI with a lower level (LL = 0.031) and upper level (UL = 0.163) did not encompass 0, indicating support for H6.

Figure 2 summarizes the results of the PLS analysis of the overall model, including the path coefficients (β), which are significant at the 99% and 90% significance levels with the associated p -value and R^2 coefficients to support the hypothesized relationships.

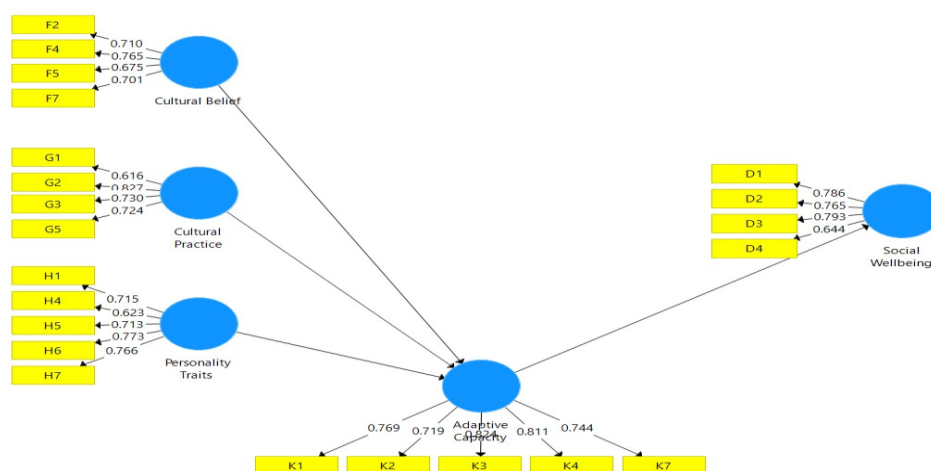


Figure 2: PLS Analysis of Proposed Structural Model

CONCLUSION

This study identified the key dimensions of traditional knowledge (TK)-cultural beliefs, practices, and personality traits-as significant factors influencing the impact of climate change on social well-being. Adaptive capacity was found to moderate the relationship between personality traits and social well-being in Malaysian island communities. This research introduced a model combining knowledge-based view theory and attribute theory to assess the role of traditional

knowledge in mitigating climate change effects, extending these theories into the context of climate change.

The findings showed that the Pulau Redang and Pulau Perhentian communities have unique worldviews rooted in traditional ecological knowledge, shaping their perceptions and responses to climate change. Preserving access to traditional lands, natural resources, and cultural sites, as well as maintaining language and ecological knowledge is essential as they face climate change, land-use shifts, and policy changes. These communities tend to resist policies that limit access to culturally significant landscapes, whereas projects aligned with their values and aspirations have a higher chance of success.

Island communities prioritize various goals: social development (e.g., aquaculture and tourism), education (youth employment and training), environmental stewardship (e.g., co-managing national parks), and preserving cultural heritage (such as transmitting traditional knowledge and safeguarding cultural sites). This diversity offers multiple opportunities to develop successful adaptation strategies. However, the key challenge for governments and service providers is to genuinely engage with these communities' worldviews and design equitable and effective strategies for climate change adaptation.

Although this study focused on Pulau Redang and Pulau Perhentian, the perspectives of other Malaysian islands and developing countries might differ. Comparative studies with other islands or countries could enhance understanding and reveal the consistency or divergence of traditional knowledge's role in climate change adaptation and economic well-being.

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DISCLOSURE STATEMENT / ETHICAL STATEMENT

The authors declare no conflicts of interest related to this research. The authors affirm that this paper is original, plagiarism-free, and has not been submitted for publication elsewhere.

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CATASTROPHIC FLOODING IN PAHANG, MALAYSIA: WHAT WENT WRONG WITH THE FLOOD RESPONSE?

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Abstract

This study aims to critically analyse the flood response in Pahang, Malaysia, focusing on identifying the issues and challenges from the perspectives of responsible agencies. Using qualitative research methods, including face-to-face interviews with 30 officers from various emergency response agencies, the study adopted thematic analysis to identify key issues. Findings indicated significant challenges, such as acute manpower shortages, severe deficiencies in logistical assets, substantial communication barriers, and coordination problems between agencies. The study underscored the need for improved resource allocation, enhanced communication technologies, better logistical planning, and stronger inter-agency cooperation to enhance flood response efficiency and effectiveness. Recommendations include adopting more robust communication technologies, comprehensive logistical asset management, proactive federal support, and a thorough overhaul of current emergency response protocols. This research highlights the urgent need for a more resilient and efficient disaster management framework to mitigate the impact of future floods.

Keywords: Flood, Flood Response, Climate Change, Pahang

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INTRODUCTION

Flooding is one of the most devastating natural disasters, causing significant damage to property, loss of lives, and disruption of daily activities (Amin & Hashim, 2014; Ata et al., 2023). Pahang, a state in Malaysia, has repeatedly experienced some of the worst floods in its history, affecting thousands of residents and causing widespread destruction. The intensity of flooding in Pahang was severe, with floodwaters rising rapidly, inundating homes and infrastructure, and leaving residents stranded and in desperate need of assistance. The severity of these floods led to panic buying and emptying store shelves as residents braced for the worst (Malek, 2021). Historical records highlight five major floods in Pahang, with the most significant displacing over 39,000 people and resulting in twenty fatalities (Rahman, 2021; Razali, 2021). Furthermore, residents in Pahang have described the 2021 floods as the worst since 1971 (Bernama, 2021).

Despite the presence of early warning systems and established evacuation protocols, the response to the floods in Pahang was marred by significant delays and operational inefficiencies, aggravating the impact on affected communities (Mabahwi et al., 2020; Mabahwi & Nakamura, 2020). The cumulative effect of these floods has highlighted the critical need for robust infrastructure and comprehensive disaster preparedness plans to protect vulnerable communities. The December 2021 floods serve as a grim reminder of the necessity for improved flood management and mitigation strategies to prevent future disasters.

Climate change is exacerbating the frequency and intensity of such flooding events, making it imperative to adopt more resilient strategies. Studies have shown that climate change significantly increases the risk of severe flooding due to more intense and frequent rainfall events (Guldberg et al., 2018; Trenberth, 2011). Given these escalating risks, it is crucial to implement effective flood response strategies to mitigate the impact of future floods, as emphasised by Wu et al. (2019). This study aims to critically analyse the flood response in Pahang, focusing on what went wrong and why from the perspectives of responsible agencies. By understanding these issues, the study plans to suggest improvements for future flood response efforts, ensuring that the lessons learned from Pahang's experience can inform better practices and policies.

LITERATURE REVIEW

Urban flood disaster management requires both structural and non-structural measures. Structural measures include the construction of dams and river dikes, while non-structural measures involve flood forecasting, public participation, and institutional arrangements. In developing countries, flood disaster management is often reactive, focusing on emergency response and recovery. However, a shift towards proactive disaster management, which involves preparedness, readiness, emergency response, and recovery, is recommended. This proactive approach

requires greater participation from government, non-governmental, and private agencies, as well as the public (Tingsanchali, 2012).

Emergency response, particularly in the context of natural disasters such as floods, involves a complex interplay of coordination, communication, and resource management. Flood response and management are critical focus areas for various stakeholders, including government agencies, non-governmental organisations, and local communities. Therefore, the literature on flood response and evacuation is extensive, covering multiple aspects of disaster management, communication, and logistical planning. In Malaysia, flood response follows a top-down approach where the government is the primary actor (Mabahwi et al., 2020). This top-down approach means that authority is centralised (Huntjens et al., 2010). Responders, who are at the forefront of these operations, face a myriad of challenges that can significantly impact the effectiveness of their actions. Previous studies have highlighted that these agencies faced many issues and challenges, particularly in the phase of flood response (Mabahwi et al., 2020).

A study by Beamon (2004), for example, reveals the challenges in coordinating relief supplies between agencies during disasters. Meanwhile, Shahid et al. (2014) claim that the challenge of inter-agency coordination during disasters is well-known on the ground but is a neglected area of research. Salmon et al. (2011) argue that disaster agencies face challenges due to unpredictable outcomes, massive casualty numbers, resource shortages, lingering side effects, disruption of public service, collapsed infrastructure, enormous time pressures, high stakes, highly interdependent tasks, and communication breakdowns. In addition to these challenges, Malalgoda et al. (2016) stated that disaster management agencies in Sri Lanka face issues of an inadequate legal framework, limited authority, outdated ordinances to support disaster risk reduction, lack of adequate tools, techniques, and guidelines, human resource constraints, funding constraints, and weaknesses in internal and external systems. These conditions are further aggravated by personal or organisational conflicts regarding authority, interests, and motives.

Case studies from various regions underscore the practical implications of these challenges. The response to Hurricane Katrina in 2005 revealed significant coordination and communication failures, leading to widespread criticism and calls for reform (Comfort et al., 2011). Studies have also shown that effective flood response requires timely and accurate communication, robust infrastructure, and well-coordinated emergency services (Cutter et al., 2010). Conversely, the effective response to the 2011 Brisbane floods demonstrated the benefits of well-coordinated efforts and robust communication systems (King et al., 2016). Additionally, research by Kuller et al. (2021) outlines that successful flood response requires timely and accurate information dissemination, robust infrastructure, and well-prepared emergency services.

These examples highlight the variability in emergency response effectiveness and the critical role of addressing the identified issues. However, gaps in existing research highlight the need for case-specific analyses to understand the unique challenges faced by different regions (Tierney, 2007). In the context of Pahang, there is limited research on operational failures during flood events, necessitating a detailed examination of the recent flood response.

Issues in Emergency Response from the Perspectives of Responders

Understanding the challenges faced by responders is crucial for improving disaster management practices. These challenges are multifaceted, encompassing coordination, communication, training, resource management, and the psychological and physical strain on responders. Addressing these issues is essential for enhancing the overall effectiveness and efficiency of flood response efforts (Smith, 2013). The following are issues synthesised from previous studies:

Coordination Challenges

Coordination between various agencies and stakeholders is a fundamental aspect of effective emergency response. However, literature indicates that coordination often falls short due to bureaucratic inertia and inter-agency rivalries. Alexander et al. (2016) notes that hierarchical structures and rigid protocols can hinder swift decision-making and adaptive responses. Similarly, Moynihan (2009) highlights that the Incident Command System (ICS), while effective in theory, often struggles with real-world implementation due to the complexity of integrating diverse agencies with differing mandates and operational cultures.

Communication Barriers

Effective communication is crucial in ensuring timely and accurate information dissemination during emergencies. However, responders frequently encounter significant communication barriers. According to Kapucu (2006), these barriers can arise from technological failures, such as the breakdown of communication networks and human factors, including language differences and unclear messaging. William et al. (2006) emphasise that the lack of standardised communication protocols can lead to confusion and delays, exacerbating the challenges faced by responders.

Training and Preparedness

Training and preparedness are vital components of emergency response, yet they are often inadequately addressed. Alexander (2015) argues that insufficient training programmes fail to equip responders with the necessary skills and knowledge to handle complex disaster scenarios. Additionally, Naser and Saleem (2018) point out that periodic drills and simulations are essential for maintaining

a high level of preparedness, but these are often neglected due to budget constraints and complacency.

Resource Allocation and Management

Resource allocation and management pose significant challenges during emergency response. Comfort et al. (2004) identify that the uneven distribution of resources can lead to critical shortages in affected areas, undermining the overall response effort. Meyer et al. (2019) add that logistical issues, such as transportation bottlenecks and supply chain disruptions, further complicate the effective deployment of resources. Responders often find themselves working with limited resources, which hampers their ability to provide timely and adequate assistance.

RESEARCH METHODOLOGY

This study adopted a qualitative method that used thematic analysis. This is a suitable interpretation method that allows the researcher to gain an insider's view of the topic under investigation (Braun & Clarke, 2006). Qualitative methods are used to answer questions about experience, meaning, and perspective, usually from the standpoint of the research subject or participant (Hammarberg et al., 2016). Qualitative thematic analysis is a method for identifying, analysing, and reporting themes within a text and is useful for theorising across many cases and for finding common patterns among research participants (Fereday & Muir-Cochrane, 2006; Mohamed et al., 2016; Riessman, 2005). This technique enables the researcher to understand the meanings behind respondents' statements according to their contexts (Joffe & Yardley, 2004; Mohamed et al., 2016). The qualitative approach adopted in this study allowed for a comprehensive understanding of flood response.

The interview data were analysed and classified to establish relevant themes for further discussion. The results were considered reliable because general consistency was found across the stakeholder responses. This research technique is in the family of qualitative thematic analysis and is used to assess the existence of certain words or themes in texts or text collections. Researchers measure and examine the existence, meanings, and relationships of specific terms and concepts and then draw inferences regarding the messages within texts and the author(s), audiences, communities, and time of which they are a part (Colorado University, 2004).

Face-to-face interviews were conducted with 30 officers involved in flood response in Pahang. For each agency, interviews were conducted with officers from the State level (Pahang main branch) and District level. The agencies involved in this study were the Fire and Rescue Department (nine officers), the Royal Malaysian Police (four officers), the Malaysia Civil Defence Force (six officers), the Department of Social Welfare (four officers), National

Disaster Management Agency (NADMA) (four officers), and Local Authorities (three officers). The interviews were conducted using an unstructured questionnaire because it provides a more in-depth understanding of participants' perceptions, motivations, and emotions (McCombes, 2019).

FINDINGS

Table 1: Summary of the challenges

Challenges in flood response	Agencies
Shortage of manpower	All agencies
Shortage of logistical assets	All agencies
Communication breakdown	Fire and Rescue Department, Royal Malaysian Police, Malaysia Civil Defence Force, Department of Social Welfare,
Lack of coordination and cooperation	Fire and Rescue Department, Malaysia Civil Defence Force

Source: Authors, 2024

In the thematic analysis of the interviews with the respondents, several critical themes emerged, including manpower, assets issues, communication, and lack of coordination and cooperation. These themes highlight the multifaceted challenges faced during flood response efforts from the perspectives of responsible agencies (refer to Table 1). One of the significant challenges faced during the flood response was the acute shortage of manpower. Despite mandates requiring all flood-response agencies to be on duty at the state and district levels, many staff members were flood victims themselves, leading to a critical lack of available personnel. This issue was particularly pronounced at the district level, where resources are inherently more limited. The Civil Defence Force and the Fire and Rescue Department faced severe staff shortages, hampering their ability to perform their response and rescue duties effectively. All interviewed agency personnel highlighted this manpower shortage as a primary obstacle during disaster response efforts.

In addition to manpower issues, the flood response was severely hindered by a significant shortage of logistical assets. Emergency services faced considerable challenges accessing affected areas due to flooded roads and damaged infrastructure. The absence of boats and other essential equipment further delayed rescue operations, leaving many residents stranded for extended periods. During interviews conducted for this study, it was revealed that, at the district Civil Defence Force office, only one boat was functional while the majority were broken and unusable. This critical shortage of operational boats led to substantial delays in operations when Temerloh and Mentakab were isolated due to severe flooding in 2021 and 2022. Consequently, responders were unable

to deliver food to flood victims in evacuation centres, resulting in food shortages and starvation among the evacuees. Interviewees from various flood-related agencies consistently reported a critical shortage of transportation assets, which posed significant logistical challenges for humanitarian operations. This shortage was identified as a major impediment to effective disaster response, particularly during the preparedness and response phases.

Effective communication is vital during flood response operations, yet significant issues have been identified with the current systems in place. The primary communication tool used by responders is the Government Integrated Radio Network (GIRN), which is the standard for all government agencies involved in disaster response. However, GIRN frequently becomes overloaded during flood events, causing substantial delays in inter-agency communication and hindering response efforts. This instability and the lack of reliable communication channels underscore a critical gap in the flood communication plan, potentially leading to failures in disaster management. Enhancing the communication capacity among agencies is essential to minimise chaos and ensure smooth coordination during flood events. Additionally, WhatsApp is utilised by responders for communication between agencies. However, this platform's dependency on a stable internet connection presents significant limitations. Major flooding and continuous heavy rain in Pahang led to a major electricity blackout, as Malaysia's primary electricity supply provider shuts off supply when water levels become dangerously high (Sean, 2013). This situation exacerbates communication challenges, as WhatsApp requires electricity and internet access, both of which become unreliable during such conditions. Interviews revealed that officers on flood response duty in Pahang frequently encounter severe communication challenges due to these blackouts and internet slowdowns during heavy rain, which further delay response efforts. The reliance on WhatsApp is critically flawed, as it fails to provide a reliable communication channel during emergencies when internet connectivity is compromised.

The lack of coordination among various agencies exacerbated the situation further, leading to inefficient and delayed response efforts. Collaboration and cooperation issues also arise during flood response. For example, the Civil Defence Force works with the Fire and Rescue Department to rescue flood victims. However, cooperation with the Fire and Rescue Department is challenging due to the hierarchical ranking in uniformed units, with Fire and Rescue Department personnel typically holding higher ranks. This disparity in rank creates tension and hampers effective collaboration. Through interviews, both agencies expressed the same problem and dissatisfaction with each other, indicating a significant barrier to effective cooperation. The Fire and Rescue Department personnel expressed dissatisfaction with being led by the Civil Defence Force during flood response operations. This lack of cooperation between agencies during flood response has delayed rescue operations, further

complicating disaster management efforts. Addressing these coordination issues requires a comprehensive review of the hierarchical structures and inter-agency protocols to foster better cooperation and streamline response efforts.

DISCUSSION

The current communication channels used during flood response operations exhibit substantial limitations, underscoring the critical need for the adoption of more robust and reliable communication technologies that can function effectively under disaster conditions. The frequent jamming of the GIRN and the dependency of WhatsApp on a stable internet connection are significant barriers to effective communication. Addressing these issues is imperative to improve the efficiency and timeliness of flood response operations, ensuring that agencies can coordinate more effectively during disasters.

Moreover, the severe lack of logistical assets highlights a critical gap in disaster management capabilities. This underscores the need for improved resource allocation and strategic planning to enhance the efficiency and effectiveness of future flood response efforts. The current state of logistical preparedness clearly demonstrates that the federal government has overlooked the importance of maintaining well-prepared assets and logistics considerations essential for effective flood preparedness and response. The lack of attention to logistical flood emergency planning by relevant stakeholders is a significant oversight. As other scholars have pointed out, the government must play a key role in the logistical preparations necessary for effective disaster response (Leeuw et al., 2009; Moe & Pathranarakul, 2006).

Compounding these issues is the overall lack of support from the federal government. Despite the evident need for additional logistical assets and resources, this lack of federal support indicates a significant flaw in Malaysia's emergency preparedness plans, which fail to adequately consider the logistical demands of a large-scale humanitarian disaster. The persistent shortages of manpower and logistical assets not only impede immediate response efforts but also undermine the overall effectiveness of disaster management strategies.

This gap highlights the urgent need for a comprehensive review and overhaul of current emergency response protocols to ensure a more robust and efficient disaster management framework in the future. A thorough reassessment of resource allocation, strategic planning, and federal support is essential to address these deficiencies. The implementation of enhanced communication technologies, better logistical planning, and stronger inter-agency cooperation are crucial steps toward achieving a more effective and resilient flood response system.

CONCLUSION AND RECOMMENDATIONS

The study identifies several critical challenges that hinder effective flood response operations in Pahang. Key issues include acute manpower shortages, significant deficiencies in logistical assets, substantial communication barriers, and coordination problems among various agencies. The reliance on outdated and unreliable communication technologies exacerbates these challenges. Furthermore, the lack of federal support and inadequate strategic planning severely undermine the overall effectiveness of disaster management strategies in Malaysia. Addressing these issues is crucial for improving the efficiency and timeliness of flood response operations, ensuring better coordination among agencies, and ultimately enhancing the resilience of disaster management frameworks.

To address these challenges, it is essential to adopt more robust and reliable communication technologies, improve logistical planning and asset management, and enhance inter-agency coordination through joint training exercises and clear communication protocols. The federal government must play a more proactive role in disaster preparedness by approving necessary resources and integrating logistics considerations into emergency plans. Overhauling current emergency response protocols to create a more efficient disaster management framework will significantly enhance Malaysia's flood response capabilities, ensuring more effective and timely disaster management and reducing the impact of future flood events on affected communities.

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INTEGRATED LAKE BASIN MANAGEMENT (ILBM) OF HYDROLOGICAL ASSESSMENT CHARACTERISTICS IN KENYIR LAKE BASIN, TERENGGANU, MALAYSIA

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Abstract

Lake water is a vital resource in supporting life, which is important for the ecosystem of both flora and fauna. Monitoring lake-related programmes based on methodical decision-making and management tools are necessary for the sustainable use of lake water resources. This research's objectives include analysing the characteristics of hydrological quality to identify the current condition of the physical environment of the Kenyir Lake Basin, and providing integrated management methods for its water resources. 21 monitoring stations were chosen for sampling in three seasons (normal season, wet season and dry season) throughout the Kenyir Lake Basin. This study evaluates both in situ and ex situ methods for water quality, followed by a lab test according to American Public Health Association (APHA) standards. Water velocity is a major factor in erosion and the production of sediment, and it is determined by the quantity and intensity of rainfall. It is discovered that there is a significant deterioration in the quality of the water, elevating the rate of erosion with the remarkable water velocity and volume. Aside from that, the rapid urbanisation and population growth in Malaysia is contributing to an increasing level of pollution in the nation's lakes. The ILBM-based adaptive management solutions are adaptable and capable of adjusting to shifting environmental circumstances, which help in revising management plans based on data-monitoring as well as stakeholder feedback.

Keywords: American Public Health Association (APHA); Integrated Lake Basin Management (ILBM); Kenyir Lake Basin; data-monitoring

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INTRODUCTION

As one of the essential components of life, lake water is used in household life, tourism, agriculture, commerce, and also for the preservation of flora and fauna. In addition, lake water resources are crucial to environmental processes, particularly those involving plant ecosystems and the supply of drinking water to humans and other animals. The study of hydrology focuses on the amount and quality of water—stream flow, sedimentation, hydraulics, and ecohydrology—in various phenomena and water sources. According to Camara et al. (2019), Abdulkareem et al. (2018) and Azlan et al. (2022), the study of hydrology is crucial to environmental sustainability management because it helps to manage water resources for public use, particularly for communities, the economy, flora and fauna, and the society.

Furthermore, the vast differences in climatological traits and the effects of land usage make them even more vulnerable to environmental change, particularly in the Terengganu River Basin and Kenyir Lake Basin, whose characteristics include high humidity, constant temperature, and intense rainfall. The anthropogenic consequences of human activities—tourism, urbanisation, deforestation, agriculture, domestic use, and residential development—along the basin are becoming more prevalent, changing specialised habitats and possibly making them non-sustainable (Kamarudin et al., 2023; Asmara et al., 2019; Bati et al., 2022; Ismail & Amin, 2020). Declining the management of environment would gradually worsen the consequences. The management process requires long-term participation from pertinent institutions managing the lake basin and their operations. Extreme weather brought on by global climate change is recognised to have a significant effect on the amount and quality of inland water bodies (Sabri & Ponrahono, 2024). In addition, the organisations involved in lake basin management must be prepared to provide long-term funds and taking part in ongoing activities. Precautionary management is required due to the long-term effects of the susceptibility of the lake environment. Therefore, it is necessary to develop and implement lake management interventions with a precautionary approach in order to safeguard them, as well as to make informed policy decisions on the extraction of natural resources and land use planning (Fitri et al., 2020; Fazli et al., 2018). Chidammodti and Muhandiki (2016) remark that the greatest way to accomplish the objectives of environmental sustainability is for everyone to thoroughly comprehend and value their various roles in relation to the issues (Ismail et al., 2023). The lessons gained from global research and studies show that an effective lake basin management necessitates: (1) Establishments to oversee the lake and its environs for the advantage of all users of the lake basin's resources; (2) Rules in controlling how people use lake resources and how it affects the lakes; (3) Participation of major stakeholders in the management of lake basin; (4) Practical technological options and constraints; (5) Traditional and

scientific understanding; and (6) Maintaining stable resources to support all of the mentioned operations (refer to Figure 1). Furthermore, there are other components of the overall management of lake water quality that are connected to the real ecosystems. Figure 1(b) shows the successful use of the management aspects on planning, operation and control procedures (Duan et al., 2016; Pokharel & Nakamura, 2010).

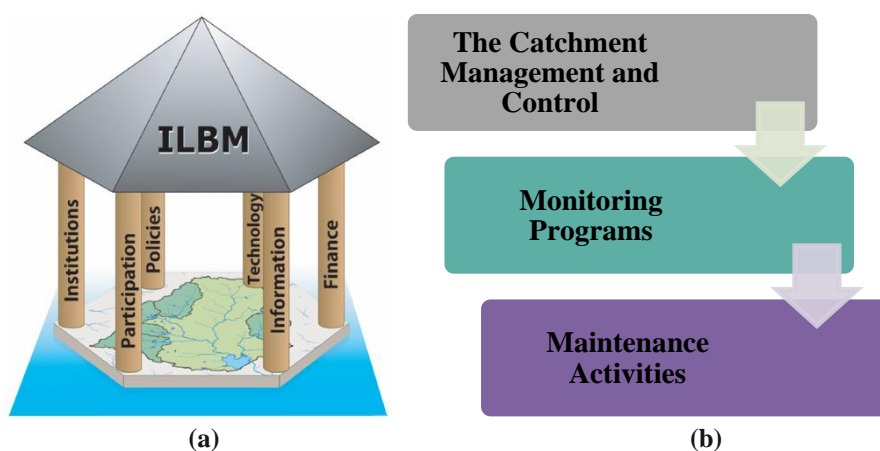


Figure 1(a): Six Pillars of the Governance Component of the ILBM Hexagonal Pagoda
Source: International Lake Environment Committee (ILEC) (2011)

Figure 1(b): Elements of Lake Management in Three Phases
Source: Pokharel and Nakamura, 2010

STUDY AREA AND RESEARCH METHODOLOGY

Study Area

Kenyir Lake is one of Terengganu's and Malaysia's most exquisite tourist destinations, generally considered as the tropical nature of the ancient rainforest. The primary aim of building this lake was to produce hydroelectric power to provide electricity to all states in the Peninsular Malaysia. The Kenyir Lake Basin serves as a fundamental infrastructure for subsistence and a means of transit throughout the basin, which has significantly benefited the local people (Kamarudin et al., 2017; Wahab et al., 2019; Wahab et al., 2023; Azlan et al., 2021; Osnin et al., 2017). The location focused in this research is situated at Kenyir Lake, Hulu Terengganu, the largest artificial lake in the Southeast Asia of over 36,900 hectares. By collecting water from the main rivers, the lake is situated at latitude 05°11'01.064"N until 05°07'34.463"N and longitude 102° 42'42.602"E until 102° 20'6.25"E, as big as the Terengganu River Basin (Rosle et al., 2018; Azlan et al., 2022; Wahab et al., 2017). To assess the hydrological quality features of the entire Kenyir Lake Basin, 21 sampling stations were chosen to represent

21 sub-catchments. The locations of the sampling stations for every season studied are all within Terengganu's Kenyir Lake Basin (refer to Figure 2).

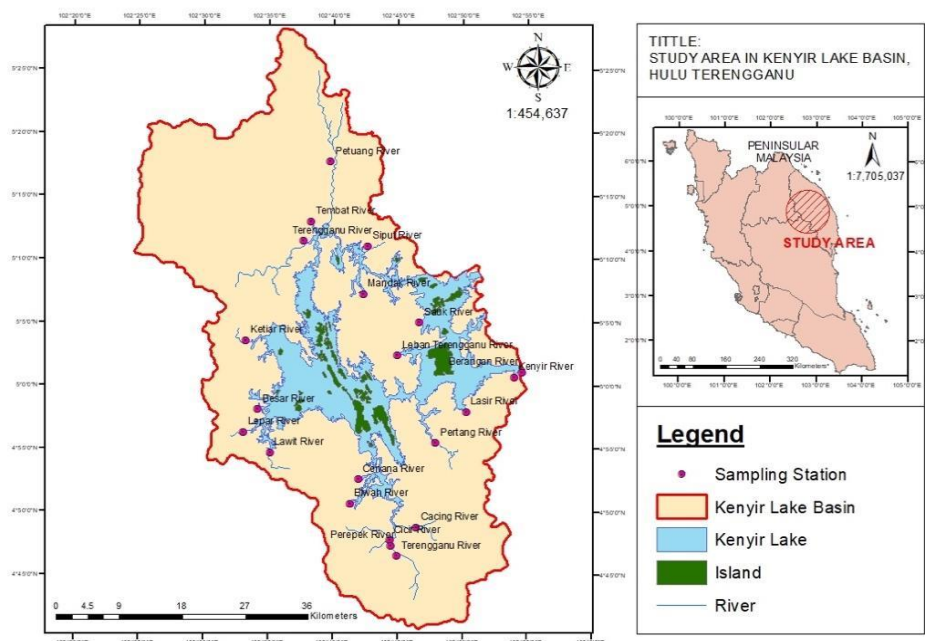


Figure 2: The Kenyir Lake Basin's Sampling Location Map of Wet, Dry, and Normal Seasons

Research Methodology

Water samples from 21 stations were taken at sampling points along the Kenyir Lake Basin, ranging from upstream to downstream. The river's cross-section is examined in order to calculate the river discharge (Q). In situ parameters consisting of Biochemical Oxygen Demand (BOD), Dissolved Oxygen (DO), Ammoniacal Nitrogen (AN) and pH were measured in the field directly. For ex situ parameters, TSS analysis using the Gravimetric method was employed, and COD Method 410 was used to analyse Chemical Oxygen Demand (COD). The standard method of analysis (APHA 2023) approach was followed in the laboratory analysis. As shown in equation 1 (Wahab et al., 2019; Tan et al., 2017), TSS is expressed in mg/L unit. The Water Quality Index (WQI) was enabled to condense intricate scientific data regarding the quality of water to more manageable format for evaluation, reporting, and sharing needs. Equation 2 below was used to determine the index, which was based on the DOE's judgement (DEO, 2023).

Equation 1

$$\begin{aligned} \text{TSS} &= \{(\text{WBF} + \text{DR}) - \text{WBF}\} (\text{mg}) \times 1000 / \text{VFW} (\text{mL}) \\ &= \text{mg/L} / 1000 / 1000 / 1000 \\ &= \text{tonne/L} \end{aligned}$$

Equation 2

$$\text{WQI} = (0.22 \times \text{SIDO}) + (0.19 \times \text{SIBOD}) + (0.16 \times \text{SICOD}) + (0.15 \times \text{SIAN}) + (0.16 \times \text{SITSS}) + (0.12 \times \text{SIpH})$$

Where: SI = Sub Index for each parameter of WQI

ANALYSIS AND DISCUSSION

Hydrological Status

Figure 3 illustrates that during the rainy season, the value (Q) of water was the greatest at Petuang River (29.59 m³/sec) and the lowest at Lepar River (0.33 m³/sec). During the dry season, the Petuang River recorded the greatest value of 10.48 m³/sec, while the Bewah River recorded the lowest value of 0.07 m³/sec. The Terengganu River had a maximum discharge value of 16.78 m³/sec during the regular season, while the Lepar River recorded a minimum value of 0.33 m³/sec. A river's measurement is considered normal when the elevated upstream water velocity, or observed value (Q), is higher than the downstream water velocity. Excess water from the Terengganu River Basin flows into the Kenyir Lake Basin in flat places, and the river's flow value is greatly influenced by the variations in its width and depth. According to hydrology theory, more sediment is deposited in the downstream area at a higher discharge value and a lower water velocity. Rainfall intensity and frequency have an impact on erosion rates as well as the water level flow. It is suggested that there is a positive correlation between the rate of side and riverbank erosion, and sediment generation. As described by Katimon et al. (2018) and Uca et al. (2018), water velocity, which is influenced by the amount of rainfall, plays a significant part in erosion and sediment generation. In general, there would be significant erosion if the water volume and speed were high. The Kenyir Lake Basin's 21 sub-catchment distribution patterns show that it was evolving at a pace. Every lake has a different relative significance for each of the major sources. Stream and river flow are often seasonal in nature, influenced by both biological and hydrological forces. As stated by Abdullah et al. (2019), Dlamini et al. (2017) and Wahab et al. (2019), the fluctuations in stream flow indicate how the net water balance of a given lake varies based on changes in imports and outputs.

To determine the total suspended solid (TSS) in tonnes per day (tonnes/day), the production of suspended sediment was calculated daily. The highest flow value and the highest TSS are the reasons for the maximum river basin's daily output of suspended sediment from Terengganu River in wet and

normal seasons, and from Tembat River in the dry season. Figure 4 displays Terengganu River's estimated TSS and its suspended sediment load, which are of 1.58 and 43.24 tonnes/day respectively. The discharge value (Q), or water velocity, in the elevated downstream is higher than the upstream in the normal reading of the hydrological theory, and when a basin's water flow is higher than its lower flow, more energy is available to transport concentrated suspended sediment load, which leads to an increment in TSS production (Chow et al., 2020; Kamarudin et al., 2017). Nonetheless, the variations in stream flow level, suspended load and meteorological changes (humidity, evaporation and rainfall intensity) brought on by climate change, particularly in areas with active anthropogenic activities, has led to maximum values recorded during the dry season being higher than normal. The primary factor of decreasing surface erosion, which increases the amount of silt load produced in a river basin, is the density of water at the top of the forest canopy. The total suspended sediment load (TSS) in a basin rises in proportion to the water flow because larger flows have more energy to move concentrated suspended sediment loads relative to lower flow levels, as well as because they accelerate erosion. The water level flow and the rates of erosion were impacted by the frequency and severity of rainfall. Additionally, the population's rapid growth and urbanisation have increased the demand for water (Nafi'Shehab et al., 2021), which has led to higher levels on pollution of water in lakes.

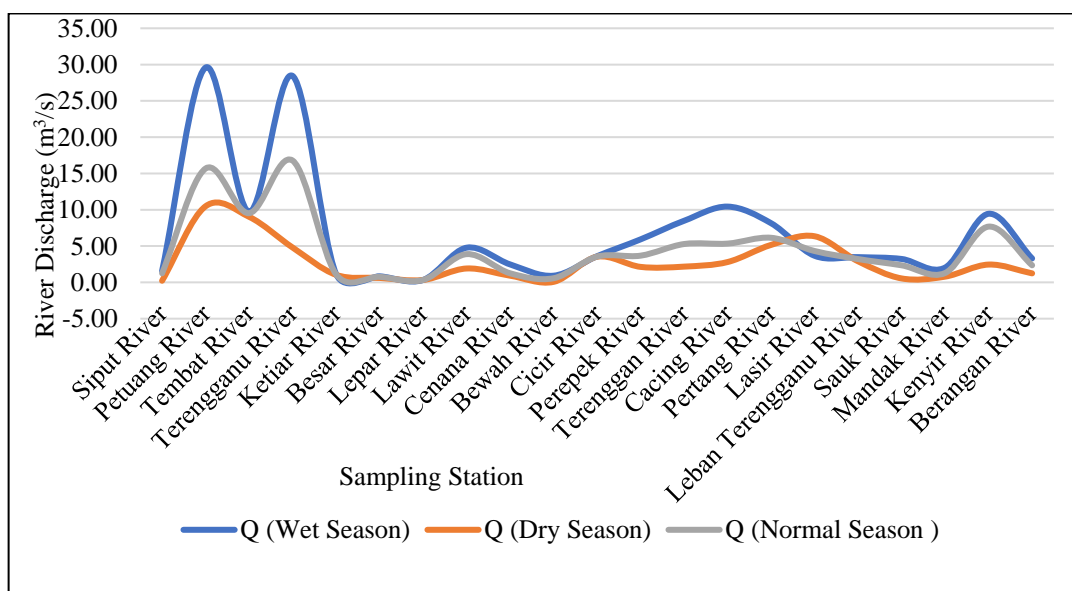


Figure 3: The 21 Sampling Stations (Feeder Rivers) in the Kenyir Lake Basin's Stream Flow

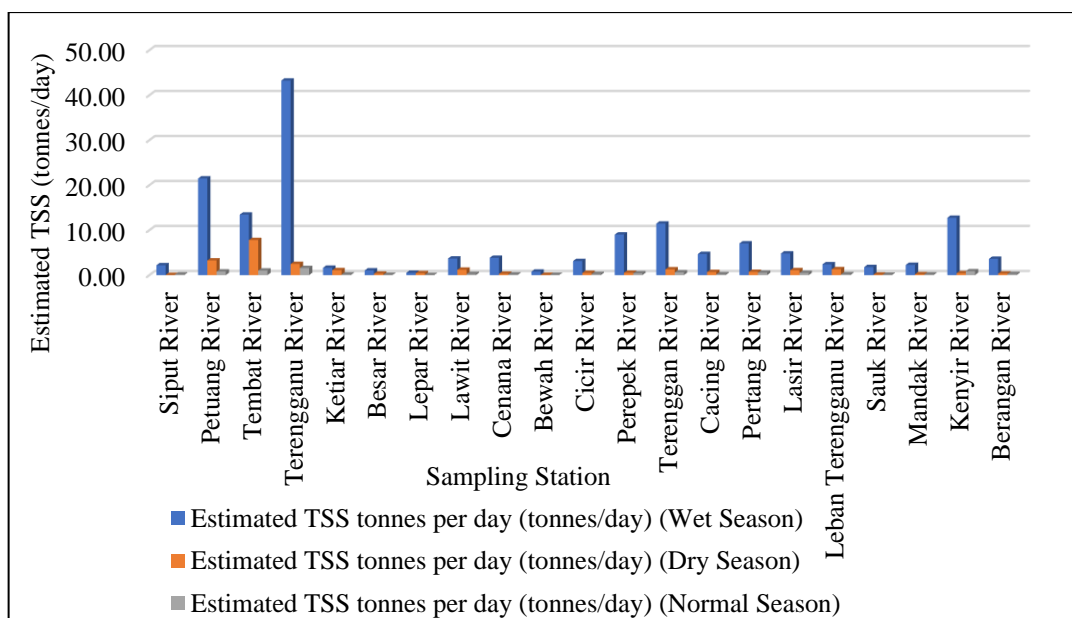


Figure 4: The Projected Suspended Load in Hulu Terengganu's Kenyir Lake Basin

Water Quality Status

The maximum BOD concentrations were 1.40 mg/L during the dry season and 1.32 mg/L during the normal season. As compared to other sample stations, Lepar River recorded the highest number during the wet season, at 0.51 mg/L. In comparison to the wet season, the trend distribution of BOD revealed larger concentrations during the dry season.

The increased warmth and increased metabolic activity of microorganisms resulted in a significant drop in water level, which in turn caused the concentration of BOD to rise throughout the dry season. Additionally, as described by Bati et al. (2022), the high volume of lake water during the rainy season would disperse organic materials, which would lead to a decrease in the BOD. The wet season (10 mg/L), dry season (5 mg/L) and normal season (6 mg/L) all had high COD values. As a result, other stations were designated as Class I, while Lasir River was placed in Class II for its COD level for the wet season. The parameter in all sample stations showed an improvement to reach the Class I's acceptable limit during the dry season and the regular season. The increased amount of wastewater from anthropogenic activities and household sewage entering the river was the cause of the high COD value seen downstream (Sutadian et al., 2017). The value of COD increases as the organic materials' quantity increases in the water. The wet season's DO concentration ranged from 58.17% to 89.10%, the dry season's from 75.17% to 88.84%, and the normal

season's from 69.90% to 88.30%. These findings show that photosynthetic activity, organic matter breakdown rate and seasonal variations (climate changes) are the primary drivers for the DO level in water. Moreover, the lowering of the DO level may cause significant changes in the types of aquatic creatures present in the body of water, which would have an immediate impact on the quality of the river water. High TSS loads are resulted from rising river water velocity, flow and discharge levels. When the TSS production in a river basin reaches a critical level, it can accelerate sedimentation issues, which can have negative consequences to aquatic ecosystems and plant populations, owing to the changes in water quality and hydrology.

The TSS distribution in the Kenyir Lake Basin was found to be 18 mg/L in the Cenana River during the wet season and 1.20 mg/L in the Siput River during the dry season. TSS concentrations varied, but generally speaking, as one moved from upstream to downstream sites, the concentration of TSS would increase. Berangan River's concentration of 0.58 mg/L during the wet season, Besar River's, Ketiar River's, Lawit River's and Lepar River's of 0.1 mg/L during the dry season, and Kenyir River's of 0.42 mg/L during the normal season all had the highest mean for ammoniacal nitrogen (AN), indicating an increase in trend. Nevertheless, the upstream AN concentration was still below the Class I NWQS's allowable limit of 0.10 mg/l. The concentration of AN was somewhat lower near midstream (Kenyir Lake Dam), particularly during the dry season. This demonstrates that throughout both the dry season and the regular season in the Kenyir Lake Basin, the level of AN concentration stayed within Class I NWQS. The pH level upstream of the Kenyir Lake Basin fell into Class I NWQS (>7.0), with a small number of samples falling in Class II (6–7). Most of the pH readings were within Class I NWQS at the midpoint, however, it fell under the ranges of 6.04 to 8.1 in the wet season (Petuang River: 6.04; Besar River: 8.1), 7.6 to 8.6 in the dry season (Cacing River: 7.6; Leban Terengganu River: 8.6), and 7.2 to 8.4 in the normal season (Lasir River: 7.2; Lepar River: 8.4). Overall, the majority of the pH measurements were at the neutral range, indicating that the trash discharge had no effect on the pH of the water in any of the stream stations. The findings demonstrate that the distribution trends of turbidity (TUR) and total suspended solids (TSS), which are greater in the Kenyir Lake Basin's middle and downstream streams than in its upstream part, are the same. The TUR distribution is higher in the wet season than in the dry and normal seasons due to hydrological, geomorphological, and human variables around the Kenyir Lake Basin, as well as the climate change factor. The process of photosynthesis by aquatic plants may be negatively impacted by the rising suspended sediment load in river basins, which may cause increased turbidity, high alkali content, the release of offensive odours, water discoloration, shallow flow, and less sunlight penetration. The water samples that were taken over the three seasons showed trends in total

dissolve solids (TDS) concentrations that were within WHO's acceptable range. Stations upstream have lower TDS primarily because there is more freshwater available there, hence less salinity, since there is not much seawater intrusion. Sefie et al. (2018) affirms that upstream areas would have lesser waste discharges when compared to downstream locations, since human activity, which is a primary factor contributing to the high TDS concentrations, is more prevalent in the latter.

Table 1: The Water quality parameter range and mean values for each sampling station during the wet, dry, and normal seasons

Parameters	Wet Season	Dry Season	Normal Season
(BOD)	0.31-0.51	0.85-1.40	0.57-1.32
(COD) (mg/L)	2-10	1-5	2-6
(DO) (%)	58.17-97.10	75.17-98.30	69.90-96.54
(TSS)	5.20-18.0	1.20-15.0	4.10-14.5
(AN)	0.17-0.58	0.07-0.10	0.08-0.42
pH	6.04-8.1	7.6-8.6	7.2-8.4
(TUR)	6.65-19.87	2.25-15.22	5.12-15.55
(TDS)	7.69-21.9	2.89-16.15	6.66-16.56

Leave One-Out Method (LOOCV) was used in identifying the quality of water, which have a major impact on the variation in river discharge. Tables 2(a), 2(b), and 2(c) present the results for the analysis of the linear association between the water quality metrics and the discharge of river to the Kenyir Lake Basin on the rainy, normal and dry seasons. 60.12%, 67.94% and 63.95% were the biggest percentage contributions (%) in wet, dry and normal seasons respectively for the DO parameter in this linear relationship based on the examination of significant factors. Furthermore, throughout the three seasons, the TSS parameter had the second-highest percentage contribution (%) values, which were 17.85% for the dry season, 30.32% for the normal season, and 34.46% for the wet season. The amount of rainfall and water velocity during the wet season caused the maximum concentration of DO in the river water flow. Typically, larger rates of water volume and velocity would cause erosion to occur more quickly (Wahab et al., 2023; Nalado et al., 2017). The velocity of the water flow has a significant effect on the DO concentration reading. The river's flow and speed determine the amount of oxygen in the water, causing the DO concentration value to increase along with the discharge value. Additionally, according to the hydrological theory, stagnant water might also be resulted from reduced water velocity. This explains why the percentage contribution of DO concentration increased slightly to 67.94% during the dry season. The TSS value during the dry season was also at the lowest point compared to those in rainy and normal seasons, while the TSS's percentage contribution (%) was the highest. This was

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 Integrated Lake Basin Management (ILBM) Of Hydrological Assessment Characteristics in Kenyir Lake Basin, Terengganu, Malaysia

caused by the trees' increased complexity in absorbing both organic and inorganic components as water flowed slowly.

Table 2(a): Factors of importance in a linear relationship to forecast River Discharge (Q) characteristics during the rainy season in the Kenyir Lake Basin

R-Square Reference = 0.9760			
Leave Variable	R-Square Leave Variable	R-Square Difference	Percent Contribution (%)
(BOD)	0.9722	0.0038	0.84
(TDS)	0.9711	0.0049	1.08
(NH3-N)	0.9744	0.0016	0.35
(DO)	0.704	0.272	60.12
(TSS)	0.8201	0.1559	34.46
Turbidity	0.9646	0.0114	2.52
(COD)	0.9747	0.0013	0.29
pH	0.9745	0.0015	0.33
Total	7.3556	0.4524	100

Table 2(b): Factors of importance in a linear relationship to predict River Discharge (Q) Characteristics for Dry Season at Kenyir Lake Basin

R-Square Reference =0.9849			
Leave Variable	R-Square Leave Variable	R-Square Difference	Percent Contribution (%)
(BOD)	0.9848	1E-04	0.02
(TDS)	0.9667	0.0182	4.25
(NH3-N)	0.9706	0.0143	3.34
(DO)	0.6937	0.2912	67.94
(TSS)	0.9084	0.0765	17.85
Turbidity	0.9568	0.0281	6.56
(COD)	0.9848	1E-04	0.02
pH	0.9848	1E-04	0.02
Total	7.4506	0.4286	100

Table 2(c): Factor of importance in a linear relationship to predict River Discharge (Q) characteristics for normal season at Kenyir Lake Basin

R-Square Reference = 0.9475			
Leave Variable	R-Square Leave Variable	R-Square Difference	Percent Contribution (%)
(BOD)	0.9458	0.0017	0.21
(TDS)	0.9397	0.0078	0.98
(NH3-N)	0.9445	0.003	0.38
(DO)	0.445	0.5025	63.45
(TSS)	0.7074	0.2401	30.32
Turbidity	0.9148	0.0327	4.13
(COD)	0.9475	0	0.00
pH	0.9433	0.0042	0.53
Total	6.788	0.792	100

The Hydrological Analysis-Based Strategic Management

Certain areas are significantly affected by the factors of land use and climate, while some other areas are far more vulnerable to environmental change. Furthermore, the unintentional or intentional introduction of non-native invasive species might also have a detrimental effect on the native species communities in the study regions. Natural occurrences might as well cause abrupt changes to the areas. Additionally, anthropogenic factors from human endeavours like intense farming, deforestation, urbanisation and tourism also contribute in driving specialised habitats to shift, contract and splinter, possibly to the point where they can no longer support themselves. Chow et al. (2020) expresses the researchers' collective primary goal accurately, which is to address and promote sustainable development in order to preserve, protect and improve biodiversity. Preserving the current fragile natural environment is crucial to maintain the interactions between humans and the environment. The consequences from gradual degradation problems and the possible extended response time of lakes to management interventions necessitate the long-term commitment from pertinent lake basin management organisations. The possibility of long-term effects also points to the necessity of taking precautions when planning and executing lake management initiatives. In order to preserve these unique settings and make well-informed policy decisions on land use and the extraction of natural resources, collaborative study to determine the resilience of these environments is essential (Chidammodzi & Muhandiki, 2016; Pokharel & Nakamura, 2010).

CONCLUSION

Lakes' place in the global hydrologic cycle and system depends on the balance between the amount of water they receive from the sources and the amount they lose. Limitation on the amount of water used, all throughout the normal, dry, and wet seasons, is important in order to improve water quantity and quality. The local community has taken up a number of initiatives to preserve and restore Kenyir Lake, including planting new trees, working with certain organisations to reforest the areas around the lake, reporting any pollution or encroachment to the authorities, requesting assistance from the concerned parties in cleaning the lake, instructing locals and visitors on keeping the areas clean and free from pollution, and carrying out waste management tasks like recycling and carrying the waste out. When the locals engage in these activities, their awareness and comprehension will grow, and their capability to manage the resources sustainably will be strengthened. Therefore, there is a great need to increase the locals' participation in the conservation and rehabilitation of the Kenyir Lake Basin areas, as well as to increase their awareness on these issues.

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REGRESSION ANALYSIS ON THE RELATIONSHIP OF LOCAL COMMUNITY ATTITUDE AND INTENTION TOWARDS MANGROVE CONSERVATION

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Abstract

Mangrove forests are among the most productive environments. It also provides another valuable service as part of the Blue Carbon Initiative. It focuses on carbon in coastal ecosystems as a possible solution to global climate change. Nonetheless, mangrove degradation remains a significant environmental issue. Estimated 147,771 km of mangroves in 2020, around half the total loss of mangrove area between 2000 and 2020 (6,769 km). The local community is integral to conservation efforts, as evidenced by all legislation and regulations to reduce mangrove damage. The attitude and desire toward mangrove protection are critical for long-term management and preservation. This study examines the relationship between local community attitudes and mangrove conservation intentions. Questionnaires were distributed to the 217 respondents living near mangrove forests in Kuala Selangor. Descriptive, Pearson correlations and regression analyses were used to show how attitude affects local community intention to conserve mangroves. This study found that local community attitudes positively and significantly affected the intentions to conserve mangroves ($r=0.764$, $p<0.01$). A positive attitude will result in a positive intention for conservation. Significantly, this study can serve as a guideline for fostering a good attitude and awareness of mangrove conservation within the local community. Minimal contact with the local community resulted in limited participation in mangrove conservation initiatives. In summary, strong local support for sustainable mangrove forest management can be fostered when a positive relationship exists between attitudes and intentions toward mangrove conservation.

Keywords: Community-Based Management, Mangrove Conservation, Environmental Psychology, Attitude, Intention

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INTRODUCTION

Mangroves are a vital part of the blue carbon ecosystem, offering significant potential to combat climate change. Research by Taillardat, Friess, and Lupascu (2018) and Alongi (2020) confirms that mangroves are the most effective ecosystems for carbon sequestration, especially in countries with extensive coastlines. With the highest carbon densities in both above-ground and below-ground biomass, mangrove forests are essential for conservation, restoration, and sustainable management to enhance carbon storage and mitigate climate change (Kauffman et al., 2020; Hagger et al., 2022; Richards et al., 2020).

Protecting mangrove biodiversity strengthens their role as carbon sinks, provides natural defenses against storms and monsoons, prevents soil erosion, and serves as a barrier against rising sea levels (Rahman et al., 2021; Sandilyan, 2012). Mangroves also deliver flood protection benefits, regulating water flow and protecting an estimated 15 million people worldwide each year (Menéndez et al., 2020). Beyond environmental benefits, they support local economies by providing forestry and fishing resources, contributing to sustainable livelihoods.

The importance of mangrove ecosystems is often undervalued, and public awareness remains low, posing a significant risk to their survival. According to the New State of the World's Mangroves Report 2024, Southeast Asia hosts one-third of the world's mangroves and the most diverse mangrove forests globally, covering approximately 50,000 km² and containing over 50 species. However, this region also suffers from some of the most severe rates of mangrove degradation (Spalding & Leal, 2021; Bhowmik et al., 2022). Studies on deforestation in Southeast Asia reveal that aquaculture followed by natural retraction and oil palm, are the primary threats to mangrove conservation (Spalding, M.D., & Leal, M., 2024) (**Figure 1**).

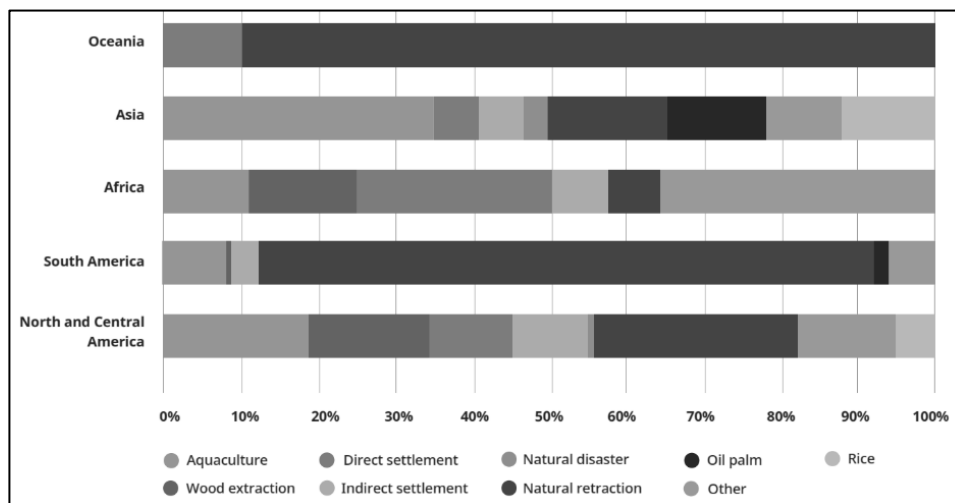


Figure 1: Composition of Drives of Mangrove Loss, by Region, 2000-2020

Source: Food and Agriculture Organization of the United Nation (FAO), 2023

Significant efforts and commitments have been made to ensure the effective management of mangrove ecosystems through policies and conservation programs, with mangrove forests being a national conservation priority in several countries, including Malaysia. The Malaysian government, for example, has committed to conserving mangroves as part of its national climate action and biodiversity strategies through the National Mangrove Replanting Program. Additionally, new community conservation strategies have developed over the past two decades. A community-based mangrove management approach has been introduced to strengthen local capacity for mangrove management (Gevana et al., 2018).

The local community plays an essential role in conservation efforts, making it important to assess the effectiveness of community-based conservation. Initiatives such as community education and tree-planting programs are being implemented to restore damaged mangrove areas (Tavita & Amir, 2023). Understanding community attitudes can make management efforts more effective and may further improve these attitudes (Allendorf et al., 2006; Sarker & Roskaft, 2011). According to Schultz et al. (2004), environmental attitude is the "collection of beliefs" that shapes a person's behavioural intentions toward environmentally related actions or situations.

This paper aims to explore the relationship between local community attitudes and intentions toward mangrove conservation. It seeks to raise awareness, foster connections between stakeholders and the local community for effective information sharing and create additional impacts on mangrove

conservation management. The insights gained from this study will help shape initiatives and interventions for conserving mangroves.

LITERATURE REVIEW

Theoretical Framework

Community-Based Conservation (CBC) is a widely adopted approach for mangrove protection. Many Southeast Asian countries, such as Malaysia, the Philippines, and Indonesia, have applied this model under various terms, including Community-Based Mangrove Management (CBMM), Community-Based Mangrove Rehabilitation (CBMR) (Datta et al., 2012), and Community-Based Natural Resources Management (CBNRM) (On-Prom, 2014). CBC operates on three fundamental theoretical frameworks: ecological, institutional, and psychological (Baral & Stern, 2011). Understanding and evaluating local community behaviour forms a critical part of the psychological dimension within CBC.

Conservation psychology plays an essential role in examining attitudes and how they shape conservation policies and practices (A. Fernandez-Llamazares, 2020). Social psychology, the scientific study of human behaviour, provides valuable insights here. The most frequently applied model for behavioural studies is the Theory of Planned Behaviour (TPB), which evolved from the Theory of Reasoned Action (TRA), developed by Martin Fishbein and Icek Ajzen in 1980 to predict human intention, leading to specific actions in particular contexts (Fishbein & Ajzen, 1975; Ajzen & Madden, 1986; Ajzen, 1991). The Theory of Reasoned Action evaluates attitudes and subjective norms related to intention and how these are linked to actual behaviour (Ajzen, 1980) (Figure 2). This framework supports a hypothesis suggesting that positive attitudes significantly influence conservation behaviour in mangrove ecosystems.

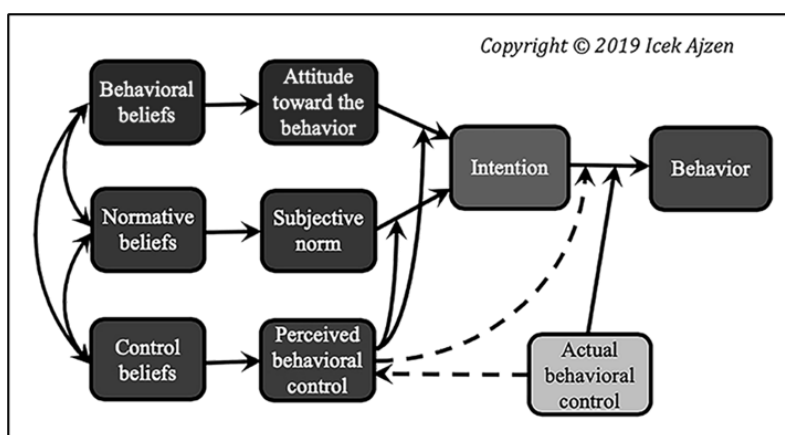


Figure 2: Theory of Planned Behaviour Diagram

Attitude towards Mangrove Conservation

In conservation psychology research, attitudes are commonly used as psychological indicators of program effectiveness. However, a key limitation of this approach is that attitudes do not always translate into behaviour, which may lead to an inaccurate assessment of a program's impact. Given that understanding and influencing human behaviour is crucial to achieving conservation goals, we propose that behaviour, rather than opinions, should be the basis for predicting conservation outcomes. Psychological theory distinguishes between behaviours and attitudes while acknowledging their interconnection. Strong attitudes, especially those formed through direct experience and closely related to specific behaviours, are more likely to exhibit a consistent link between attitude and action (Ajzen, 1991).

Measuring conservation behaviours involves defining the target behaviour(s), identifying the optimal timing for assessment, and selecting the most suitable measurement method—whether direct observation, objective indicators, self-reported behaviour, or behavioural intentions—by considering each approach's strengths and limitations (Nilsson et al., 2020). Research on the impact of human values on attitudes and behaviours toward forest conservation in Sub-Saharan Africa found that anthropocentric and relational value orientations were predominant. These value orientations shaped both positive and negative attitudes and behaviours toward forest conservation. Positive outcomes included utilitarian motivations and cultural beliefs, such as community support for conservation, adherence to forest norms, sustainable forest use, and active involvement in forest management. Notably, positive influences on behaviour appeared to outweigh negative ones (Ihemezie et al., 2021).

Behavioural Intention on Mangrove Conservation

A person's intention toward conservation is described as the determination and readiness to engage in pro-environmental behaviour, shaped by three factors: personal attitudes, perceived behavioural control, and social norms (Bamberg & Moser, 2007; Ajzen, 1991). In the Theory of Planned Behaviour, intention is a direct precursor to behaviour, with positive intentions generally leading to positive actions.

Awareness of environmental issues is closely linked to intent. Villagers are aware of the mangrove degradation problem in their region; however, there is a lack of consistent conservation programs that actively involve the local community. Programs that have taken place tend to be isolated events involving specific organizations, such as school initiatives or tree-planting activities organized by government bodies. Villagers have limited opportunities to participate, and there is insufficient funding or expertise to establish their own conservation and monitoring programs. Additionally, villagers must obtain

approval for any mangrove rehabilitation efforts, which influences their attitudes toward participating in conservation programs. Effective management of community-based conservation is essential to foster engagement and support among the local community.

RESEARCH METHODOLOGY

Description of Study Area

Urbanization has degraded forestland and disrupted ecological networks and biodiversity in Kuala Selangor (Ma, T.Z. et al., 2024). Urban expansion, conservation efforts, and community involvement all influence the state of mangroves in Kuala Selangor. Rapid urban growth has driven significant land use changes, including habitat fragmentation and a reduction in mangrove areas (Ma, T.Z. et al., 2024). Nonetheless, efforts are underway to restore and protect mangrove ecosystems, underscoring their ecological and economic importance (Tavita & Amir, 2023).

Community participation in conservation activities has been notably enthusiastic, reflecting a positive trend toward mangrove preservation. Despite these efforts, urban pressures and land use changes continue to impact Kuala Selangor's mangrove habitats, emphasizing the need for sustainable conservation policies.

The study's respondents were local community residing near mangrove forests, primarily from coastal fishing villages. The research area is located in Kuala Selangor, situated in the western part of Selangor, along the Selangor River estuary. This region has one of the densest mangrove forests in Kuala Selangor, including the well-known Kuala Selangor Nature Park, or Taman Alam Kuala Selangor. Located near the Selangor River's mouth, the park spans roughly 800 hectares, with 95 hectares dedicated to mangrove swamp forest, making it a popular eco-tourism site. It serves as an ideal location to learn about mangrove ecosystems and has hosted numerous mangrove rehabilitation programs. However, mangrove coverage has declined significantly in the area, from 24.29 percent in 1989 to 15.57 percent in 2008 and further down to 13.12 percent in 2021, as shown by Sayad Romli et al. (2021).

The research area includes Kg. Tg. Keramat and Kg. Sungai Yu, coastal villages near the mangrove forest, which heavily depend on mangroves for resources like food. Given the extensive mangrove swamp forest in this part of Peninsular Malaysia, the local community plays a crucial role in conservation efforts, particularly in Taman Alam, Kuala Selangor. **Figure 3** shows an image of mangrove degradation in Kuala Selangor, located near the study area.

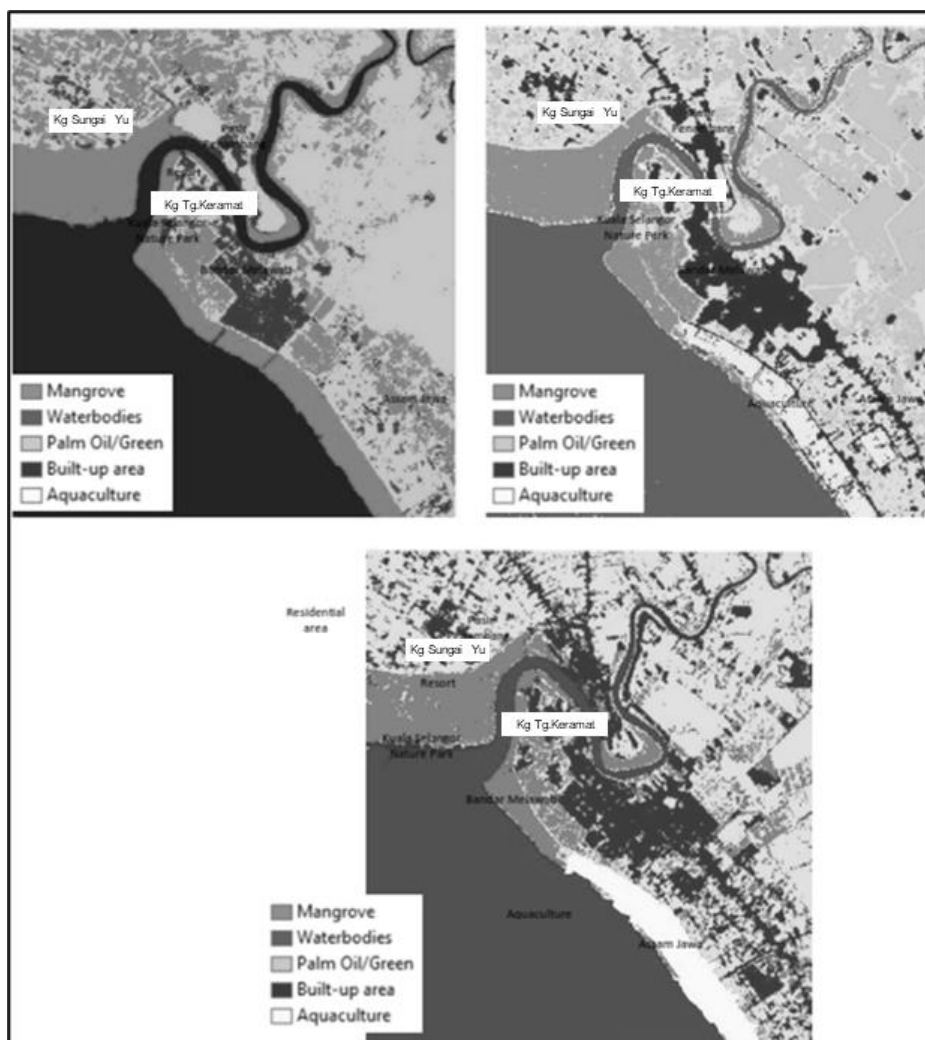


Figure 3: Image for Landsat 8 in 1989 (left), 2008 (right) and 2021 (below)
Source: Romli et al. (2021)

Data Collection and Analysis

This study examines local community intentions and attitudes toward mangrove forest conservation. Structured interviews were conducted with 217 respondents selected through simple random sampling, achieving a 90% confidence level and a 5% margin of error from a total population of 1,065. The questionnaire included both open-ended and closed-ended questions, with each item designed based on prior research and adapted to local conditions. Respondents selected the response category that best reflected their view on the closed-ended questions, which

utilized a Likert scale ranging from strongly disagree, disagree, neutral/no opinion, agree, to strongly agree. The Likert scale approach is commonly used to gauge sensitivity and assess attitude levels (Secor, 2010).

Pearson correlation and regression analysis was conducted to examine the relationship between attitude and intention toward mangrove conservation. A Pearson correlation analysis was conducted, where $r > 0.5$ indicates a relationship and $r > 0.7$ reflects a strong relationship between two continuous variables (Evans, 1996). A regression analysis was then performed to examine the relationship between attitude and intention toward mangrove conservation. To assess the strength and direction between these variables and to understand how changes in one variable affect the other. According to established guidelines, a P-value of $P < 0.01$ provides strong evidence of significance (Cohen, 1992). Assumptions of normality, linearity, homoscedasticity, and independence of residuals were verified, confirming that the residuals are normally distributed (Tabachnick & Fidell, 1996). Assumptions of normality, linearity, homoscedasticity, and independence of residuals were tested, showing that residuals are normally distributed (Tabachnick & Fidell, 1996). Descriptive statistics were used to analyse respondents' socio-economic and demographic characteristics within the study area.

Two hypotheses were developed for this study:

- H_0 : There is no relationship between Attitude and Intention ($\beta_1 = 0$).
- H_1 : There is a relationship between Attitude and Intention ($\beta_1 \neq 0$).

ANALYSIS AND DISCUSSION

Characteristics of Respondents

Table 1: Socio-demographic characteristics

Socio-Economic Variables	
Gender	
Female	35%
Male	65%
Age	
18-29	34.5%
30-39	19%
40-49	27.5%
50-59	15%
>50	4%
Length of stay	
<5 years	10.5%
5-9 years	0.5%

Socio-Economic Variables	
10-14 years	10%
15-20 years	13.5%
>21 years	65.5%
Education level	
No School	3%
Elementary	10.5%
Secondary	55.5%
College	22%
University	9%
The Main Occupation	
Government sector	9%
Private sector	23%
Self-employed	47%
Unemployed	21%

Table 1 summarizes the socio-economic characteristics of the sample. Most respondents are male, accounting for 65% of the total. The largest age group is 18-29, representing 34.5% of respondents, followed by the 40-49 age group at 27.5%. A majority, 65.5%, are over 21 years old and are part of the local population, while 10.5% have relocated from other areas and have lived in the community for less than five years.

Regarding education, a substantial portion of respondents (55.5%) have completed secondary school. Only a small percentage, 3%, have no formal education, while 22% hold a college degree, indicating an overall moderate to high education level among respondents.

The primary occupations of the respondents include self-employment roles, such as fishermen, farmers, and small business owners. Government sector employment is minimal, comprising just 9% of the sample.

Factor Analysis

Table 2: Descriptive statistics for the items of Intention

		Mean	SD
1	I am willing to participate in a mangrove conservation program.	3.27	1.120
2	I am willing to monitor mangrove rehabilitation projects.	3.23	1.071
3	I am committed to participating in mangrove conservation over the long term.	3.37	1.082
4	I am willing to discuss the mangrove conservation program with other community members.	3.56	1.017
5	I am willing to volunteer my time for mangrove conservation without pay.	3.18	1.147
6	I am willing to share my knowledge and skills in mangrove rehabilitation.	3.58	1.108
7	I am prepared to dedicate my time to the mangrove rehabilitation program.	3.42	1.065
8	I am willing to contribute manpower to ensure the program's future success.	3.45	1.142

Table 3: Descriptive statistics for the items of Attitude

		Mean	SD
1	Conserving mangroves means ensuring my activities are environmentally friendly and do not contribute to global warming.	3.68	1.061
2	Mangrove conservation involves dedicating my time to volunteer work.	3.33	1.031
3	I am interested in participating in any mangrove conservation program.	3.51	.996
4	I believe my time will be well-spent in any mangrove conservation program.	3.50	1.147
5	My involvement in a mangrove conservation program will help reduce the rate of mangrove degradation.	3.52	1.167
6	Participating in mangrove conservation programs will support the project's long-term success.	3.77	1.041
7	I believe I play an important role in mangrove conservation.	3.49	1.093
8	I agree that the role of mangrove forests is vital, and conservation efforts should be taken seriously.	4.19	.962

Table 4: KMO and Bartlett's Test

Variables	KMO	Bartlett's
Attitude	0.839	0.000
Intention	0.927	0.000

This study employed the KMO and Bartlett's Test to assess sampling adequacy. Kaiser (1974) recommended a minimum acceptable KMO value of 0.5 and a significance level below 0.05. As shown in **Table 4**, the KMO values for both variables, Attitude and Intention, exceed 0.5, with a p-value of 0.000. This indicates that the relationships among the variables are strong enough to proceed with reliable factor identification.

Attitude Towards Mangrove Forest Conservation Intention

Table 5. Pearson Correlations

Intention	Pearson Correlation	1	.764
	Sig. (2-tailed)		.000
	N	217	217
Attitude	Pearson Correlation	.764	1
	Sig. (2-tailed)	.000	
	N	217	217

** Correlation is significant at the 0.01 level (2-tailed)

Table 6. Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		β	Std. Error	Beta	t	
1	Constant	.065	0.195		0.333	.739
	Attitude	.916	0.053	.764	17.377	.000

Dependent Variable: Intention

Pearson correlation and regression analyses were conducted to examine the relationship between attitude and intention toward conservation. As shown in **Table 5**, there is a statistically significant positive correlation ($r=0.764$, $p = 0.01$), indicating that more positive attitudes are closely associated with higher intentions. In **Table 6**, a linear regression was calculated to predict intention based on respondents' attitudes. Respondents predicted intention is equal to $0.065 + 0.916$ (attitude). This result shows that respondents' intention increases by 0.916 for each unit increase in attitude, confirming that attitude significantly predicts intention toward mangrove conservation.

According to these results, attitude is significantly associated with intention toward mangrove conservation, with a p-value of 0.000. The analysis also found that attitude is a key factor influencing conservation intentions, with a standardized coefficient of $\beta=0.764$, indicating a strong predictive relationship ($\beta>0.6$). The positive and substantial impact of attitude on intention is statistically significant ($p = 0.000$), reinforcing the idea that improvements in attitude would likely enhance conservation intentions.

CONCLUSION

The study rejects the null hypothesis, revealing that positive attitudes among local people lead to positive intentions toward mangrove conservation. Local communities show strong concern for preserving their natural habitat, with attitudes shaped by their close connection to and dependence on it. They recognize the indirect benefits, such as coastal protection as a natural barrier against storms, hurricanes, and tidal surges, as well as the safeguarding of marine species and enhanced fishery productivity. To ensure effective conservation, local communities must be empowered. Enforcement efforts should be strengthened through community involvement, with support provided to village leaders in managing local resources. Empowered communities are more likely to adopt sustainable development practices and should be incentivized to protect their natural resources for future generations. This approach fosters a positive attitude, a crucial factor influencing mangrove conservation behaviour. These findings have implications for conservation program design and implementation, underscoring the importance of building conservation awareness within the community.

DISCLOSURE STATEMENT

The article represents original work, that has not been published or under consideration for publication elsewhere. There are no financial conflicts of interest to disclose.

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ESTIMATION OF CARBON STORAGE AND SEQUESTRATION OF IPOH URBAN TREES FOR VOLUNTARY CARBON MARKET

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Abstract

Ipoh has strategies to sequester carbon by establishing a tree-planting program and increasing carbon storage in urban trees. The tree-planting program provides many environmental and social benefits. Hence, this research aims to quantify the mitigation of CO₂ in the atmosphere by trees in the selected area which is Taman DR Seenivasagam for a pilot case study. The research objectives are to measure the carbon storage and sequestration of urban trees and to value the carbon credit for nature conservation. For the tree plant identification, carbon storage and sequestration were analysed using physical observation and a systematic literature review. A total of 220 trees were analysed and the total net carbon sequestration is estimated at 10,468.22 kg C/year, and the price for voluntary carbon credit in nature-based offset is estimated at USD 9.74 per year. This finding is an eye-opener to the community and policymakers: it signifies that every tree has a market value.

Keywords: Carbon Storage and Carbon Sequestration, Urban Tree, Carbon Credit, Nature Conservation Project, Voluntary Carbon Market

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INTRODUCTION

Carbon dioxide in the atmosphere is increasing yearly, especially in urban areas where primary industries and businesses are settled. Vegetation plays a vital role as it functions to 'absorb' carbon dioxide through photosynthesis and plays a part in the ecosystem's biodiversity. Vegetation has different functions, characters, and abilities for storing or sequestering carbon.

Carbon Storage, Carbon Sequestration, and Carbon Credit

According to Neufeld (2022), in the earth's ecosystem, carbons are stored in three ways: in the soil, atmosphere, plant and animal life. Among these, the soil component stored the highest carbon, followed by the atmosphere then the plant and animal life. One of the strategies to mitigate the carbon in the atmosphere is to store as much carbon in the plant life through tree planting programs and nature conservation. Carbon storage in plant life is the total amount of carbon in plant tissue or part of trees, such as in leaves, stems, fruits, and roots.

Carbon sequestration is the process of removing carbon from the atmosphere and storing it in another form that cannot immediately be released, like hardwood trees. It is the rate of uptake of carbon from the atmosphere. Half of the dry weight of trees contains carbon that was removed from the atmosphere. When a tree releases its stored carbon, whether by decomposing or tree burning, it produces CO₂. Converting the carbon in a tree to the equivalent amount of CO₂ makes it easier to compare with greenhouse gas mitigation strategies (Kosiba, 2021). Therefore, tree carbon is usually expressed as carbon dioxide equivalent (CO₂e).

According to Hassan Shah (2023), carbon credit is a certificate or permit that allows the owner to emit a certain amount of CO₂ or other GHG over a limited time. Carbon credits are represented in the unit of a tonne of CO₂ emission. Any company can purchase these credits to offset their carbon emissions, such as heavy factories that produce many carbon emissions. These credits represent emission reduction from projects that help to mitigate greenhouse gas emissions. In order to ensure the credits purchased are significant, they must genuinely result in a reduction in GHG emissions, and the exact credit cannot be used to offset emissions from more than one company. An example of purchase and sale is a fossil fuel producer, and car manufacturing industries that will purchase from companies that can provide quality carbon. In Malaysia, Shell (2023) is also involved in buying carbon credits in Voluntary Carbon Markets (VCM), which offers a platform for investors in carbon credits.

There are three types of carbon credit projects namely nature conservation, reforestation and carbon capture using technology (The Straits Times, 2022). Firstly, the nature conservation of carbon credit projects can be created by conserving existing forests. Secondly, reforestation of carbon credits is created based on the carbon captured by new trees planted like in the tree

planting program. Thirdly, in carbon capture using technology, carbon dioxide is removed from the atmosphere and injected deep underground for storage, like Climeworks company, which established a carbon capture plant in Iceland (The Straits Times, 2022). According to Live Carbon Prices (2023), the first and second categories fall under nature-based carbon credit projects in the voluntary markets. Taman DR Seenivasagam in Ipoh City was selected for a case study for carbon storage and sequestration for voluntary carbon credit projects for nature conservation.

Ipoh towards Low Carbon Cities by 2030

The Low Carbon Cities also support two central Sustainable Development Goals: SDG11 of Sustainable Cities and Communities and SDG13 Climate Action. The government sets up many initiatives and strategies to mitigate carbon in the atmosphere to achieve low-carbon cities. One of the seven (7) key challenges that have been highlighted in the National Low Carbon Cities Masterplan (NLCCM) (2021 is that the data for greenhouse gas (GHG) inventory are weak in availability and access as well as accuracy, lack proper data, and have inconsistent methodology.

Malaysian Green Technology and Climate Change Corporation (MGTC) (2023) states that initiatives in developing low-carbon cities have five elements: energy, water, waste, mobility, and greenery. Under Greenery elements, the shift towards protecting existing greenery (conservation) and planting more trees are highlighted. For example, according to Setiausaha Kerajaan Negeri (SUK) Perak (2023), Perak state has also planted more trees and committed to planting 2.5 million trees in 2023. In Malaysia, there is no published information on the extent of carbon storage and sequestration by urban trees for the VCM. It was undeniable that the value of carbon is relatively low due to the life span of trees and ecosystems (Neufeld, 2022) compared with the tropical rainforest in Sabah, as reported by Cannon (2023). Thus, this research supports the government's agenda.

To investigate the strategies for urban governance employed by the local government in relation to LCC, the study also applied the case study method as mentioned in Abdullah (2022). It explained the importance of carbon to be investigated by the Shah Alam local authorities through a case study. In Perak, there are many efforts to mitigate the carbon dioxide in the atmosphere as initiated by the local government. In Ipoh City, to select the greenery conservation place, the researcher interviewed the director of the Landscape Department in Ipoh Local Authorities to suggest a place that has many trees in the city centre and also close to community engagement. Based on the feedback, Taman DR Seenivasagam is an active park where the trees are on a conservation track. The park has a variety of plant species, from heritage trees to different palms, exotic and non-exotic shrubs, and aquatic plants. It also offers a strategic location where

the trees are accessible and under direct maintenance by local authorities and has an active community engagement, especially during weekends. Thus, Taman DR Seenivasagam was selected as the pilot case study for the Ipoh urban city under the management of Ipoh City Council and UiTM, which collect the data on carbon storage and sequestration of trees in designated parks in the urban areas. The research objectives are:

1. To measure the carbon storage and sequestration of urban trees in Taman DR Seenivasagam, and
2. To value the carbon credit for nature conservation.

MATERIALS AND METHOD

Two stages of data inventory are involved: physical observation and narrative literature review. The research was conducted in 2023.

Physical Observation for Tree Inventory

The Taman DR Seenivasagam has approximately 450 - 500 trees in approximately 195,477 m² or 48.3 acres. The inventory project has been divided into two phases, and for Phase 1, 220 trees with 39 tree species were collected in 2023. It was estimated that the tree inventory project would be completed in 2024.

Collaboration was made with the National Landscape Department and Ipoh City Council, to generate the tree inventory by a certified arborist who identifies and measure trees on the site. Several lists of data observed on the site was the name of tree species, tree count, and tree girth of diameter at breast height (DBH). The DBH are measured approximately 1.3 m from the ground level by using DBH tape. Based on the DBH tree measurements, the trees are categorised into four categories, namely girth 1 to 4 (Table 1). This category was referred to the National Parks Board (NPB) of Singapore for carbon storage and sequestration secondary data. The categorisation refers to the data value on carbon storage and sequestration to simplify the calculation in obtaining the estimation of carbon storage and sequestration, as stated in Tan (2009).

Table 1: Tree girth categories in Taman DR Seenivasagam.

No	Tree Girth Classification by the NPB	Girth
1	Girth at diameter of breast height (DBH) <50cm	Girth 1
2	Girth at a diameter of breast height (DBH) between 50cm - 100cm	Girth 2
3	Girth at a diameter of breast height (DBH) between 100cm -150cm	Girth 3
4	Girth at a diameter of breast height (DBH) more than 150cm	Girth 4

Source: Tan (2009).

Narrative Literature Review of Estimation Carbon Storage and Carbon Sequestration

According to George (2019), a narrative literature review is a general approach to an interesting topic. As shown in Figure 2, there are four steps to conduct narrative review; step 1: conduct a search, step 2: identify keywords, step 3: review abstracts and articles, and step 4: document results (George, 2019). This study was conducted to supply secondary data on carbon storage and sequestration of urban trees collected at Taman DR Seenivasagam. From 220 number of trees, 150 data (68.2%) were referred to from the book by Tan (2009) and 70 data (31.8%) were based on tree data from various journals published in Thailand, India and Nigeria such as Prasadani (2018), Anil Ragula (2021), Potadar (2016), Potadar (2017), Pinyarat (2021), and Olajide (2021),. Tan (2009) was referred to as a primary source of carbon storage and sequestration as they were recorded in Singapore, and the tropical data are more likely significant with Malaysia.

From these two stages of data inventory, the researcher measured the first objective of the carbon storage and sequestration of urban trees in Taman DR Seenivasagam by using the formula as stated in Figure 3 (Tan,2009) Figure 3. To obtain total carbon storage, the total of trees on the site needs to be multiplied by the value of carbon storage obtained through a narrative literature review. The same method was applied to find the value with carbon sequestration. The findings can be referred to in Table 2 in the results and discussion section.

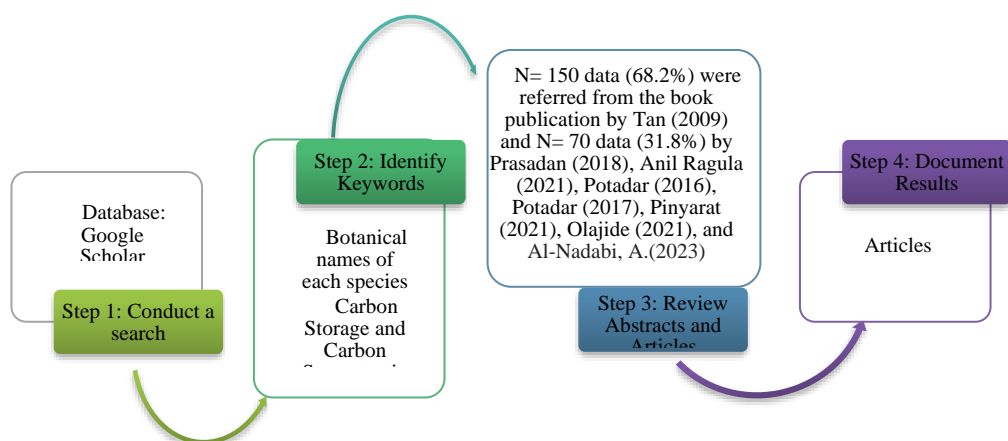


Figure 2: Secondary data on carbon storage and sequestration obtained from book and journal articles.

Source: Author

Total Carbon Storage (D) = Tree Count (A) x Per Tree Carbon Storage Rate (B)
Net Carbon Sequestration (E) = Tree Count (A) x Per Tree Carbon Sequestration Rate (C)

Figure 3: Formula in obtaining total carbon storage and net carbon sequestration.
Source: Tan (2009)

To answer the second objective of the value of the carbon credit for nature conservation, according to a recent update in Sabah forest regarding nature conservation, for the voluntary market, prices have ranged between USD1 and USD3 since early 2023, with nature-based credits currently going for \$1.10 on the voluntary carbon market on November 1, 2023, (Cannon,2023). Thus, this statement was used to obtain the estimation value of carbon credit on this project, as it is closely related to the context of this project.

RESULTS AND DISCUSSION

The tree was tagged using a GPS handheld unit and presented in Figure 4. In phase 1 data collection, based on the physical observation and SLR, the researcher analysed that carbon storage of 220 trees is accumulated with a minimum of 166,349.42 kg C of carbon storage, and the total net carbon sequestration in a year is a minimum of 10,468.22 kg C / year as shown in Table 2. The largest size of tree girth and the highest value of carbon storage and sequestration is from *Ficus sp.*, which makes a total of 90,214 kg C of carbon storage and 7,525 kg C / year or 54.2% to 71.9% of the total contribution, respectively. The DBH of *Albizia saman* is reported as the largest girth at 386cm at tree tagged DR031, followed by *Pithecellobium dulce* at 304.4cm at tree tagged DR080.

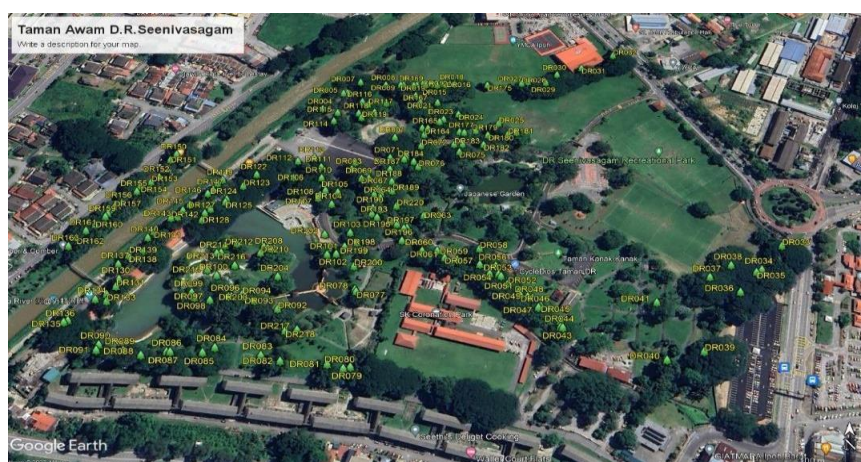


Figure 4: Inventory data collection of 220 tree tagging in Taman DR Seenivasagam
Source: Author

Table 2: Carbon storage and sequestration of 220 total tree count in Taman DR Seenivasagam.

No	Species	Tree tagging reference (DR)	Girth	Tree count (A)	Per Tree Carbon Storage Rate (kg C/tree) (B)	Per Tree Carbon Sequestration Rate (kg C year / tree) (C)	Total Carbon Storage (kg C) $D=A \times B$	Net Carbon Sequestration (kg C/year) $E=A \times C$
1	<i>Adenanthera pavonina</i>	2	G2	1	994.39	82.86	994.39	82.86
2	<i>Albizia saman</i>	122, 125, 126	G2	3	147	10	441	30
		1, 7, 39, 113, 124, 127, 128, 135, 150	G3	9	447	18	4023	162
		4, 5, 6, 29, 30, 31, 32, 33, 34, 36, 37, 38, 106, 123, 129, 136, 151	G4	17	1707	21	29019	357
3	<i>Andira inermis</i>	190, 194, 196, 213, 214, 215	G2	6	153	11	918	66
4	<i>Castanospermum australe</i>	77	G2	1	-	-	0	0
		78	G3	1	-	-	0	0
5	<i>Ceiba pentandra</i>	102, 200	G2	2	1137.66	94.8	2275.32	189.6
6	<i>Cinnamomum iners</i>	192, 193	G2	2	127	10	254	20
7	<i>Cyrtophyllum fragrans</i>	208	G1	1	24	4	24	4
		205, 206, 207, 209, 210	G2	5	102	9	510	45
8	<i>Delonix regia</i>	103, 181	G3	2	246	21	491.7	41
9	<i>Eucalyptus deglupta</i>	19, 21	G3	2	-	-	0	0
10	<i>Ficus benghalensis</i>	67	G4	1	2098	175	2098	175
11	<i>Ficus benjamina</i>	43, 44, 45, 47, 49, 50, 51, 54, 55, 57	G2	10	2098	175	20980	1750
		42, 48, 52, 53	G3	4	2098	175	8392	700
		46	G4	1	2098	175	2098	175
12	<i>Ficus callosa</i>	111, 112	G2	2	2098	175	4196	350

No	Species	Tree tagging reference (DR)	Girth	Tree count (A)	Per Tree Carbon Storage Rate (kg C/tree) (B)	Per Tree Carbon Sequestration Rate (kg C year / tree) (C)	Total Carbon Storage (kg C) D=A x B	Net Carbon Sequestration (kg C/year) E=A x C
		35, 61	G3	2	2098	175	4196	350
13	<i>Ficus elastica</i>	58	G4	1	2098	175	2098	175
14	<i>Ficus heteropleura</i>	110, 202	G2	2	2098	175	4196	350
		23	G3	1	2098	175	2098	175
15	<i>Ficus kurzii</i>	60, 72	G4	2	2098	175	4196	350
16	<i>Ficus microcarpa</i>	204	G3	1	2098	175	2098	175
		24, 76, 81, 116	G4	4	2098	175	8392	700
17	<i>Ficus religiosa</i>	68	G3	2	2098	175	4196	350
18	<i>Ficus rumphii</i>	131, 132	G2	2	2098	175	4196	350
		70, 71, 74, 75, 134	G3	4	2098	175	8392	700
		8, 25, 63, 114	G4	4	2098	175	8392	700
19	<i>Firmiana malayana</i>	185, 186, 201	G2	3	-	-	0	0
20	<i>Hura crepitans</i>	176, 177, 178, 182, 183	G2	5	750	62.5	3750	312.5
21	<i>Khaya senegalensis</i>	9-18, 28, 94-99, 137-149, 152-163, 168-175, 203	G2	49	143	10	7007	490
		16, 27, 92, 93, 97	G3	5	431	17	2155	85
22	<i>Lagerstroemia floribunda</i>	217	G2	1	124	9	124	9
23	<i>Lagerstroemia speciosa</i>	104	G2	1	124	9	124	9
		105	G3	1	373	16	373	16
24	<i>Mangifera cf pentandra</i>	187	G1	1	32	5	32	5
25	<i>Mangifera foetida</i>	100, 211, 212, 218	G2	4	150	10	600	40
26	<i>Mangifera indica</i>	199	G2	1	150	10	150	10
27	<i>Millettia pinnata</i>	73	G3	1	99	9	99	9
28	<i>Mimusops elengi</i>	64	G3	1	348	14	348	14

No	Species	Tree tagging reference (DR)	Girth	Tree count (A)	Per Tree Carbon Storage Rate (kg C/tree) (B)	Per Tree Carbon Sequestration Rate (kg C year / tree) (C)	Total Carbon Storage (kg C) D=A x B	Net Carbon Sequestration (kg C/year) E=A x C
29	<i>Morinda elliptica</i>	184	G2	1	-	-	0	0
30	<i>Nephelium lappaceum</i>	216	G2	1	-	-	0	0
31	<i>Peltophorum pterocarpum</i>	107, 108, 109, 133, 179, 180, 188, 197, 198	G2	9	139	10	1251	90
		90	G3	1	396	16	396	16
		26	G4	1	1135	30	1135	30
32	<i>Pithecellobium dulce</i>	79	G3	1	382.18	31.8	382.18	31.8
		80	G4	3	382.18	31.8	1146.54	95.4
33	<i>Polyalthia longifolia</i>	191, 195, 219, 220	G2	7	82.67	6.9	578.69	48.3
34	<i>Pterocarpus indicus</i>	101, 130, 167	G2	3	97	9	291	27
		20, 84, 85, 87, 89, 91	G3	6	390	17	2340	102
		22, 86, 88	G4	3	3233	38	9699	114
35	<i>Sterculia foetida</i>	3, 41, 69	G3	3	71	5.92	213	17.76
36	<i>Swietenia macrophylla</i>	40, 66, 189	G2	3	140	10	420	30
37	<i>Syzygium grande</i>	62	G2	1	144	10	144	10
		56	G3	1	389	16	389	16
38	<i>Tamarindus indica</i>	65	G2	1	153	10	153	10
		59	G3	1	392	17	392	17
39	<i>Tectona grandis</i>	115, 117, 118, 119, 120, 121	G2	6	582.1	48.5	3492.6	291
Total				220			166,349.42	10,468.22

Source: Author

There are limitations in identifying the figure of carbon storage and sequestration based on the SLR due to limited data resources. Five species are not able to be identified for their carbon storage and carbon sequestration. The researcher put a Zero (0) value which indicates the minimum estimation value for *Castanospermum australe*, *Eucalyptus deglupta*, *Firmiana malayana*, *Morinda elliptica*, and *Nephelium lappaceum*. Due to the limited data resources, the

researcher replicated the number of figure carbon storage and sequestration of *Ficus sp.* with 2,098 kg C / tree and 175 kg C year/tree to all girth categories in G1-G4, which put in the minimum estimation value. The highest frequency of species in the park is *Khaya senegalensis* with 54 tree counts, followed by *Albizia saman* at 29 and *Ficus benjamina* at 15.

The estimation value of carbon credit for nature conservation is based on the voluntary carbon market on November 14th, 2023, and was obtained in Live Carbon Prices (2023) at one metric ton of carbon dioxide valued at USD0.93. The price range, however, has been decreasing since the end of September 2023 (Figure 5). In Figure 6, the price was once as high as USD18.59 per metric ton on January 19th, 2022.



Figure 5: Voluntary Carbon Markets of Nature-Based Carbon Offset. 1 metric ton of carbon dioxide is valued at USD0.93 or MYR4.38.

Sources: Live Carbon Prices (2023) at November 14th, 2023



Figure 6: Voluntary Carbon Markets of Nature Based Carbon Offset trend from 2022 until 2023.

Sources: Live Carbon Prices (2023) at November 14th, 2023

In considering the Phase 1 data collection, the researcher put the minimum number of estimation values in carbon storage and carbon sequestration cited through SLR. Thus, the total net carbon sequestration of Taman DR Seenivasagam is 10,468.22 kg C/year, equal to 10.47 metric tons times USD0.93, equal to USD9.74 per year or RM45.90 in a year. Although the number is relatively low, the voluntary market of nature-based offset is among the highest compared with the aviation industry offset and technology-based offset in Figure 7, both at USD0.68.

CarbonCredits.com Live Carbon Prices	Last	Change	YTD
Compliance Markets			
European Union	€ 77.74	-0.44%	-2.83%
UK	£40.66	-9.04%	-44.49%
California	\$29.45	-	+1.31%
Australia (AUD)	\$31.00	-	-8.28%
New Zealand (NZD)	\$70.10	-	-8.27%
South Korea	\$7.49	-1.00%	-37.81%
China	\$9.87	+1.25%	+24.62%
Voluntary Markets			
Aviation Industry Offset	\$0.68	+21.43%	-82.29%
Nature Based Offset	\$0.93	+8.14%	-79.78%
Tech Based Offset	\$0.68	+33.33%	-40.35%

Figure 7: The comparison of carbon credit prices of voluntary markets.
 Sources: Live Carbon Prices (2023) on November 14th, 2023

CONCLUSIONS AND FUTURE WORKS

In conclusion, the research aims to mitigate carbon emissions in the atmosphere through a nature conservation project by using carbon credit of voluntary markets. It is shown that there are fluctuations in the markets throughout the year. The outcome of this research paper can be used as an eye-opener to any nature-based project in Malaysia to obtain money from the voluntary markets by keeping the project sustained. According to the New Straits Times (2022), there is a lack of supply of carbon credits in Malaysia, even though they are in high demand.

Another nature-based project in Malaysia that has been committed to this project is found in Sabah, which has signed a nature conservation agreement with Hoch Standard from a Singaporean firm to sell credits for carbon and other natural capital for 4.9 million per acre of forest for the next 100 years (Cannon, 2023). However, to start the project, the ownership of the project must be clear for legal contributions. Taman DR Seenivasagam is one of the examples of a pilot study which involves calculating the carbon credit nature conservation project. In town planning for Low Carbon Cities, the tree planting program in a designated area of clear land ownership is an example of planning the small steps in change to obtain credit from a nature conservation project. The size and location of the project also affect the methods used in calculating the estimation of carbon storage and sequestration.

This research uses secondary data to estimate the pilot project for a small-scale nature conservation project due to time constraints. To improve the data collection, the primary data on carbon sequestration should be retrieved from

the on-site measurement for significantly precise data collection. Depending on the land use classification, where the intensity of the tree is observed, and if the location is an urban site, the use of an instrument that can measure the photosynthesis rate for the carbon sequestration study is sufficient. However, if the location is in the forestry area and the accumulation of trees gathered can be obtained on average, the use of remote sensing technology and GIS can be conducted further.

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BEYOND COMFORT: UNMASKING THE SYNERGY BETWEEN HUMAN NEEDS AND ENVIRONMENTAL BEHAVIOUR

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Abstract

This research empirically investigated the relationship between environmental behaviour [EB] and meeting human needs based on Maslow's Hierarchy of Needs [HON] within the realm of Subjective Well-Being [SWB] and Human Interdependence [HI]. Research Questions: Does EB increase when human needs are conveniently satisfied? Can EB increase even if human needs are unmet, and if so, which human needs have little effect on EB? Purpose: This paper determines the variance of EB across the convenience and difficulty of meeting human needs. Approach: Mann-Whitney U test was conducted to determine the variance of EB across the convenience and difficulty of meeting 24 human needs. Findings: EB significantly increased with the convenience of meeting 13 human needs. Neither convenience nor difficulty of addressing the other 11 human needs affect EB, indicating their unlikeliness to have an impact on EB. Furthermore, EB can evolve independently of meeting human needs.

Keywords: environmental behaviour, human needs, subjective well-being, human interdependence with the environment

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INTRODUCTION

This paper examined the statistical interaction between meeting human needs and environmental behaviours. It significantly contributes to the ongoing research on Human Interdependence with the Environment [HIE] by expanding upon previously published papers. This effort broadens the continuing investigation in the field of positive psychology, specifically focusing on Human Interdependence [HI], Subjective Well-Being [SWB], and Maslow's Hierarchy of Needs [HON].

HUMAN INTERDEOENDENCE

A growing body of research has shown a fresh viewpoint on Human Interdependence [HI] as an essential aspect driving long-term Subjective Well-Being [SWB]. The latter describes an individual's subjective rating of happiness, well-being, and life satisfaction by emphasising the emotional, judgmental, and psychological dimensions. While SWB focuses on present well-being assessments, HI is future-oriented. It is based on the concept that changes in one's well-being are inextricably related to changes in the well-being of those around them as a result of their contributions. This suggests that the contributions one makes to others have a favourable effect on their SWB. Several authors strongly believe that HI plays an important role in promoting long-term well-being (Dirzyte & Valatka, 2023; Isham et al., 2022; Garcia et al., 2015; Kjell, 2011).

The features of HI comprise both internal feelings and perspectives towards the surroundings. These characteristics include belief systems, learning experiences, daily routines, involuntary acts, and deliberate behaviours that cause changes in the surrounding environment and, as a result, influence individuals' sustainable SWB. HI is defined in two contexts: Human Interdependence with Other Humans [HIH] and Human Interdependence with the Environment [HIE]. The two contexts can be stretched into four dimensions, as seen in Figure 1.

Within the context of a more comprehensive scientific research (Abu Bakar et al., 2020a; Abu Bakar et al., 2020b; Abu Bakar et al., 2018; Abu Bakar et al., 2017a; Abu Bakar et al., 2017b), Environmental Behaviour (EB) has been propounded as the third component of HIE. Conversely, it stands as the subject of this paper.

ENVIRONMENTAL BEHAVIOUR

Environmental Behaviour [EB] emphasises engagement with the surroundings, execution of sustainable roles and tasks, offering environmental skills, and practising environmental responsibilities. It comprises several traits, such as careful and conscious decision-making, smart consumerism, recycling, energy-saving initiatives, and waste handling (Abu Bakar et al., 2020a; Abu Bakar et al., 2020b).

HI DIMENSIONS	Human Interdependence with other Humans (HIH)	Human Interdependence with the Environment (HIE)
DIMENSION 1	Personal Empowerment (PE)	Eco-Personality & Lifestyle (PL)
Lifestyles, personality, inner-strength, willpower, wisdom, awareness, and life prospects.	Focus And Resilience, Sense of Control, Self-Determination, Goal Orientation and Self-Improvement	Ecological Mindset, Collectivistic Cultures, Modesty and Moderation in Material Pursuits, and Environmental Mindfulness.
DIMENSION 2	Positive Relationship (PR)	Interaction With Nature (IN)
Intimacy, closeness, familiarity, empathy, affection, voluntary and involuntary interactions.	Affection, Compassion, Forgiveness, Ability to Tolerate Others, Sense of Inclusion and Self-Regulation.	Closeness to Nature, Knowledge of and Empathy Towards Nature, And Health Associated Attributes in Relation to Surroundings.
DIMENSION 3	Organizational Opportunity (OO)	Environmental Behaviour (EB)
Engaging with the surrounding, executing roles or tasks, proving skills and responsibility.	Articulatory and Versatility, Initiatives of Positive Interactions and Cooperative Engagements towards Professional Growth.	Careful and Conscious Decision-Making, Smart Consumerism, Recycling, Energy-Saving Initiatives, and Waste Handling.
DIMENSION 4	Community Movement (CM)	External Condition (EC)
Attitude towards circumstances, interpersonal behaviours with the larger public, etc.	Proactivity, Public Participation, Friendliness, Openness, Respect for Diversity and Sense of Belonging.	Attitudes towards Surroundings Convenience and Encouragements to be Environmentally Responsible

Figure 1: Dimensions of HIH and HIE
Source: Abu Bakar et al., 2017

In general, EB refers to the environmentally conscious and conscientious activities and choices that are made on a daily basis in order to protect the environment. These behavioural acts comprise recycling, reusing waste handling, energy conservation, and responsible purchasing behaviour. EB is associated with a collectivistic culture that prioritises collective efforts in sustainable living. Individuals practising EB have an awareness of their own well-being in relation to the natural environment. EB also promotes the understanding that everyday activities have a significant impact on the ecosystem and other living beings, therefore fostering a sense of environmental responsibility. Embracing EB promotes HIE and fosters deep experiences by establishing a strong link between current actions and future outcomes. This not only enhances individuals' immediate satisfaction but also contributes to long-term and heightened SWB (Abu Bakar et al., 2018; Abu Bakar et al., 2017a; Abu Bakar et al., 2017b) (see Table 1).

Table 1: Definition, Factors, and Indicators of Environmental Behaviours

Definition	Factor	Code	Indicators
The positive and responsible behaviours throughout everyday decisions and actions in favour of the environment	Energy-Saving	EB1	turning off fans and lights when they are unutilised
		EB2	turning off taps when brushing teeth
		EB3	throwing rubbish according to designated recycle bins
	Waste Handling	EB4	separating rubbish at home (metals, paper, glass, etc.)
		EB5	reusing grocery bags/ jars/ bottles/ boxes/ cans, etc.
		EB6	using towels instead of tissues
	Smart Consumer	EB7	using water tumbler instead of purchasing water
		EB8	purchasing refillable detergents
		EB9	purchasing energy-savings appliance
		EB10	purchasing products that are organically produced

HUMAN NEEDS FULFILLMENT AND WELLBEING

The Hierarchy of Needs [HON] is a hierarchical framework consisting of five levels that delineate the stages of human motivation (Maslow, 1943). It consists of two sets: deficiency needs and growth needs. The four most critical deficiency needs are those related to physiological needs, safety needs, love and belonging needs, and esteem needs, respectively organised in order of urgency. The growth needs were first linked to self-actualisation. In the 1960s and 1970s, the five phases of HON were expanded to a total of eight stages. Maslow (1962) included cognitive needs and aesthetic needs as part of the growth needs set. Subsequently, Maslow (1970) incorporated transcendence needs as the eighth and ultimate level (see Figure 2).

Deficiency needs are the needs for subsistence that arise from scarcity. As time passes, the urge to fulfil deficiency needs often rises if they are unmet. Take hunger as an example; it gets worse when it persists for too long. Psychological fulfilment is at the heart of growth needs, which are provided by intellectual and creative pursuits. By attending to the lower levels of human needs, one can then reach the highest degree of HON, namely the transcendence needs. Although individuals usually ascend the hierarchy in a consistent manner, personal circumstances, such as marital disputes or professional losses, can trigger changes in HON. Individuals are unlikely to go through HON in an upward direction in reality; rather, they will bounce between the varied levels.

According to Maslow (1943), humans must first satisfy the lower-level needs before progressing to the higher level of the hierarchy. For instance, it is necessary to fulfil esteem needs before progressing to cognitive needs, and this principle applies to every level of HON. Later, Maslow (1987) expounded that fulfilling a need is not a definitive or binary process. He recognised that his earlier statements might have conveyed the inaccurate notion that a need must be fully satisfied before progressing to higher ones. Typically, most individuals have progressed towards meeting lower-level needs while the majority of them seem to have partially met these needs. Human needs are characterised by their dynamic and adaptable nature, allowing humans to address several needs simultaneously (Abu Bakar, 2022).

There are two conflicting viewpoints presented in the literature. Initially, it is important to fulfil the human needs to attain SWB. However, over-satisfying some needs might result in dissatisfaction. For example, unhappiness from monetary wealth shows the shallowness of certain needs. Furthermore, individuals who triumph over obstacles like unmet needs can forge a deeper bond to life meaningfulness. Intriguingly, partially fulfilled or unmet needs may increase life meaning. This research found 24 indicators of human needs throughout the eight stages of HON using literature reviews and surveys (see Figure 3).

	HON	UNDERSTANDING
DEFICIENCY NEEDS	1	Physiological Needs The body's need for balance and consistent levels in different bodily systems is called homeostasis. It is driven by survival instincts like seeking shelter, water, food, warmth, rest, and good health. Until this need is met, all other needs are secondary.
	2	Safety and Security Needs The need for safety and security in one's life and surroundings involve seeking protection from violence, health threats, sickness, and economic pressures in order to thrive in modern societies.
	3	Belonging and Love Needs The need for love and a sense of belonging is fulfilled through supportive and communicative friendships, family, and intimate relationships. Deprivation of these needs can lead to feelings of guilt, loneliness, depression, or low extraversion values.
	4	Esteem Needs The need for self-confidence and recognition is fulfilled through positive feelings of self-worth achieved via accomplishments, appreciation, and recognition. Without meeting this need, one may experience feelings of inferiority.
	5	Cognitive Needs The need for knowledge and understanding is fulfilled by yearning for learning, exploration, discovery, and creation to better understand the world. Failure to fulfil this need may result in confusion and identity crisis.
GROWTH NEEDS	6	Aesthetic Needs The need to appreciate and connect with nature's beauty which involves taking time to immerse oneself in natural surroundings, allowing the sights, sounds, and sensations of the environment to refresh and rejuvenate the mind and body.
	7	Self-Actualization The instinctual need to maximize one's abilities and strive to be the best leading to a feeling of generativity –the desire to vote, contribute, volunteer, nurture and guide others to the well-being and growth of future generations or to outlast oneself.
	8	Transcendence Needs The need to surpass self-centeredness, and assist others in self-fulfilment and unlocking potential, also known as spiritual needs – when fulfilled, results in a sense of integrity, elevating one's existence to a higher plane.

Figure 2: Understanding the Stages in the Hierarchy of Human Needs
 Source: Abu Bakar et al., 2022

STAGES OF HUMAN NEEDS	HON	#	HUMAN NEEDS INDICATORS	
Essential Requirements <i>In the absence of them, the living system of mankind is obstructed.</i>	Physiological Needs	HN01	Nutritional and Wholesome Food	
		HN02	Access to Medical Care	
		HN03	Clean Water (for Drinking and Washing)	
		HN04	Clean and Fresh Air	
		HN05	Functional and Well-Maintained Lavatory	
	Safety & Security Needs	HN06	Sufficient Electrical Supply	
		HN07	Affordable Housing and Conveniences	
		HN08	Financial Security and Stability	
		HN09	Personal Safety and Security	
		HN10	Health Insurance	
Supplementary Requisites <i>In the absence of them, the living system is not obstructed but lives would be challenging</i>	Belonging & Love Needs	HN11	Work-Life Balance	
		HN12	Social Acceptance and Cultural Inclusivity	
		HN13	Reliable Communication Network	
		HN14	Access to Internet with Reliable Connectivity	
Aspired Prospects <i>In the absence of them, the living system is not obstructed and lives would not be too challenging</i>	Esteem Needs	HN15	Primary Education Attainment	
		HN16	Secondary Education Attainment	
	GROWTH NEEDS	Cognitive Needs	HN17	Tertiary Education Attainment
			HN18	Employment Prospects and Opportunities
		Aesthetic Needs	HN19	Well-Kept Areas for Recreational Activities
			HN20	Rich Biodiversity of Flora and Fauna
		Self-Actualization	HN21	Rights to Participate in Leadership Selection
			HN22	Freedom of Expression
			HN23	Opportunities Free from Corruption
			HN24	Artistic and Cultural Freedom

Figure 3: Human Needs Indicators
 Source: Abu Bakar et al., 2022

TRANSCENDENCE AND ENVIRONMENTAL BEHAVIOUR

HON provides an objective look at the variables that influence SWB. Individuals could build their SWB by meeting their human needs and also experience human needs differently according to their circumstances. Pursuing HON and SWB is highly personal; there is no standard approach. While some individuals can find SWB via artistic attempts, others may acquire SWB via charitable contributions or relationships with others.

Additionally, Maslow (1970) posited that just over one percent of the worldwide population has reached transcendence, the highest level of HON. Those who experience transcendence often attain a deep sense of contentment and inner tranquillity by improving the well-being of others and dedicating themselves to the betterment of society.

To transcend their distinct identity and challenges, one must have the capacity and desire to establish a relationship with something larger than themselves (Koltko-rivera, 2015). Realising one's worth and contributing to a higher cause are essential components of this state of selflessness. Transcendence may have varied meanings to different individuals; for some, it is the desire to feel at one with the universe, with nature, or with a greater power.

EB pertains to the realisation of transcendence needs whereby it features a shift in focus, from the individual's self-interest towards a higher obligation to the natural environment. Individuals with greater EB commit to causes that are greater than themselves and strive towards a more sustainable and harmonious cooperation between humans and the environment (Abu Bakar et al., 2020a; Abu Bakar et al., 2020b). Those who adopt EB typically exhibit a better sense of purpose in their daily activities. The notion of transcendence, in which individuals pledge to go beyond their interests and desires to bring about positive change in the world, is in line with practising EB.

RESEARCH QUESTIONS

This study investigates the following questions: (1) Does fulfilling human needs improve EB? If so, which human needs? (2) Can EB thrive without human needs? If so, which human needs are not inherently influencing EB?

METHOD

A survey was administered to a sample of 4,315 Malaysian respondents, requiring them to assess their EB on an 11-point Likert scale. The Kolmogorov-Smirnova test results indicated that the data was not normally distributed. This warranted the Mann-Whitney U test to assess the mean difference of EB between convenience and difficulty in meeting 24 human needs.

FINDINGS

The following tables show (i) the mean distribution of EB items, (ii) the Mann-Whitney U test results, and (iii) the Mann-Whitney U test results interpretation.

Table 2: Mean Distribution of EB Items

Indicators	Code	\bar{x}	\bar{xEB}
I turn off fans and lights if I see them switched on.	EB1	8.54	7.84
I turn off taps whenever I brush my teeth.	EB2	8.24	
I throw rubbish according to designated recycling bins.	EB3	7.76	
I separate rubbish at home (metals, paper, glass, etc.).	EB4	7.32	
I reuse grocery bags/jars/bottles/boxes/cans, etc.	EB5	7.67	
I use towels instead of tissues.	EB6	7.69	
I use water tumbler instead of purchasing water.	EB7	7.94	
I purchase refillable detergents.	EB8	7.97	
I purchase energy-saving appliances.	EB9	7.76	
I purchase products that are organically produced.	EB10	7.55	

Note. Mean Distribution of EB Items (\bar{x}) and Overall Mean of EB (\bar{xEB})

Table 3: Mann-Whitney U Test Results

HON STAGES	HUMAN NEEDS	Difficult			Convenient			U	z	p
		N	\bar{xR}	\bar{x}	N	\bar{xR}	\bar{x}			
Physiological Needs	HN01	336	2163.81	8.0	3979	2157.51	8.0	666519.0	-.089	.929
	HN02	423	2084.66	7.9	3892	2165.97	8.0	792134.5	-1.275	.202
	HN03	392	2238.31	8.1	3923	2149.97	8.0	737425.5	-1.339	.181
	HN04	1330	1953.90	7.7	2985	2248.94	8.1	1713573.5	-7.185	.000
	HN05	805	2009.59	7.8	3517	2192.04	8.0	1293308.5	-3.748	.000
Safety & Security Needs	HN06	428	2116.51	7.9	3887	2162.57	8.0	814060.5	-.726	.468
	HN07	1114	2174.45	8.0	3201	2152.28	8.0	1764635.0	-.512	.609
	HN08	1861	2086.15	7.9	2454	2212.48	8.0	2149741.5	-3.300	.001
	HN09	1578	2010.98	7.8	2737	2242.77	8.1	1927488.0	-5.888	.000
	HN10	1325	1986.60	7.7	2990	2233.95	8.1	1753772.0	-6.018	.000
Belonging & Love Needs	HN11	1582	1987.20	7.7	2733	2256.87	8.1	1891602.0	-6.853	.000
	HN12	1310	2025.62	7.8	3005	2215.71	8.0	1794854.0	-4.610	.000
	HN13	328	2107.51	8.0	3987	2162.15	8.0	637308.0	-.764	.445
Esteem Needs	HN14	932	2206.34	8.1	3392	2144.85	7.9	1520794.0	-1.330	.184
	HN15	313	2225.16	8.1	4002	2152.75	8.0	605291.0	-.991	.322
Cognitive Needs	HN16	390	2160.43	8.0	3925	2157.76	8.0	764428.0	-.040	.968
	HN17	836	2088.09	7.8	3479	2174.80	8.0	1395781.0	-1.807	.071
Aesthetic Needs	HN18	1678	2104.78	7.9	2637	2191.86	8.0	2123144.0	-2.239	.025
	HN19	1430	1989.90	7.7	2885	2241.32	8.1	1822394.5	-6.242	.000
	HN20	1453	1985.57	7.7	2862	2245.54	8.1	1828700.0	-6.480	.000
Self-Actualisation	HN21	1823	2043.27	7.8	2492	2241.93	8.1	2062312.0	-5.175	.000
	HN22	1957	2071.89	7.8	2358	2229.47	8.1	2138780.5	-4.137	.000
	HN23	2247	2126.75	7.9	2068	2191.95	8.0	2253186.5	-1.718	.086
	HN24	1531	1960.71	7.7	2784	2266.49	8.2	1829107.5	-7.716	.000

Note. Mean Rank of $\bar{x}\Sigma$ EB across Difficult and Convenient; **Bold** shows higher mean rank.

The data in Table 3 indicated that EB was statistically higher in meeting all the highlighted human needs. The results showed that 13 out of the 24 test outcomes were statistically significant.

Table 4: Mann-Whitney U Test Results Interpretation

HON	HUMAN NEEDS	INTERPRETATION
Physiological Needs	Nutritional and Wholesome Food	Those who claimed difficult had greater mean rank (N = 336, $\bar{x}R = 2163.81$) than those who claimed convenient (N = 3979, $\bar{x}R = 2157.51$), but the difference was not statistically significant (U = 666519.0, p = .929).
	Access to Medical Care	Those who claimed convenient had greater mean rank (N = 3892, $\bar{x}R = 2165.97$) than those who claimed difficult (N = 423, $\bar{x}R = 2084.66$), but the difference was not statistically significant (U = 792134.5, p = .202).
	Clean Water (For Drinking and Washing)	Those who claimed difficult had greater mean rank (N = 392, $\bar{x}R = 2238.31$) than those who claimed convenient (N = 3923, $\bar{x}R = 2149.97$), but the difference was not statistically significant (U = 737425.5, p = .181).
	Clean and Fresh Air	Those who claimed convenient had greater mean rank (N = 2985, $\bar{x}R = 2248.94$) than those who claimed difficult (N = 1330, $\bar{x}R = 1953.90$). A statistically significant difference was found (U = 1713573.5, p = .000).
	Functional and Well-Maintained Lavatory	Those who claimed convenient had greater mean rank (N = 3517, $\bar{x}R = 2192.04$) than those who claimed difficult (N = 805, $\bar{x}R = 2009.59$). A statistically significant difference was found (U = 1293308.5, p = .000).
Safety and Security Needs	Sufficient Electrical Supply	Those who claimed convenient had greater mean rank (N = 3887, $\bar{x}R = 2162.57$) than those who claimed difficult (N = 428, $\bar{x}R = 2116.51$), but the difference was not statistically significant (U = 814060.5, p = .468).
	Affordable Housing and Conveniences	Those who claimed difficult had greater mean rank (N = 1114, $\bar{x}R = 2174.45$) than those who claimed convenient (N = 3201, $\bar{x}R = 2152.28$), but the difference was not statistically significant (U = 1764635.0, p = .609).
	Financial Security and Stability	Those who claimed convenient had greater mean rank (N = 2454, $\bar{x}R = 2212.48$) than those who claimed difficult (N = 1861, $\bar{x}R = 2086.15$). A statistically significant difference was found (U = 2149741.5, p = .001).
	Personal Safety and Security	Those who claimed convenient had greater mean rank (N = 2737, $\bar{x}R = 2242.77$) than those who claimed difficult (N = 1578, $\bar{x}R = 2010.98$). A statistically significant difference was found (U = 1927488.0, p = .000).
	Health Insurance	Those who claimed convenient had greater mean rank (N = 2990, $\bar{x}R = 2233.95$) than those who claimed difficult (N = 1325, $\bar{x}R = 1986.60$). A statistically significant difference was found (U = 1753772.0, p = .000).
Belonging and Love Needs	Work-Family Balance	Those who claimed convenient had greater mean rank (N = 2733, $\bar{x}R = 2256.87$) than those who claimed difficult (N = 1582, $\bar{x}R = 1987.20$). A statistically significant difference was found (U = 1891602.0, p = .000).
	Social Acceptance and Cultural Inclusivity	Those who claimed convenient had greater mean rank (N = 3005, $\bar{x}R = 2215.71$) than those who claimed difficult (N = 1310, $\bar{x}R = 2025.62$). A statistically significant difference was found (U = 1794854.0, p = .000).
	Reliable Communication Network	Those who claimed convenient had greater mean rank (N = 3987, $\bar{x}R = 2162.15$) than those who claimed difficult (N = 328, $\bar{x}R = 2107.51$), but the difference was not statistically significant (U = 637308.0, p = .445).
	Access to Internet with Reliable Connectivity	Those who claimed difficult had greater mean rank (N = 932, $\bar{x}R = 2206.34$) than those who claimed convenient (N = 3392, $\bar{x}R = 2144.85$), but the difference was not statistically significant (U = 1520794.0, p = .184).
Esteem Needs	Primary Education Attainment	Those who claimed difficult had greater mean rank (N = 313, $\bar{x}R = 2225.16$) than those who claimed convenient (N = 4002, $\bar{x}R = 2152.75$), but the difference was not statistically significant (U = 605291.0, p = .322).
	Secondary Education Attainment	Those who claimed difficult had greater mean rank (N = 390, $\bar{x}R = 2160.43$) than those who claimed convenient (N = 3925, $\bar{x}R = 2157.76$), but the difference was not statistically significant (U = 764428.0, p = .968).
Cognitive Needs	Tertiary Education Attainment	Those who claimed convenient had greater mean rank (N = 3479, $\bar{x}R = 2174.80$) than those who claimed difficult (N = 836, $\bar{x}R = 2088.09$), but the difference was not statistically significant (U = 1395781.0, p = .071).
	Employment Prospects and Opportunities	Those who claimed convenient had greater mean rank (N = 2637, $\bar{x}R = 2191.86$) than those who claimed difficult (N = 1678, $\bar{x}R = 2104.78$). A statistically significant difference was found (U = 2123144.0, p = .025).

Note. Result Interpretation of Mann Whitney U Test; Bold & Highlighted shows statistically significant output.

Table 4: Mann-Whitney U Test Results Interpretation (continued)

HON	HUMAN NEEDS	INTERPRETATION
Aesthetic Needs	Well-Kept Areas for Recreational Activities	Those who claimed convenient had greater mean rank (N = 2885, $\bar{x}R = 2241.32$) than those who claimed difficult (N = 1430, $\bar{x}R = 1989.90$). A statistically significant difference was found (U = 1822394.5, p = .000).
	Rich Biodiversity of Flora and Fauna	Those who claimed convenient had greater mean rank (N = 2862, $\bar{x}R = 2245.54$) than those who claimed difficult (N = 1453, $\bar{x}R = 1985.57$). A statistically significant difference was found (U = 1828700.0, p = .000).
Self-Actualisation Needs	Rights to Participate in Leadership Selection	Those who claimed convenient had greater mean rank (N = 2492, $\bar{x}R = 2241.93$) than those who claimed difficult (N = 1823, $\bar{x}R = 2043.27$). A statistically significant difference was found (U = 2062312.0, p = .000).
	Freedom of Expression	Those who claimed convenient had greater mean rank (N = 2358, $\bar{x}R = 2229.47$) than those who claimed difficult (N = 1957, $\bar{x}R = 2071.89$). A statistically significant difference was found (U = 2138780.5, p = .000).
	Opportunities Free from Corruption	Those who claimed convenient had greater mean rank (N = 2068, $\bar{x}R = 2191.95$) than those who claimed difficult (N = 2247, $\bar{x}R = 2126.75$), but the difference was not statistically significant (U = 2253186.5, p = .086).
	Artistic and Cultural Freedom	Those who claimed convenient had greater mean rank (N = 2784, $\bar{x}R = 2266.49$) than those who claimed difficult (N = 1531, $\bar{x}R = 1960.71$). A statistically significant difference was found (U = 1829107.5, p = .000).

Note. Result Interpretation of Mann Whitney U Test; Bold & Highlighted shows statistically significant output.

Table 5: Summary of Findings

Statistically Significant Difference Established (p < .000)		Difference Did Not Reach Significance
Condition 1:	Condition 2:	Condition 3:
EB Increases with Difficulty	EB Increases with Convenient	Neither Change EB
The difficulty to meet human needs increases EB, or EB is greater with the difficulty to meet human needs.	The convenience to meet human needs increases EB, or EB is greater with convenience to meet human needs.	Neither convenience nor difficulty to meet human needs increases EB, or EB does not change with convenience or difficulty to meet human needs.

	HON	Code	Human Needs	Findings/Condition
DEFICIENCY NEEDS	Biological & Physiological Needs	HN01	Nutritional and Wholesome Food	Condition 3
		HN02	Access to Medical Care	Condition 3
		HN03	Clean Water (For Drinking and Washing)	Condition 3
		HN04	Clean and Fresh Air	Condition 2
		HN05	Functional and Well-Maintained Lavatory	Condition 2
	Safety & Security Needs	HN06	Sufficient Electrical Supply	Condition 3
		HN07	Affordable Housing and Conveniences	Condition 3
		HN08	Financial Security and Stability	Condition 2
		HN09	Personal Safety and Security	Condition 2
		HN10	Health Insurance	Condition 2
	Belonging and Love Needs	HN11	Work-Life Balance	Condition 2
		HN12	Social Acceptance and Cultural Inclusivity	Condition 2
		HN13	Reliable Communication Network	Condition 3
		HN14	Access to Internet with Reliable Connectivity	Condition 3
	Esteem Needs	HN15	Primary Education Attainment	Condition 3
		HN16	Secondary Education Attainment	Condition 3
GROWTH NEEDS	Cognitive Needs	HN17	Tertiary Education Attainment	Condition 3
		HN18	Employment Prospects and Opportunities	Condition 2
	Aesthetic Needs	HN19	Well-Kept Areas for Recreational Activities	Condition 2
		HN20	Rich Biodiversity of Flora and Fauna	Condition 2
	Self-Actualisation	HN21	Rights to Participate in Leadership Selection	Condition 2
		HN22	Freedom of Expression	Condition 2
		HN23	Opportunities Free from Corruption	Condition 3
		HN24	Artistic and Cultural Freedom	Condition 2

Table 2 shows that the majority of Malaysian respondents had a positive sentiment towards EB, with mean scores ranging from 7.32 to 8.54. They were asked regarding the convenience or difficulty of satisfying human needs. More than half of the respondents stated that it was convenient to fulfil all 24 human needs (see Table 3). The average means of the EB items were used to perform the Mann-Whitney-U tests, which analysed the variation of means between the two points (convenience and difficulty).

The findings indicate that EB increases when more than half of human needs are convenient to meet. It suggests that the convenience of meeting these human needs will heighten overall environmental behaviour. However, EB did not significantly rise across the difficulty nor convenience of fulfilment for certain human needs, namely (i) nutritional and wholesome food, (ii) access to medical care, (iii) clean water, (iv) sufficient electrical supply, (v) affordable housing and conveniences, (vi) reliable communication network, (vii) access to internet with reliable connectivity, and (viii) primary, secondary, and tertiary school accomplishments.

DISCUSSION AND CONCLUSION

The results of this study highlight crucial aspects that greatly improve environmental behaviour. Clean air and well-maintained lavatories have a positive influence on health and hygiene, thus promoting environmentally friendly habits. Financial stability allows for eco-friendly choices, while personal safety and health insurance promote resistance to environmental dangers. Work-life balance encourages participation in environmental activities, while social acceptability and inclusive societies promote collective action. Furthermore, employment possibilities stimulate sustainable innovation, whilst biodiverse habitats and recreational spaces foster environmental appreciation. The right to engage in government and cultural liberties also strengthens lobbying for green measures. These factors demonstrate how human well-being and environmental stewardship are inextricably linked, resulting in a complete approach to sustainable living.

On the contrary, environmental behaviour is not dependent on meeting all human needs, such as nutritious and healthy food, access to medical care, and inexpensive housing and comforts. While these criteria are essential for existence and stability, people may still be environmentally conscious and participate in sustainable actions regardless of their monetary circumstances. Higher-level demands, such as tertiary education, may boost environmental consciousness by raising awareness and enabling educated judgements. However, environmental consciousness is mostly driven by personal beliefs, upbringing, cultural norms, and knowledge of global environmental concerns. As a result, people with varied backgrounds and degrees of need fulfilment may actively engage in and support environmental stewardship and sustainability initiatives.

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ASSESSING POTENTIALLY WALKABLE HERITAGE TRAIL IN JOHOR BAHRU, MALAYSIA USING ANALYTICAL HIERARCHICAL PROCESS AND GEOGRAPHICAL INFORMATION SYSTEM

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Abstract

This study aims to assess walkability on potential heritage trails in Johor Bahru City using AHP and GIS. In this study, MCDA was used to determine the weightage of the criteria used by GIS to assess the potentially walkable heritage trail in Johor Bahru City. Past studies have been used as a reference to determine the criteria for potentially walkable heritage trails. The criteria are all measurable and can be represented as spatial data on the ground to be used in GIS analysis. Then, the weightage was calculated using the Analytical Hierarchy Process (AHP), which is one of the MCDA weighing methods. The weightages were then used in Travelling Salesman Problem (TSP) Analysis to assess the potentially walkable heritage trail. Weightages are added as a cost during TSP analysis by calculating their value in a field script. The script includes the cost and each criteria name for a better understanding of the TSP process. A single heritage trail was produced that connects six different heritage locations while prioritizing criteria in this study when creating the heritage trail. The six heritage locations are the Royal Abu Bakar Museum, Johor Bahru Chinese Heritage Museum, Bangunan Sultan Ibrahim, Johor Ancient Temple, Masjid Al-Attas and Arulmigu Sri Rajakaliamman Glass Temple. The heritage trail has improved in its accessibility and travel time compared to the existing path. This indicates that travelling using potentially walkable heritage trails produced by this study will shorten travel time and be healthier as it focuses on walking rather than passive transportation.

Keywords: Analytical Hierarchical Process, Geographical Information System, Multi-criteria Decision Analysis, Travelling Salesman Problem, Walkable Heritage Trail

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INTRODUCTION

A heritage site serves as a cultural treasure, holding immense value for a country by encapsulating rich cultural elements and reflecting the identity of the local community or people. Essentially, a historical site serves as a continual bridge connecting the past to the present, narrating the societal story (Rostami et al., 2014). Johor Bahru City boasts numerous cultural heritage landmarks, including the over-a-century-old Sultan Abu Bakar Mosque, the Catholic Church of the Immaculate Conception, and the Johor Ancient Temple, hosting a Chingay procession for over 140 years. These cultural gems were integrated into the Majlis Bandaraya Johor Bahru (MBJB) urban development project along the Coronation Avenue, transforming the city into a metropolitan area. However, without proper monitoring and solutions in place, this urban expansion could jeopardize the cultural heritage.

The government urgently required real-time information on urban expansion to formulate effective legislation and policies for land management and protection (Ji et al., 2001). In order to promote walking as a viable travel option for both residents and tourists, a proposed heritage trail was introduced, incorporating walkability criteria as a crucial factor (Ghadzlie et al., 2024; Ruslan et al., 2023). The challenge, however, lies in the absence of studies addressing walkability on a proposed heritage trail. Selecting appropriate walkability criteria was essential and tailored to the specific conditions of Johor Bahru City and the proposed heritage trail. Researchers faced the dilemma of omitting certain variables when choosing criteria or models (Wong et al., 2011). Illustrating the efficacy of the proposed heritage trail using Crime Prevention Through Environmental Design (CPTED), a visual representation of the trail on a map was essential. Creating a cartography map and a dashboard emerged as the preferred method to offer interactive information for end-users and tourists, enhancing the overall experience.

LITERATURE REVIEW

Heritage trail is a trail that has been developed or designed based on history as its theme with the aim of acting as a connecting journey to link sites, attractions, and other businesses by providing interactive or factual and fictional information such as legend or myth along the way (Timothy and Boyd, 2015). Every government aims to provide a walkable environment, such as a safe path to downtown, a pleasant experience for elders, women, children, people with disabilities, and reduced automobile dependency. Thus, the concept of a walkable heritage trail combined could be described as a safety trail with an environment perceived as walkable, designed with history as the theme. The walkable heritage trail concept highlighted that each trail had a unique or special theme for its location, visual aesthetic qualities, and safety (Orbasli and Vellinga, 2020). A successful

walkable heritage trail possessed strong meaning-making and had been developed through a detailed selection and interpretation process to ensure the trail was "worthy of preservation, visitation, and remembrance" (Cantillon, 2020). Another benefit of a walkable heritage trail was that it enhanced the concept of aesthetics. A proper walkable heritage trail improves a city's view or environment and sense of place. In a sense, a walkable heritage trail provides tourists with an opportunity to immerse themselves in experiencing cultural and historical sites in a more immersive and dynamic way (Miles, 2017).

RESEARCH METHODOLOGY

In this study, the weightage for criteria was obtained based on the ratings provided by experts through interviews. The interviews were conducted with experts in this field, such as architects and people working in the tourism industry. The purpose of this was to ensure that the weightage reflects the actual practices and preferences of the residents and users of paths or roads in Johor Bahru City. The process of obtaining the weightage involved several stages. Firstly, the criteria were identified during the literature review. Then, an Analytical Hierarchical Process (AHP) model was developed, as shown in Figure 1. This model included control criteria and sub-criteria, with arrows indicating the dependencies between them.

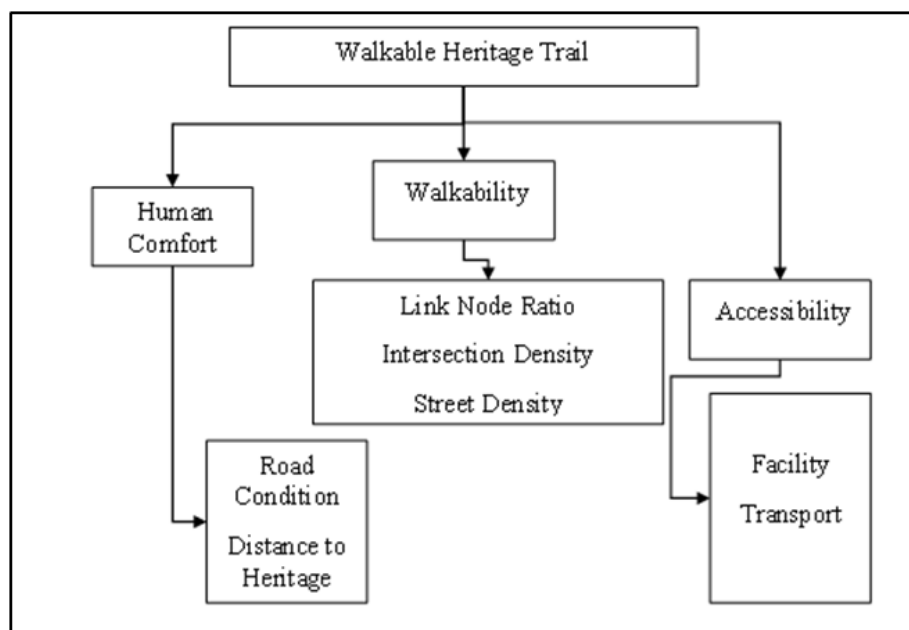


Figure 1. Analytical Hierarchical Process Model
 Source: Authors (2024)

The model in Figure 1 consists of three main criteria: walkability, human comfort, and accessibility. Human comfort is further divided into sub-criteria, i.e., road condition and distance to heritage sites. Accessibility includes sub-criteria such as facility and transport. Walkability encompasses intersection density, link node ratio, and street density as its sub-criteria. Next, ratings were obtained from the choices made by experts. Experts were selected based on two conditions: they had to be residents of Johor Bahru City or tourists who had experienced touring the city. Once the ratings were identified, the weightage could be derived and concluded.

Criteria for this study were derived using the AHP formula. If public opinion implied that road condition is preferable to distance to the heritage site, the value was put under the road condition column. As for the calculation, each column over one was totalled. Then, the criteria value in each row for that column was sum. The total sum of the row was multiplied by the number of criteria over one. The general formula can be defined by the equation below. Alternative n is the number of criteria of the same level; if it is the main criteria, l is the number of main criteria ($l = 1, 2, \dots, p$). According to (Malczewski and Rinner, 2015), alternative $w_k(l)$ is the weight assigned to the k th attribute associated with the l th objective. Then, the $v(a_{ik})$ is the value function. The sub-criteria will also use the same equation, but the value acquired was multiplied by the value of the main criteria. Refer to Equation 1 for the criteria formula calculation with the general alternative.

$$V(A_i) = \sum_{k=1}^n w_l w_{k(l)} v(a_{ik}) \quad (1)$$

Next, assess the walkable heritage trail using the Travelling Salesman Problem (TSP) available in ArcGIS. The input or data needed in TSP is network data and point data acquired by converting building data. In this study, a criterion attribute field will be prepared to provide a cost or barrier during TSP analysis according to the criteria of this study. Figure 2 presents the procedure for determining a walkable heritage trail using TSP analysis.

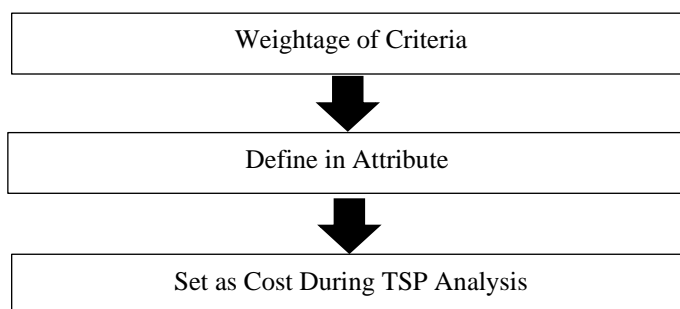


Figure 2. Procedure of Determining Walkable Heritage Trail using TSP Analysis
Source: Authors (2024)

The process involved three fundamental steps. Firstly, the weightage of each criterion was obtained through AHP based on expert opinions. Secondly, the attribute field was defined by assigning the weightage values to each criterion. For example, if road condition was given a higher weightage compared to the distance to heritage sites, the weightage attribute field for road conditions would have a higher value compared to the distance to heritage sites. Finally, in the TSP analysis, there was an option to set the cost as the weightage for analysis. In this step, the attribute field with the weightage value of the criteria was set as the cost attribute. Figure 3 presents the field script for the cost attribute in the attribute field during the TSP analysis. The cost for each criterion was obtained from the AHP analysis conducted using the Superdecision software.

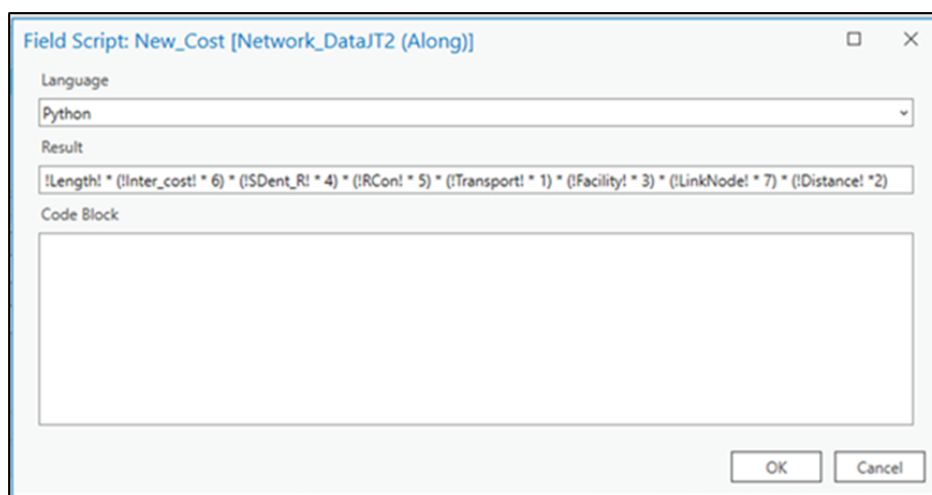


Figure 3. Field Script for Criteria Cost in Attribute Field
Source: Authors (2024)

The field script could be selected in the network dataset properties, specifically under the travel attributes tab, and then the cost tab could be chosen. In this study, a new cost attribute was created for the network dataset using a Python script, as illustrated in Figure 3.8. The script included various components, such as length, inter_cost, RCon, transport, facility, Linknode, and distance, each multiplied by their respective weightage values. For instance, length represented the length of the road in meters, inter_cost denoted the intersection density multiplied by six, RCon indicated the road condition multiplied by five, transport referred to the transport dataset acquired from Google Maps multiplied by one, facility represented the facility dataset acquired from MBB multiplied by three, Linknode represented the link node value acquired from processing the network dataset multiplied by seven, and distance represented the distance to the heritage site multiplied by two.

ANALYSIS AND DISCUSSION

Criteria for Potentially Walkable Heritage Trail in Johor Bahru City

In this study, the weightage of each criterion for the potentially walkable heritage trail was determined to prioritize the criteria during the network analysis process. The Analytical Hierarchical Process (AHP) method was used to calculate the weightage values. In order to determine the relative importance of each criterion, pairwise comparison techniques were employed to gather expert choice preferences. Pairwise comparison methods involve ranking or assessing the competence level of a set number of choices (Kułakowski, 2018). The questionnaire used for pairwise comparison included all main and sub-criteria, divided into four sections. The questionnaire was administered to three expert respondents with knowledge and experience in tourism, heritage, and town planning. One respondent worked in the tourism industry, another was an academician with previous experience in tourism, and the third respondent was an architect.

Weightage of Potentially Walkable Heritage Trail in Johor Bahru City

Weightage is important in AHP since it shows which criteria should be prioritized during network processing. Weightage shows which criteria should be ranked above the other criteria, and the ranking is used to decide which path is taken to provide the best potential walkable heritage trail according to this study's needs. Since weightage acquired in this study was from multiple individuals, the concept of group judgement and geometric mean calculation was done to finalize the weightage value.

The concept of group judgment in reorganizing the ranking of weightage involves a collaborative approach to reassessing and adjusting the importance or priority of criteria in a ranking system. When the initial ranking of

weightage does not adequately reflect the group's collective judgment or new insights arise, the group comes together to reevaluate and reorganize the weights assigned to each criterion. Almost all methods to determine group judgement are based on the assumption that there are no actual ties in this judgement between each individual (Bury and Wagner, 2008).

Table 1. First Respondent Weightage Result

Criteria	Weightage
Distance to Heritage Trail	0.146129
Facility	0.020933
Intersection Density	0.00712
Link Node Ratio	0.019644
Road Condition	0.584516
Street Density	0.054197
Transport	0.167461

Source: Authors (2024)

Table 1 shows the result of weightage acquired from the first respondent of this study questionnaire. The weightage of criteria with the highest value is road condition. According to the first respondent, road conditions are extremely important for assessing a potentially walkable heritage trail in Johor Bahru City. Meanwhile, the lowest criterion weightage is intersection density. This may happen because the respondent considered that places with more intersections are a hassle, or it preferred to walk through a route or path with single road making.

Table 2. Second Respondent Weightage Result

Criteria	Weightage
Distance to Heritage Trail	0.247960
Facility	0.072124
Intersection Density	0.020064
Link Node Ratio	0.005174
Road Condition	0.030995
Street Density	0.046689
Transport	0.576994

Source: Authors (2024)

Table 2 shows the second respondent weightage result acquired from the AHP questionnaire. The second respondent or expert has a different approach to determining the priority of each criterion because, from the three available experts, only the second respondent has a different value of the most important criteria for the walkable heritage trail in Johor Bahru City. This showed the importance of group judgement as different people or experts provided different judgements. The second respondent considered transport extremely important for

potentially walkable heritage trails in Johor Bahru City. Meanwhile, the link node ratio is valued as the least important for potentially walkable heritage trail criteria.

Table 3. Third Respondent Weightage Result

Criteria	Weightage
Distance to Heritage Trail	0.108186
Facility	0.011988
Intersection Density	0.077816
Link Node Ratio	0.020064
Road Condition	0.540932
Street Density	0.181074
Transport	0.059939

Source: Authors (2024)

Table 3 displays the weightage results obtained from the questionnaire completed by the third and final respondent in this study. The criterion with the highest weightage value is road condition, indicating its significant importance in identifying a potentially walkable heritage trail in Johor Bahru City, according to the last respondent's perspective. On the other hand, the criterion with the lowest weightage value is facility. This decision may be attributed to the abundance of facilities already present in Johor Bahru City. Therefore, the respondent considered it less crucial as most routes would likely pass through facilities regardless of the chosen route.

Table 4. Geometric Mean Weightage Results

Criteria	Weightage
Distance to Heritage Trail	0.108186
Facility	0.011988
Intersection Density	0.077816
Link Node Ratio	0.020064
Road Condition	0.540932
Street Density	0.181074
Transport	0.059939

Source: Authors (2024)

Table 4 presents the mean weightage results for all the criteria of potentially walkable heritage trails in Johor Bahru City, calculated using the geometric mean. The mean weightage indicated that road conditions obtained the highest value of 0.21399825, reflecting its significant importance in determining the potentially walkable heritage trail. Conversely, the criterion with the lowest weightage value was the link node ratio, with a value of 0.01268113. This result aligns with the weightage tables from all three respondents, as two tables assigned a higher weightage to road conditions while all three tables assigned a lower

weightage to the link node ratio. Notably, the second respondent's weightage table exhibited the lowest weightage value for the link node ratio criterion.

Potentially Walkable Heritage Trail in Johor Bahru City

This study aimed to provide an output of potentially walkable heritage trails in Johor Bahru City. Considering that visitors often prefer self-guided tours, their experience is a key concern (Hayes and Macleod, 2008). Therefore, this study focused on analyzing and identifying potentially walkable heritage trails in Johor Bahru City that are safe and comfortable for self-guided tours. The study specifically centered around heritage sites in Johor Bahru city as destinations. Criteria such as road conditions, distance to each heritage site, facilities, and transport were determined based on a center-to-edge approach, with the heritage sites serving as the central focus. This allowed the study to prioritize particularly significant criteria for this research.

Map of Potentially Walkable Heritage Trail in Johor Bahru City

Figure 5 below shows the potentially walkable heritage map of Johor Bahru city. Maps include a route path that should be taken to discover some of the most historical and aesthetic in the city while walking on a trail with pedestrian walkways, pedestrian overpasses, passing through local food restaurants and facilities such as public toilets, hotels, and nearby bus stops.

The title of this map is "Johor Bahru Heritage Trail Map", and "Welcome to Johor Bahru" as its introduction. The map includes walking duration with an estimated time of two hours, and information on each heritage building in Johor Bahru city is shown on the map. Information about the heritage building includes the date or year of establishment, the influential person who launched the inauguration of the building if available, and any achievements the heritage building might have had during its glory days. The trail starts from building number one until building number six respectively. The information on the left side of the map for each building uses the same numbering shown in the heritage trail. The trails started from the Royal Abu Bakar Museum, Johor Bahru Chinese Heritage Museum, Bangunan Sultan Ibrahim, Johor Ancient Temple, Masjid Al-Attas and Arulmigu Sri Rajakaliamman Glass Temple, respectively.

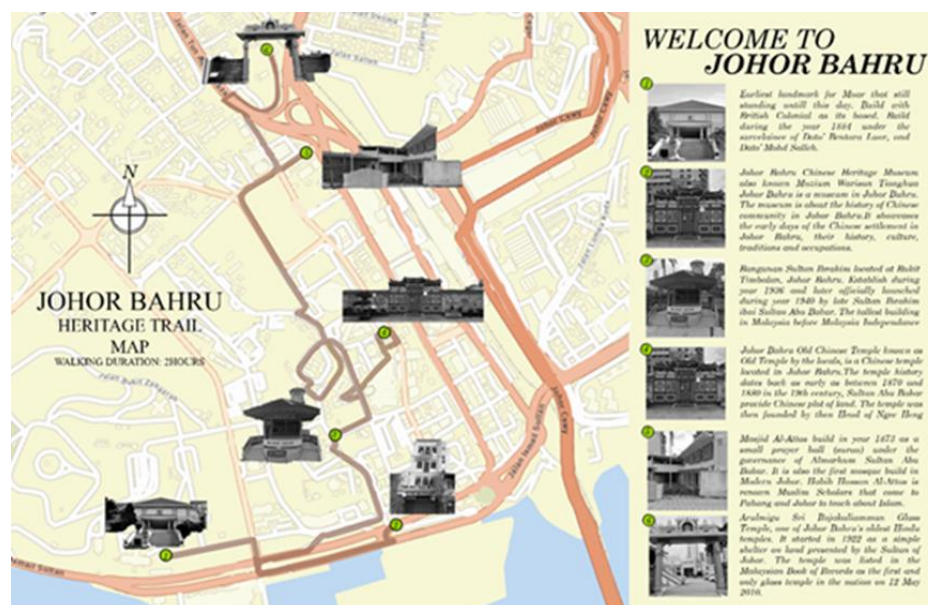


Figure 5. Potentially Walkable Heritage Map of Johor Bahru City
 Source: Authors (2024)

Table 5. Attribute Table for Potentially Walkable Heritage Trail in Johor Bahru City

Lane	Length (m)	Time Travel (h)	Time Travel (hour, minute, second)
1	2531	0.843667	0 hours, 50 minutes, 37 seconds

Source: Authors (2024)

Table 5 shows the results acquired from TSP processing. This study only produces one heritage trail as the TSP method is a method to visit each set of locations while assessing the shortest distance for such a trip (Rexhepi et al., 2013). As defined by Rexhepi in its research study, the output of TSP method analysis is one single route traverses through all heritage sites. The total length from Royal Abu Bakar Museum to Arulmigu Sri Rajakalliamman Glass Temple is 2531 meters or 2.531 kilometers, and the total time travel is 0.843667 hours or 50 minutes and 37 seconds.

Site Verification for Walkable Path for Heritage Trail in Johor Bahru City

Verification of walkable heritage trails includes several assessments or evaluations. First is safety assessment, which helps assess potential safety hazards along the route. By inspecting the trail firsthand, one can identify any obstacles, slippery surfaces, steep sections, unstable terrain, or other conditions that may pose a risk to walkers. This information is crucial for ensuring the safety of trail users and implementing appropriate measures to mitigate potential dangers. Since

most of the trails use pedestrian paths, slippery surfaces are invalid or checkout for this assessment.



Figure 6. Terrain and Accessibility Along Walkable Heritage Trail
Source: Authors (2024)

Figure 6 shows the condition of terrain and accessibility in Johor Bahru City during site verification of the study area along the walkable heritage trail. As can be seen in the figure with a tree above, the terrain surface along the Royal Abu Bakar Museum, which is the first destination in this study, was stable terrain and in good condition. Johor Bahru City road condition is good and well-maintained. Because it is a royal city and rich in history, it can be a good reason why the roads in the city are in good condition. Additionally, verifying walkable heritage trails includes accessibility evaluation. Verifying walkable heritage trails allows for evaluating the trail's accessibility for different user groups, including individuals with disabilities, the elderly, or those with limited mobility. By examining the trail's slope, width, surface quality, and the presence of accessible infrastructure such as ramps or handrails, the verification process helps determine if the trail meets accessibility standards or if modifications are necessary to enhance inclusivity.

Heritage Trail in Improving Accessibility in Johor Bahru City

Heritage trails aim to improve accessibility by providing inclusive and engaging experiences for visitors to historical sites and cultural landmarks. These trails are designed to enhance access to heritage sites, ensuring that people of all abilities can explore and appreciate the historical and cultural significance of these locations. By implementing criteria in this study, heritage trails can become more accessible, enabling a wider range of visitors to engage with and appreciate the cultural and historical significance of the trail. Creating an inclusive experience ensures that everyone can participate and enjoy the rich heritage on display.

Travel Time for Potentially Walkable Heritage Trail in Johor Bahru City

Figure 7 shows comparisons between the existing path and heritage trail in Johor Bahru City. The existing path is green, the heritage trail is red, and the line that is in a darker color is the path that is used by both the existing path and the heritage trail. The symbol with the restroom logo is used to show the facilities available in Johor Bahru City, which was acquired from Majlis Bandaraya Johor Bahru (MBJB).

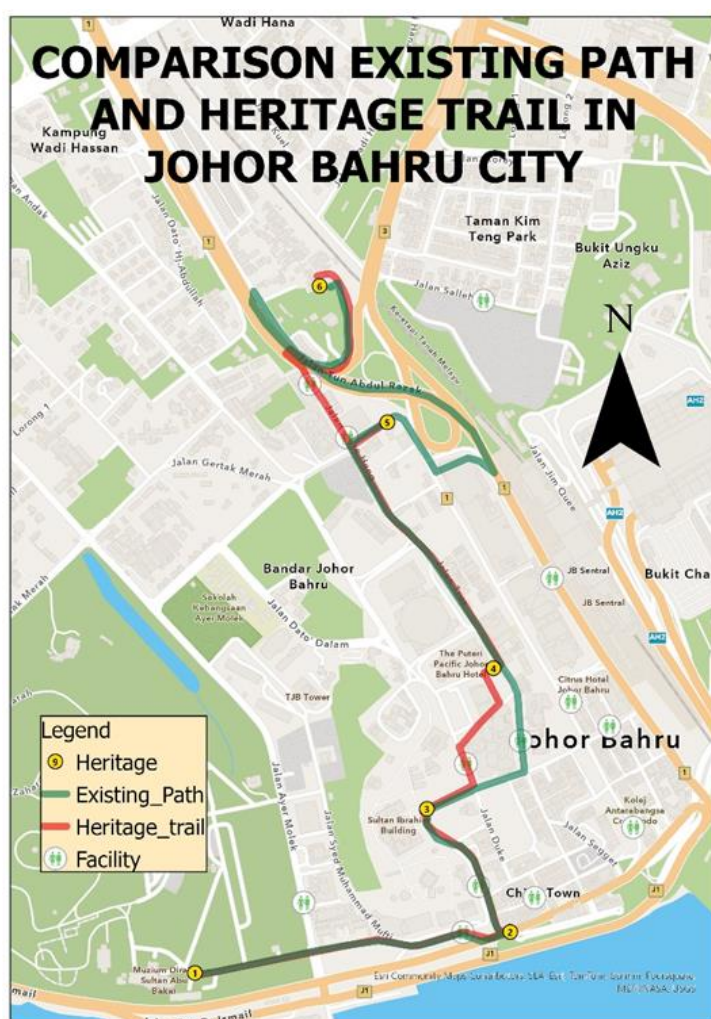


Figure 7. Comparison of existing path and heritage trail in Johor Bahru City
Source: Authors (2024)

As can be seen in Figure 7, the existing path passes through four facilities, while the heritage trail passes through five facilities. The existing path passes through highways or main roads much more frequently than the heritage trail, which focuses on passing through roads with pedestrian paths, which means less vehicle traffic and is suitable for tourists to walk.

Table 6 shows a comparison table for the existing path and potential heritage trail in Johor Bahru City using the TSP method and creating a single path that passes through all heritage locations similar to the heritage trail map. Table 6 has three columns, which are from right for lane, length in meter units, and time travel shown in hours, minutes, and seconds, respectively. The existing path length is 3620 meters or 3.62 kilometers, and the time travel taken to finish it is 1 hour, 12 minutes and 24 seconds. Meanwhile, the heritage trail acquired from this study is only 2531 meters or 2.531 kilometers and takes 50 minutes and 37 seconds.

Table 6. Comparison Table for Existing Path and Potential Heritage Trail in Johor Bahru City

Lane	Length (m)	Time Travel (hour, minute, second)
Existing	3620	1 hour, 12 minutes, 24 seconds
Heritage	2531	0 hours, 50 minutes, 37 seconds
Difference	1089	0 hours, 21 minutes, 47 seconds

Source: Authors (2024)

Cost attributes bend the result of TSP analysis in producing an optimal road while prioritizing all seven criteria in this study. It is evident, as a result, in Figure 7, that both existing paths without cost attributes overlap with potentially walkable heritage trails with cost attributes. The method of storing and arranging data on travel cost attributes in a geodatabase proves to be an excellent tool used in different types of spatial models (Ursu & Bulai, 2012). Databases have a few benefits, including the ability to model the behavior of geographic objects, the ability to assign rules, and the efficient and reliable administration of relationships across internal datasets (Nicaora & Haidu, 2011).

CONCLUSION

To conclude, this study aimed to identify potential heritage trails in Johor Bahru City using AHP and TSP analyses. The study addresses issues arising from a preliminary background study, emphasizing the significance of heritage sites in preserving culture and stimulating the local economy. The first objective involves determining criteria for assessing walkable heritage trails, drawing from 22 literature sources to establish main criteria such as walkability, human comfort, and accessibility. The second objective focuses on identifying potential heritage trails, employing AHP for weightage determination and TSP analysis to find an

optimal route. The study concludes that TSP analysis offers a single, optimized route through all destinations. The third objective involves visualizing the heritage trail through GIS mapping successfully creating a heritage map for Johor Bahru city. Ultimately, all three objectives are achieved, providing a comprehensive approach to enhancing tourist experiences and preserving cultural heritage in the city.

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EMPOWERMENT OF COASTAL COMMUNITIES THROUGH MARINE TOURISM: A FUNCTIONAL APPROACH

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Abstract

This research examined the empowerment of coastal communities through the development of marine tourism, employing a functional approach. The coastal area of Taman Roya Village in Jeneponto Regency, South Sulawesi, Indonesia, holds significant tourism potential, yet the local community has not fully capitalised on this opportunity. The study aims to identify the potential for marine tourism in Taman Roya Village and to design a comprehensive empowerment strategy grounded in functional sociology. Using a descriptive qualitative methodology, data were collected through field observations, in-depth interviews, focus group discussions with 30 marine tourism stakeholders, and a relevant literature review. Thematic analysis was employed to explore the roles and functions of various stakeholders in marine tourism development and to assess the potential for community empowerment. The findings indicate that the development of marine tourism can be an effective tool for empowering coastal communities when implemented through an appropriate functional approach. Taman Roya Village has substantial marine resources, which, when developed, can significantly improve the quality of life for its residents. Key factors include active community participation, capacity building, collaboration among stakeholders, and supportive government policies, such as infrastructure improvements and community skills training in managing marine resources. The practical implications of this study suggest that a functional approach to marine tourism development can empower local communities, enhance economic welfare, foster stakeholder collaboration, and promote sustainable coastal management.

Keywords: Community empowerment, marine tourism, functional approach, coastal communities

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INTRODUCTION

Coastal communities in Indonesia frequently encounter various socio-economic challenges, including poverty, low levels of education, and limited access to resources. Empowering these communities through marine tourism development is crucial for improving their welfare and quality of life. Previous studies have explored community empowerment as a means to enhance the quality and welfare of coastal communities (Rocha & Pomeroy, 2023). Given the need for solutions for socio-economic issues, marine tourism can serve as a pathway for coastal communities to achieve development goals and leverage the opportunities provided by coastal areas and marine resources to improve their quality of life. Understanding the complexity of coastal community life requires various analytical approaches, with one effective method being functional theory (Parsons, 1951; Merton, 1968). In sociology, functional theory offers a practical framework for analysing the intricate dynamics of coastal communities and the potential for marine tourism development (Cinner & Barnes, 2019).

This approach views society as a system composed of interrelated elements, each serving a specific function in maintaining the stability and continuity of the whole system. In the context of coastal community empowerment, a functional approach identifies and analyses the roles played by social, economic, and environmental components in the development of sustainable marine tourism. Bramwell and Lane (1993) emphasised the importance of viewing coastal communities as a cohesive unit that requires strategies to address various socio-economic challenges. The relationship between maritime tourism and community empowerment has garnered significant academic attention (Lasso & Dahles, 2018). However, a gap remains in the tourism literature regarding the dynamics between marine tourism and community empowerment from a functional perspective. In this sense, the research addresses three key areas: first, the need for a functional approach to analyse the current conditions of coastal communities and their relationship to marine tourism (Yusof & Ibrahim 2019). Second, examining coastal areas using a functional approach; and third, analysing how different societal elements support one another in the process of marine tourism development, with a focus on the role of community elements and the social structures that facilitate community empowerment (Merton, 1968).

Taman Roya Village in South Sulawesi Province, Indonesia, was selected as the research setting due to its classification as a low-income community (Hamzah & Arifin, 2023). Located in Jeneponto Regency, this village is part of a region characterised by diverse topography. The northern part of the regency comprises highlands ranging from 500 to 1,400 meters above sea level, the central part includes areas with elevations of 100 to 500 meters, and the southern part features lowlands at 0 to 150 meters above sea level. Approximately 91 km from Makassar, Jeneponto Regency consists of 114 villages and sub-

districts, with Taman Roya being one such sub-district. Covering an area of 29.91 km², Taman Roya is divided into five hamlets: Tamanroya Kota, South, Ujung Tanah, East, and Alukka. Two of these hamlets, located in the southern coastal area of Jeneponto district, are classified as economically underdeveloped and face extreme poverty levels (BPS, 2023). Despite these challenges, the village's coastal area holds significant natural and cultural, carrying enormous potential for community welfare enhancement through marine tourism. However, the full realisation of this potential has been hindered by various obstacles. Therefore, empirically exploring and formulating holistic empowerment strategies to optimise marine tourism's potential while strengthening coastal communities' social structure is vital.

LITERATURE REVIEW

Coastal Communities

Coastal communities live in transition areas between land and sea, highly dependent on coastal and marine resources. Jahan et al. (2021) described that coastal communities have unique socio-economic characteristics, where most of the population work as fishermen, pond farmers, or are involved in the marine tourism industry. This uniqueness forms a distinctive local culture and wisdom, often becoming a unique attraction for developing marine tourism in their region (Pham, 2020). However, coastal communities also face various challenges in sustainable development. Climate change and coastal environmental degradation pose severe threats to their livelihoods. Islam et al. (2023) explained that rising sea levels and coastal erosion have caused the loss of productive land and increased the risk of natural disasters in most coastal areas. Thus, adaptation and mitigation strategies that involve the active participation of coastal communities in managing coastal and marine resources must be taken immediately (Abdullah & Rahman, 2023).

Marine Tourism

Marine tourism presents economic opportunities and simultaneously enhances the capacity of local communities to manage natural resources sustainably. This rapidly growing segment of tourism encompasses various sea and coastal activities, offering not only recreational and adventurous experiences but also contributing positively to local economies and environmental conservation. Menhat et al. (2021) described that marine tourism includes activities such as snorkelling, diving, beach tourism, sailing, and coastal ecotourism. The growth of this sector is fueled not only by the natural beauty of marine environments but also by a rising global awareness of the importance of conserving marine ecosystems. Cahyanto et al. (2021) emphasised that sustainable marine tourism can effectively increase environmental awareness and support conservation efforts while providing economic benefits to local communities. However,

developing marine tourism requires careful balancing of economic interests with environmental sustainability. Alves et al. (2022) identified several negative impacts of poorly managed marine tourism, such as coral reef damage, pollution, and disruption of marine wildlife habitats. Therefore, adaptive and participatory management approaches are essential for the sustainable development of marine tourism.

Community Empowerment Through Functional Approach

Community empowerment through a sociological functional theory approach is a strategy designed to enhance community welfare and independence by strengthening social functions. This approach increases the capacity of individuals and groups within society to achieve prosperity and self-sufficiency by developing the necessary skills, knowledge, and resources to overcome challenges and seize opportunities (Pratama et al., 2021). Empowerment, in this context, involves transferring power and building the community's ability to effectively fulfil its social and economic roles, which, in turn, fosters greater participation and ownership of development programs (Helling et al., 2005). Effective implementation of this approach requires identifying and developing local potential, as Rahman et al. (2020) emphasise the importance of understanding society's assets and capacities. Strengthening local institutions is also critical, as robust and well-functioning institutions can drive sustainable social and economic change. Additionally, building networks and partnerships are essential, and there is a need for collaborative relationships among the community, government, private sector, and civil society organisations to support the empowerment process (see Azinuddin et al., 2023; 2020).

RESEARCH METHODOLOGY

This research employs a qualitative method that is well-suited for studying the empowerment of coastal communities through marine tourism, as it enables a deep understanding of the social, cultural, and economic contexts of local communities. To collect data, observations and in-depth interviews were carried out with ten key individuals. This group comprised community leaders, tourism enthusiasts, and government officials, each offering valuable insights into the economic contributions within Taman Roya Village, South Sulawesi Province, Indonesia. Furthermore, a focus group discussion was organised to understand the community's collective viewpoint on empowerment via marine tourism. The thirty participants consisted of seven fishermen, seven seaweed farmers, seven salt farmers, four representatives from local government (including the hamlet head), two members from mass organisations, a boat owner, a salt pond owner, and the head of the village. As Krueger and Casey (2015) observed, focus group discussions can reveal social norms and group dynamics that may not emerge in individual interviews, helping to identify challenges, opportunities, and potential

strategies for empowerment by examining the maritime potential of Taman Roya Village, Indonesia.

This research used a thematic analysis, which allows for identifying patterns in the data (Braun & Clarke, 2022), subsequently enabling the interpretation of the meaning of texts and interviews (Bengtsson, 2020).



Figure 1. Research Location
Source: Google Maps (2024)

RESULTS AND DISCUSSION

The coastal communities of Taman Roya exhibit distinctive characteristics, largely shaped by their dependence on marine and coastal resources. The primary sources of income for the residents of Taman Roya are fishing, seaweed farming, and salt production. These occupations are seasonal and vulnerable to weather fluctuations, which can lead to fluctuations in income and, consequently, economic instability. According to the 2023 data from the Indonesian Central Statistics Agency (BPS), approximately 701 household heads in this region of Taman Roya village are classified as economically vulnerable, with relatively high poverty rates compared to other communities in the Jeneponto district. In the context of economic challenges, most coastal communities have been unable to implement diversified livelihood strategies, which entail a combination of sea-based activities (fisheries, seaweed cultivation, and salt production) and land-based activities (such as small-scale agriculture, trade, or tourism). In general, the residents of Taman Roya Village rely on income to meet their daily needs. Consequently, global environmental changes, such as environmental degradation, climate change, and the increasing demands of modern life, present

a significant challenge to the economic and social sustainability of the community, particularly the coastal community of Taman Roya Village.

The social structure of coastal communities in Taman Roya Village is generally characterised by cooperation, with strong kinship ties and a high sense of community. This is reflected in various community practices, such as *gotong royong* (a traditional Indonesian communal work system) during wedding parties and a profit-sharing system generally found in fisheries activities and management of other marine products, such as seaweed harvests and fish catches. In some instances, these activities are seen to share each other's results, especially those intended for daily consumption. The coastal areas of Taman Roya Village are geographically distant from urban areas, which often results in limited access to education, health services, and other basic infrastructure. The government's attention and involvement as an institution responsible for the community's welfare have been lacking, which limits opportunities for mobilisation in the economic mobility

Furthermore, the community's capabilities in terms of skills and creativity remain severely limited. This is evidenced by the fact that most of the community's members have only completed elementary school or have not completed it, indicating that a significant proportion of the population has dropped out of school (see **Table 1**). Consequently, the community's creativity and skills are still nascent, constraining their capacity to engage in activities that could enhance their economic prospects. This is because they have not been exposed to training opportunities that could enhance their skills. Furthermore, a disparity exists between communities that play a pivotal role in sustainable development and those situated in coastal areas.

Table 1: Data on Educational Classification of Tamanroya Village Population in 2022-2023

Number	Level of education	Tamanroya Environment					Amount
		Kota	Selatan	Ujung Tanah	Timur	Alluka	
1	Not yet in school	243	107	140	52	120	662
2	Not completed in primary school	58	72	122	30	33	315
3	Elementary School Graduated	69	321	341	25	87	843
4	Graduated from junior high school	34	83	62	33	39	251
5	Graduated from high school	25	45	47	75	48	240
6	Graduated from college/academy	60	35	55	94	56	300
	Amount	489	663	767	309	383	2.611

Source: Tamanroya Village Data 2023

Nexus between Natural Resources Potential and Community Attributes

The natural resources owned by the coastal community of Taman Roya Village represent a largely untapped potential, serving as the foundation for the livelihoods and economic activities of coastal communities. However, this potential remains largely overlooked. The marine resources, salt ponds, natural charm, and social behaviour of coastal communities are assets that can be developed. The diversity of natural resources in this region not only supports ecological balance but also provides a source of livelihood that can be diversified for local communities through marine tourism, representing an alternative income source for the community.

However, the community's natural resources, including beaches, seascapes, and community activities, are not fully utilised due to a lack of knowledge and skills beyond the daily professions in which they are engaged. Furthermore, the community faces various challenges and threats, including climate change, garbage pollution, and coastal ecosystem degradation, exacerbated by environmental pollution. These challenges and threats are particularly evident in Taman Roya Village. This phenomenon frequently occurs from September to December, when the sea breeze blows ashore, endangering the sustainability of natural resources that directly impact the welfare of seaweed and salt farmers. Therefore, sustainable and adaptive coastal resource management is vital to ensuring the continuity of the ecological and socio-economic functions of coastal areas.

The human resources of coastal communities in Taman Roya Village exhibit distinctive characteristics shaped by their interaction with the marine and coastal environment. These distinctive characteristics of coastal communities are exemplified by the diverse professions that contribute to the livelihoods of Taman Roya Village. These include traditional fishermen with a depth of knowledge and expertise in navigating natural conditions at sea that rivals that of professional fisheries experts. The fishermen can discern the direction of the wind and the optimal times for fishing, which allows them to maximise their profits. Coastal communities typically possess a wealth of local knowledge regarding marine ecosystems, weather patterns, and navigation techniques. This knowledge is typically transmitted from generation to generation and is a valuable asset in the sustainable management of coastal and marine resources. However, the challenges of modernisation and climate change necessitate that coastal communities adapt and enhance their capacity to respond to environmental and socio-economic changes.

The educational attainment of coastal communities in Taman Roya Village remains comparatively low compared to urban communities, which impacts access to employment and economic opportunities. Consequently, coastal community empowerment programs must prioritise enhancing access to formal and non-formal education and skills training aligned with local economic

potential, including marine tourism management, aquaculture, and seafood processing. Another crucial element in developing the human resources of coastal communities in Taman Roya Village is the need to reinforce the capacity of local institutions. This underscores the significance of establishing and strengthening integrated coastal community institutions such as fishing groups, cooperatives, and tourism management organisations.

Supporting Provision of Marine Tourism Infrastructure

The provision of adequate supporting infrastructure for coastal communities is of paramount importance in the development of coastal areas and the improvement of the welfare of their communities. The availability of suitable infrastructure can catalyse local economic growth and encourage community participation in sustainable development. The development of infrastructure in Taman Roya Village is relatively slow, with the construction of roads, bridges, and educational and health facilities lagging. This has resulted in relatively slow population mobility and the economic distribution of goods and services. Furthermore, the provision of clean water represents a crucial aspect that needs to be considered to enhance the quality of life of coastal communities. In the context of community empowerment through marine tourism, supporting infrastructure serves a dual role. The significance of infrastructure in fulfilling the necessities of a community needs to be underscored while simultaneously serving as a crucial element in attracting and catering to tourists. The development of tourist facilities, such as docks, inns, restaurants, and tourist information centres, should be encouraged. This is because the government of Taman Roya Village has not yet considered the potential for the area to become a sustainable tourist destination. Instead, the government is still focused on assistance programs, such as offering assistance in procuring boats, fishing gear, and additional funds for seaweed cultivation. However, these programs are not sustainable and cannot improve the community's economic welfare. This is illustrated by the head of Taman Roya hamlet in Ujung Tanah, who has received assistance on numerous occasions but lacks the financial resources to support his children's education beyond secondary school. However, balancing infrastructure development and coastal environmental preservation must be underscored to ensure the ecosystems' sustainability and tourism's long-term viability.

Analysis of Holistic Community Empowerment with a Functional Approach to the Sociology of the Taman Roya Village Community

The AGIL functions, developed by Parsons (1951), offer a valuable framework for analysing how coastal communities maintain stability and meet their needs, particularly in the context of marine tourism development. The analysis begins with *adaptation*, which in Taman Roya's coastal community is exemplified by their ability to adjust to the dynamic and often challenging marine environment.

This adaptation involves the development of new skills necessary for engaging in marine tourism, such as guiding, homestay management, or producing coastal handicrafts. Marine tourism, as suggested by Putra and Cottrell (2021), can thus serve as a dual-income source, complementing traditional occupations like fishing, seaweed farming, and salt production. These occupations, far from being merely subsistence activities, can be transformed into attractive and lucrative endeavours that also serve educational and informational purposes. For instance, the use of traditional fishing techniques, the cultivation and processing of seaweed, and the artisanal production of salt can all be showcased as unique and engaging tourist experiences. Tourists can be invited to observe or even participate in these activities, gaining firsthand insight into the local fishing community's way of life. Additionally, cultural practices such as the Selamatan ceremony before fishing can be featured as part of the tourist experience, enhancing the appeal of the destination.

Goal attainment in this context is closely linked to the diversification of livelihoods through marine tourism, aiming to improve the standard of living for coastal communities. Establishing shared objectives in developing coastal ecotourism can strengthen social cohesion and encourage broader community participation. By diversifying income sources and creating new opportunities in marine tourism, the community can achieve its goals of economic upliftment and sustainable development. *Integration* plays a crucial role in aligning the various interests within the community and fostering cooperation among different social institutions. This includes cooperatives, local businesses, academic institutions, tourism industry actors, and regional governments. Mustika et al. (2020) emphasises the importance of collaborative management approaches in marine tourism to ensure that benefits are distributed equitably and sustainably. By integrating these diverse elements, the community can work together towards common goals, enhancing overall development and resilience.

Finally, *latency* (or Pattern Maintenance) is vital in preserving the cultural identity and social cohesion of the Taman Roya coastal community amidst rapid modernisation. The continued practice of cooperation and collective action helps maintain local traditions and intellectual heritage. Vitasurya (2023) highlights the importance of preserving these cultural elements not only as tourist attractions but also as mechanisms for social-ecological protection. By maintaining these patterns, the community can ensure that its cultural values remain intact while navigating the challenges of modern development.

Coastal Community Empowerment with a Functional Theory Approach

The concept of manifest and latent functions in society's social structure is a fundamental tenet of sociological theory. In coastal communities, manifest functions are evident in the primary economic activities, such as fishing and seafood cultivation, which are explicitly oriented towards fulfilling basic needs

(Ferrol-Schulte et al., 2015). However, there are latent functions that remain unfulfilled beyond these manifest functions. One such latent function is the formation of robust social cohesion among fishermen through a profit-sharing system and cooperation in their fishing activities. The manifest function is described in the profession of most coastal communities that are routinely carried out every day as fishermen, seaweed farmers and salt pond farmers who constitute the livelihood of coastal communities in Taman Roya Village in meeting their daily needs without realising the activities of working hand in hand, working together and sharing catches in fishing and sharing catches for daily consumption to form a strong sense of solidarity and kinship. This creates a strong capital that can be developed in setting a common goal for goal attainment in coastal communities related to efforts to improve community welfare.

Merton's (1968) concept of functional alternatives can also be applied in the analysis of coastal communities. In the context of community-based marine tourism development, the adaptability of fishermen, seaweed farmers, and salt farmers in maintaining their livelihoods during periods of famine can be regarded as a functional alternative that not only provides a new source of income for the Taman Roya Village community but also contributes to the conservation of the coastal environment. This illustrates that the coastal communities of Taman Roya Village possess the capacity to identify innovative solutions for meeting their functional requirements despite the constraints of limited resources and the challenges posed by climate change. Coastal communities can develop a range of functional alternatives to sustain their social and economic structures, a process that aligns with Merton's (1968) perspectives on social dynamics and structural adaptation.

The empowerment of communities with regard to the marine potential in the coastal area of Taman Roya represents a pivotal stage in the advancement of sustainable coastal development. It is anticipated that empowerment programs will enhance the capacity and participation of local communities in the responsible management of marine resources. Such activities may include the provision of training in relevant skills, such as the cultivation of seaweed, the processing of seafood into value-added products, or the management of marine ecotourism. The formation of fishing groups or cooperatives has the potential to enhance the community's bargaining position within the fisheries value chain. Educating the public on marine environmental conservation and sustainable fishing practices is crucial to maintaining ecosystem balance. Furthermore, community involvement in the planning and decision-making processes related to coastal area development can foster a sense of ownership and commitment to the development programs. With effective empowerment, the coastal communities of Taman Roya Village can not only improve their economic welfare but also play an active role in preserving marine wealth for future generations.

Coastal Community Empowerment Program through Marine Tourism *Entrepreneurship Training*

Entrepreneurship training for coastal communities in Taman Roya Village represents a potential avenue for enhancing skills, welfare, and economic independence in this coastal region. The program generally encompasses developing business skills, financial management, and product innovation based on local resources, such as marine products and tourism. The coastal and marine potential of these resources offers significant opportunities for business diversification, including establishing seafood restaurants and producing handicrafts from marine products and handicrafts from coconut tree materials. The coastal region is characterised by a proliferation of coconut trees, providing a rich source of raw materials for these potential businesses (Anggoro et al., 2018). The participatory and contextual approach to this training is designed to enhance program effectiveness, cultivate entrepreneurial motivation within the community, and empower coastal communities. Furthermore, technology integration and digital market access, such as social media, are crucial elements in preparing coastal entrepreneurs for the era of digital economy (Mior Shariffuddin et al., 2023; Mohd Salim et al., 2024).

Development of Tourism Skills

Developing tourism skills for coastal communities represents a strategic step towards enhancing well-being and community empowerment (Nugroho & Numata, 2022). By utilising focused training and education, coastal communities can obtain the requisite knowledge and abilities to participate actively in the tourism industry, including homestay management, tour guiding, and regional food processing. In addition to its picturesque coastal setting, the village of Taman Roya boasts a distinctive house model and a range of activities. Furthermore, developing these skills can also facilitate the preservation of local culture and the environment, which serve as tourist attractions. With increased tourism skills, coastal communities can optimally utilise their natural and cultural resources, create new employment opportunities, and enhance local income.

Environmental Education

Environmental education for coastal communities is essential to increase awareness and participation in preserving coastal and marine ecosystems. An influential environmental education program must consider the socio-cultural characteristics of local communities and involve local wisdom in managing coastal resources. Therefore, it is important to have a participatory approach in developing learning materials and methods relevant to the needs of coastal communities. Furthermore, Widiastuti and Purwanto (2020) show that integrating traditional knowledge with the latest scientific information can

increase the effectiveness of environmental education programs in encouraging sustainable coastal resource use practices.

Community-based Business Development

Community-based business development represents a pivotal strategy for empowering coastal communities and leveraging their distinctive and sustainable local resources. The construction of homestays enables local communities to provide authentic accommodation experiences that allow tourists to immerse themselves in the coastal lifestyle. The distinctive coastal cuisine, comprising fresh seafood and traditional dishes, is a significant promotional factor for the region's rich culinary heritage. Furthermore, developing handicrafts and souvenirs made from marine-based materials or coastal resources, such as coconut wood, preserves traditional skills and generates additional income sources. Integrating these three elements—homestay, culinary, and handicrafts—forms a creative economic ecosystem that empowers coastal communities, enhances well-being, and strengthens local cultural identity. It also provides visitors to Taman Roya with a comprehensive and memorable tourism experience.

Community Involvement in Planning and Management

Empowerment of coastal communities can start with forming tourism awareness groups (POKDARWIS), which involve residents in developing sustainable tourism. This group plays a role in tourism promotion and becomes a forum for active community participation in decision-making regarding coastal area management. Through forums held by POKDARWIS, residents can voice their aspirations and be directly involved in planning the development of tourist areas. Furthermore, this group can advocate for implementing a fair profit-sharing system in managing coastal natural resources, ensuring that profits from tourism activities and the use of marine resources are distributed evenly to all levels of society, not just the elite or external investors. In this context, POKDARWIS becomes a crucial tool for achieving participatory and equitable coastal development.

Role of Stakeholders

Empowering coastal communities requires synergy from various parties to achieve optimal and sustainable results. The central government plays a role in formulating supporting policies and regulations, while local governments are responsible for implementing programs and providing basic infrastructure. The private sector and investors can contribute through investment, technology transfer, and by opening market access to local products. Non-Governmental Organisations (NGOs) are essential in mentoring, capacity building, and policy advocacy that favours coastal communities. Furthermore, scholars and research institutions provide scientific support through applied research, appropriate

technological innovation, and training that meets community needs. Close collaboration between all stakeholders will create an ecosystem that supports the comprehensive empowerment of coastal communities, from human resource development to improving the local economy and preserving the environment (Azinuddin et al., 2022).

CONCLUSION

The research findings suggest that empowering coastal communities through marine tourism, guided by a functional approach, is a viable strategy. Taman Roya Village, with its rich marine resources, presents substantial development opportunities to improve local well-being. The primary economic activities—capture fisheries, seaweed cultivation, and salt pond farming—are supported by the region's natural assets, including mangroves and coconut trees. Maritime tourism, driven by the area's beaches and local maritime culture, holds promising prospects. The development of high-value marine products and marine-based renewable energy could further generate new economic opportunities. Success in coastal community empowerment through marine tourism will depend on optimising the roles and functions of all stakeholders, including local communities, government, and the private sector. Enhancing the capacity of local communities through targeted training and mentoring is crucial for the effectiveness of these programs. By leveraging these insights, the functional approach can help maximise the impact of marine tourism on community empowerment in Taman Roya Village.

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**THE LEVEL OF VISITOR SATISFACTION OF THE FACILITIES USE
AND SERVICES IN CAMPING TOURISM: CASE STUDY MUROG
PUROG CAMPSITE, KG. TAMBATUON, KOTA BELUD, SABAH,
MALAYSIA**

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Abstract

This study focuses on camping tourism as a growing outdoor recreational activity, gaining attention locally and through extensive media coverage, particularly on social media platforms. Despite its popularity, camping tourism has not received widespread attention compared to other tourism sectors. The study aims to explore attraction factors and satisfaction levels regarding facilities and services at Murog Purog Camp Site Tambatuon Village (MPCST) in Kota Belud. The three main objectives of the study are to identify attractions motivating campers at MPCST, examine camper satisfaction with facilities and services, and propose recommendations for improvements. The research design involves an online exploratory approach with a quantitative method as the primary research tool. A total of 70 respondents who have visited MPCST in Kota Belud participated in the study, providing their responses through an online questionnaire. Attraction factors identified include the location, scenic surroundings, clear and cool river water, unique river flow structure, and offered activities. Respondents expressed very high satisfaction levels with these attraction factors. Additionally, overall satisfaction with facilities and services, such as water and electricity facilities, online reservation services, and staff services, was generally high. Several recommendations were proposed to enhance facilities and services, including building a dedicated place of worship, expanding parking areas, constructing a convenience store, increasing toilet and tent facilities, adding more electricity facilities, and installing lights around the camping area.

Keywords: Camping Tourism, Attraction factors, Satisfaction level, Facilities and services, Recreation

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INTRODUCTION

The World Tourism Organization (WTO) recorded an increase in the number of international tourist arrivals between 2004 and 2007. This increase is very encouraging as it recorded an average annual growth rate of 7%. Furthermore, the WTO estimates that the growth will continue towards the year 2020 (Badaruddin, 2008; Pirdaus et al., 2022). The tourism sector is considered one of the most significant and rapidly growing contributors to the global economy. The recognition as a UNESCO World Heritage City back in 2008 resulting Melaka becoming the most popular destination in Malaysia. Extensive research efforts have been focused on determining the preferences of tourist in various countries, regions, cities, and beyond. this analysis is crucial for generating thorough evaluation of the economic advantages of tourism in specific area (Amir, S. et al., 2014). In 2009, Malaysia ranked 11th as a popular tourist destination and became one of the top choices in the world. This is evident through the rapid increase in the number of tourists, from 5 million people in 1999 to 22 million people in 2009 (Ahmad Tharmizzie et al., 2011). The development of tourism is also influenced by the nature of the tourist's curiosity, the desire for new experiences, exploring new and unique areas, and having leisure time (Murphy, 2013). The Sabah Tourism Board (STB) is a responsible agency for promoting the tourism industry in Sabah. The government has allocated RM 228 million from the state budget as stated in the State Government's Direction Policy. Therefore, RM 15 million was allocated in the 2018 budget to strengthen rural tourism and diversify attractive destinations in the state (Amanda Jemmy et al., 2020). In order to maintain and grow successful tourism spots, it's essential to have high-quality surroundings and with appealing settings, there wouldn't be any tourism-related activities. However, individual contribute to various changes in the environment, which can either ease or increase stress levels. In this situation, it's important to grasp the viewpoint of the tourist and to know their preferences for specific location to gain a deeper insight into how people move around and the zones that are sustainable for tourism (Asbollah, Z. A. et al, 2017).

LITERATURE REVIEW

Campground Tourism

Over the past 40 years, the number of campers has increased from 13 million people in the 1960s to 83 million people in 2000 (Rosenberger & Loomis, 2001). Currently, camping is one of the most popular outdoor recreational activities in the United States, with more than a quarter of the country's population participating (Rosenberger & Loomis, 2001). From the late 1950s to the early 1970s, researchers studied the experiential elements of camping such as activities and social interactions (Clark et al., 1971). Early studies were conducted to understand and explore the relationship between camping and sociocultural

variables such as family size, child age, marital status, community type, population, camping frequency, education, and occupation. Burch Jr (1965), in his study on camping looked at the motives, values and significance of camping. The meaning of camping that was commonly identified in this early study included escaping the hustle and bustle of the city. For example, Burch's family camping study described how camping can provide an escape from daily commitments in the city. He was also the first to discuss the importance of family togetherness as a social meaning of camping. Etzkorn, (1964) studied the social meaning of group camping. He introduced the concept of values related to participation in camping, rest and relaxation, meeting people in isolation, and understanding the outside world. Motivation is the act of giving someone a reason to act, such as engaging in camping activities. Travel involves going to a specific location using a mode of transportation. Thus, travel motivation has the purpose of going to a specific place (Crawford & Godbey, 1987). Motivation occurs when individuals want to fulfill their needs and desires. In terms of motivation, the driving factor is the social psychological needs that encourage a person to travel (Iso-Ahola, 1980).

Outdoor Recreation and Leisure

Goodale & Witt, (1989) explained the reasons or factors why an individual likes one recreation area over another. This is important for planners and managers of recreational developments. Therefore, recreation motivation must be identified to make the best use of urban parks that can have positive effects on urban residents and increase user satisfaction.

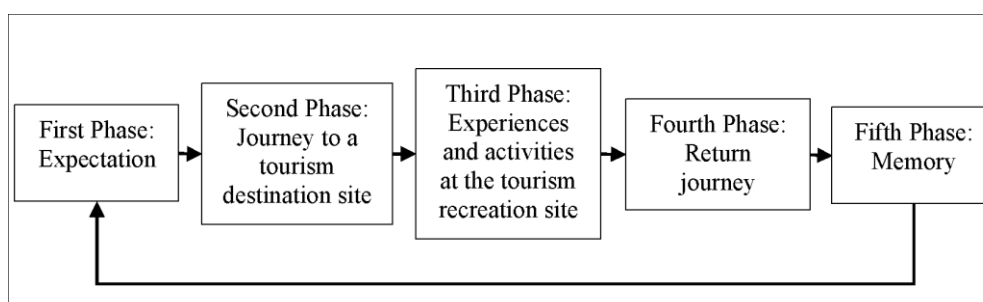


Figure 1: Phases of Outdoor Recreation Experience

Source: Clawson and Knetsch (1966)

Based on Figure 1, Clawson and Knetsch, (2013) explain that there are five phases involved in a person's tourism activity. The first phase is related to the individual's expectations when traveling, whether it will be satisfying or unsatisfying. The second phase is the individual's journey to a tourism destination site. The third phase describes the experiences and activities at the tourism

recreation site. The fourth phase is the individual's return journey to a new location or back to the place of origin, and finally, the fifth phase is about memory, where the individual who traveled will remember all the experiences in terms of enjoyment, challenges, problems, and so on.

The Camping Area and Services

Kyle et al., (2005) conducted a study in three different camping areas in the Southeast National Forest and found that motivation had a positive effect on participation and sustainability. Vogelsong, (1998) emphasized that the characteristics of park areas have an impact on the determination of motivation. According to Field & Cheek Jr, (1974), social structure in the selection of recreational sites has an impact on both site characteristics and targeted activities. Manfredo et al., (1996) studied changes in motivation over time. Motivations that change over time include appreciating scenic environments, rest and relaxation, spending time with family, socializing and making new friends, being close to nature, feeling relaxed after sports activities, and meeting new acquaintances. Çakir et al., (2016) studied recreational motivations in public camping areas in Ankara. The study found that recreational motivations vary according to user gender, age, work status, and recreational area expertise. Campsites in Finland are classified from one-star to five-star based on capacity and services provided. According to the reviewer's assessment, one-star campsites provide basic services while five-star campsites provide the best services (Poudel, 2013). This classification is an important source of information for travelers who make choices based on their needs and preferences.

Natural-Based Recreation Experience Model Theory

In the natural-based recreation experience model theory, each discussed theory can help explain the interactive aspect of the process between humans and the natural environment. The information processing model theory by Kaplan & Kaplan, (1989) is effective in explaining the human factors that respond to the environment according to the types of elements seen along the way and how all these different elements are arranged. However, this theory still seems insufficient to explain the dynamic processes that occur when someone visits a trail, park, or other natural area. Research results show that visitors' perceptions, priorities, and experiences are complex, and positive elements along the trail contribute to an overall positive experience, while negative observations do not seem to have an overall negative impact on the visitor's experience. In the context of camping tourism activities, this study focuses more on the relationship between leisure time, camping tourism, and outdoor recreation.

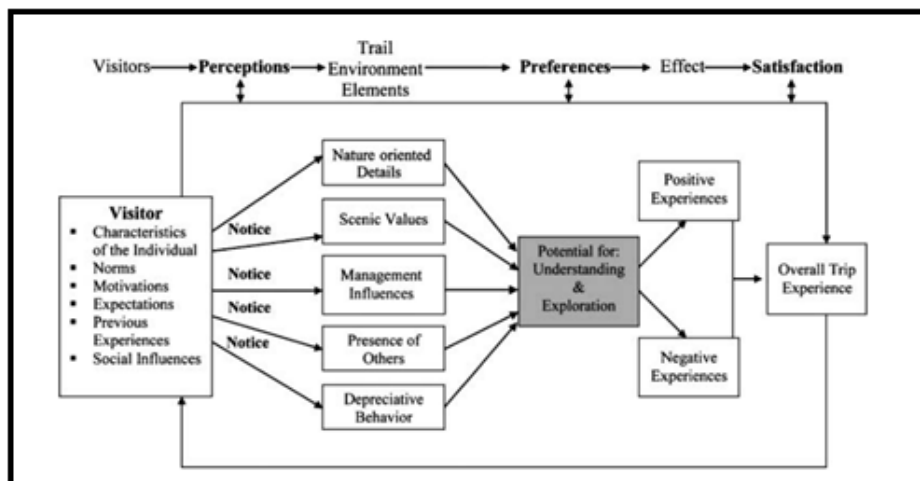


Figure 2: Natural-Based Recreation Experience Model
 Source: Catherine et al. (2009)

METHODOLOGY

The quantitative method has been chosen as the primary approach for obtaining research data. According to Rohana (2003), the quantitative method is an effort to formulate general principles and rules that assume social reality as objective and detached or unrelated to individuals. Quantitative research involves addressing identified problems based on testing a theory formulated by variables, measured through numerical representation, and analyzed using statistical techniques (Neuman, 2000). In the quantitative approach, a survey is a useful method for collecting data to explain a population compared to observational methods. Furthermore, surveys involve a large amount of data and a large sample size but are effective and cost-efficient (Roca et al., 2008).

FINDINGS OF THE STUDY

Respondents' Demographic Profile

The results of the study showed that females were more numerous than male respondents, with 48 respondents (68.6%) being female and only 22 respondents (31.4%) being male. Camping tourism is an outdoor recreation that involves semi-rough activities that require physical activity by an individual.

Meanwhile, the respondents who were most numerous were in the age range of 21-30 years old, with a total of 65 people (91.5%), while the second most numerous age group was in the range of 31-40 years old, with a total of four people (5.6%). Furthermore, the age group of 20 years and below had only two people (2.8%), while the age group of 41 to 60 and above had zero respondents.

As for the marital status of the respondents, the study found that the majority of respondents who answered the questionnaire through the google form were unmarried compared to those who were married. The total number of unmarried respondents was 65 (92.9%), while the number of married respondents was five (7.1%). Regarding the level of education, the respondents who filled out the online questionnaire had a high level of education (diploma and degree), with a total of 58 people (82.9%). The number of respondents with secondary education was 12 (17.1%), and they were in Form 6 and below. Overall, the researcher found that frequent visitors to camping activities were those with a higher level of education. In addition, the average respondents who filled out the questionnaire were mainly students, with a total of 61 people (87.1%), while only four respondents (5.7%) worked in the private sector. For respondents who worked in the public sector, there were two people (2.9%). Furthermore, two respondents (2.9%) were self-employed and the last respondent was a housewife or unemployed, with a total of one person (1.4%). As for the respondents' hometowns, those who came from Sabah recorded the highest number, with a total of 58 people (82.8%), although they came from different districts. The highest number came from Kota Belud, Kudat, Semporna, and Tawau, each recording five respondents (7.1%), while Kota Marudu ranked second with a total of four respondents (5.7%). Keningau, Kunak, Papar, Sandakan, and Tamparuli ranked third, with each recording three respondents (4.3%). Furthermore, respondents from Beaufort, Kota Kinabalu, Penampang, Tambunan, and Tuaran each recorded two respondents (2.9%), while the last group of respondents from Beluran, Putatan, Telipok, Telupid, Tenom, Tongod, and Tuaran each recorded one respondent (1.4%) only. As for respondents who came from outside Sabah, a total of 12 people (17.2%) were recorded. The highest number of respondents who came from outside Sabah was from the state of Sarawak, with a total of nine people (12.9%), while respondents from the state of Kelantan ranked second with two respondents (2.9%). The least number of respondents came from Terengganu, with only one person (1.4%).

Table 1: Respondents' Demographic Profile

Characteristic	Criteria	Numbers (People)	Percentage (%)
Sex	Male	22	31.4
	Female	48	68.6
Age	20 years and below	2	2.8
	21 – 30	65	91.5
	31 – 40	4	5.6
Marital Status	Single	65	92.9
	Married	5	7.1
Education Level	Secondary School	12	17.1
	Higher Education	58	82.9
Occupation	Public Sector	2	2.9
	Private Sector	4	5.7
	Self-employment	2	2.9
	Unemployed/housewife	1	1.4
	student	61	87.1

Source: Fieldwork (May, 2021)

The Level of Respondent Satisfaction Regarding the Convenience at Murog Purog Camp Site Tambatuon, Village Kota Belud, Sabah.

This section describes the level of satisfaction of respondents towards the facilities at Murog Purog Camp Site Kg. Tambatuon, Kota Belud, Sabah. Respondents' answers were based on a 5-point Likert scale, namely 1 - 'very dissatisfied'; 2 - 'unsatisfied'; 3 - 'neutral'; 4 - 'satisfied'; and 5 - 'very satisfied' (Table 3). To interpret the minimum score, the researcher used the score presented by Alias (1999) (Table 2)

Table 2: Interpretation Min Score

Range	Levels
1.00 - 2.33	Low
2.34 - 3.66	Moderate
3.67 - 5.00	High

Source: Alias (1999)

Table 3: Level of Respondent Satisfaction on Facilities at MPCST Kota Belud, Sabah

Issues	Respondent's view									
	1		2		3		4		5	
	N	%	N	%	N	%	N	%	N	%
Registration area	0	0	1	1.4	15	21.7	31	43.9	23	33.3
Camping area	0	0	0	0	8	11.4	27	38.6	35	50
Cooking area	0	0	0	0	11	15.7	26	37.1	33	47.1
Rental of equipment (tent, table, kitchen, etc.)	1	1.4	1	1.4	11	15.7	25	35.7	32	45.7
Water supply facilities	0	0	2	2.8	7	10	22	31.4	39	55.7
Electricity supply facilities	2	2.9	1	1.4	6	8.6	25	35.7	36	51.4
Toilet facilities	0	0	3	4.3	7	10	23	32.9	37	52.9
Trash disposal facilities	0	0	1	1.4	11	15.7	26	37.1	32	45.7
Safety facilities (injury treatment, first aid, etc.)	0	0	3	4.3	13	18.6	30	42.9	24	34.3
Prayer room/surau facilities	2	2.9	0	0	21	30	28	40	19	27.1
Parking facilities.	2	2.9	2	2.9	16	22.9	29	41.4	21	30

Indicators: 1 – very dissatisfied, 2 – dissatisfied, 3 – moderate, 4 – satisfied, 5 – very satisfied

Source: Fieldwork (May, 2021).

Table 3 shows the level of respondent satisfaction on the facilities at Murog Purog Camp Site Kg. Tambatuon, Kota Belud, Sabah. The study's findings indicate that the majority of the respondents answered 'very satisfied' regarding the level of services offered. The water supply facility recorded the highest number, with 39 people (55.7%) stating that they agreed that this facility was very satisfactory because the water flow through the pipes was very strong, which facilitated their work or activities throughout the camping tourism.

Table 4: Respondents' Satisfaction Level towards Facilities

NO	Facilities	Min	Levels
1.	Camping space	4.36	H
2.	Toilet facilities	4.33	H
3	Cooking area	4.29	H
4.	Garbage disposal area	4.27	H
5.	Rental equipment facilities	4.23	H
6.	Registration area	4.09	H
7.	Water supply facilities	4.09	H
8.	Safety facilities	4.07	H
9.	Parking space	3.93	H
10.	Prayer room/mosque facilities	3.50	M
11	Electricity supply facilities	3.44	M

Source: Fieldwork (May, 2021)

The Level Of 'High' Satisfaction

Based on Table 4, the researcher can identify the level of respondent satisfaction towards several camping tourism facilities at MPCST at a 'high' level. Among the facility aspects that show a 'high' minimum score are camping spaces (4.36), toilet facilities (4.33), cooking spaces (4.29), waste disposal facilities (4.27), rentals (4.23), water supply facilities (4.09), equipment facilities, registration space (4.09), safety facilities (4.07), and vehicle parking facilities (3.93).

The Level of 'Moderate' Satisfaction

According to Table 4, the aspects of camping tourism facilities that received a minimum score at the "moderate" level are the provision of electricity and prayer facilities only. The prayer facilities at MPCST also recorded only a moderate minimum score (3.50) because the space for prayer is quite small and unable to accommodate many visitors praying at the same time. The findings of this study are relevant and in line with the requirements of the Guidelines for Planning Theme Park Development approved by the State Government Council on September 8, 1999. According to these guidelines, any proposed theme park development must comply with the established guidelines. The guidelines serve to assist state and local authorities in determining and planning the suitability of the location, site, and facilities for theme park development during the planning approval process.

The Level of Satisfaction of Respondents Towards the Services at Murog Purog Camp Site Tambatuon Village

This section discusses the level of satisfaction of respondents towards the services provided at Murog Purog Camp Site Kg. Tambatuon, Kota Belud, Sabah. Several Likert scale statements were asked to the respondents to investigate their level of satisfaction towards the services offered by the owner of MPCST. Respondents' answers are based on a 5-point Likert scale, which includes 1 - 'very unsatisfactory'; 2 - 'unsatisfactory'; 3 - 'moderate'; 4 - 'satisfactory' and 5 - 'very satisfactory' (Table 5).

Table 5: Respondents' Satisfaction Level towards Services at Murog Purog Camp Site, Tambatuon Village

Issues	Respondents' Views									
	1		2		3		4		5	
	N	%	N	%	N	%	N	%	N	%
Online reservation services provided	0	0	0	0	6	8.6	33	47.1	31	44.3
Services provided by registration staff	0	0	0	0	8	11	31	44.3	31	44.3

Issues	Respondents' Views									
	1		2		3		4		5	
	N	%	N	%	N	%	N	%	N	%
Camping site entrance fee payment	0	0	0	0	7	10	36	51.4	27	38.6
Safety briefing and guide services before camping	0	0	1	1.4	11	15.7	26	37.1	32	45.7
Technical assistance provided by campsite operators	1	1.4	0	0	10	14.3	26	37.1	33	47.1
Visitor safety monitoring services	0	0	1	1.4	15	21.4	31	44.3	23	32.9
Emergency facility services provided.	0	0	0	0	10	14.3	26	37.1	34	48.5

Source: Field Study (2021)

Table 5 shows the level of satisfaction of respondents towards the services at MPCST. The study results indicate that the majority of respondents answered the level of 'satisfied' for the services provided at the study location. The entrance fee to the camping area recorded the highest number, with 36 respondents (51.4%) stating that the fee was very satisfactory and reasonable.

Table 6: Minimum Satisfaction Level Scale of Respondents towards Services

NO	Services	Min Scale	Levels
1	Online Reservation Services	4.36	H
2	Staff Services	4.33	H
3	Entrance Fee Payment	4.29	H
4	Technical Assistance	4.29	H
5	Visitor Safety Monitoring Services	4.27	H
6	Emergency Facility Services	4.27	H
7	Safety Guide Services	4.09	H

Source: Field Study (2021)

Table 6 shows all the parameters that record a 'high' score for camping tourism services at MPCST. The study results indicate that online reservations are the highest rated service that provides satisfaction with a minimum score of 4.36. This is because the prices offered by the operators are reasonable and not too expensive. Not only that, but prompt response and good service from the operators also affect the level of satisfaction of respondents towards the services at MPCST.

Level of 'High' Satisfaction

Table 6 displays the minimum score values obtained from the data analysis. The researcher found that the minimum scores for each aspect of the services studied did not differ significantly. Respondents' satisfaction level with the 'high' minimum score was for online reservation services (4.36), safety officer services (4.33), entrance fee payment (4.29), visitor safety monitoring services (4.27), technical assistance services (4.29), emergency facility services (4.27), and safety guide services (4.09), as well as friendly and prompt service from operators and officers at MPCST while carrying out their duties, which can affect the level of respondent satisfaction.

The Problems Faced When Camping at Murog Purog Camo Site Kg. Tambatuon, Kota Belud, Sabah

In this section, an explanation is given regarding the problems faced by respondents during camping at Murog Purog Camp Site Kg. Tambatuon, Kota Belud, Sabah. The researcher provided open-ended questions to obtain feedback from respondents. Out of 70 respondents, only 38 respondents (54.3%) provided feedback, while the remaining 32 respondents (45.7%) did not feel bothered by the shortcomings and challenges faced during the camping activity. The responses given by the respondents are shown in Table 4.8 to facilitate discussion of the research findings.

Table 7: Problems Faced by Respondents

Issue	Numbers	Percentage
Internet Network Issues	16	22.9
Untarred Roads	8	11.4
Inclement Weather (Heavy Rain)	4	5.7
Insufficient Toilets	3	4.3
Limited Electricity Facilities	2	2.9
Limited Changing Rooms	2	2.9
Stray Dog Disturbances	1	1.4
Damage of Tents	1	1.4
Lack of Designated Prayer Spaces	1	1.4
Total	38	100

Source: Field Study (May, 2021)

Based on Table 7, the majority of respondents stated that the main problem they faced was the internet network, with 16 people (22.9%). Internet access is crucial nowadays, especially in various fields such as entertainment, education, business, and the tourism sector itself. Meanwhile, eight respondents (11.4%) stated that the problem of unpaved roads was a major issue they faced. This is because the MPCST area is a remote rural area far from the city, and the roads leading to the area are hilly and challenging. Next, heavy rain is one of the

main problems faced by respondents when camping at MPCST. Meanwhile, three respondents felt that the number of toilets at MPCST is insufficient and unable to accommodate a large number of visitors at the same time. Electrical facilities and changing rooms each had two respondents (2.9%) who felt that both facilities were somewhat limited and should be upgraded in the future to meet the needs of visitors, especially during public holidays. Finally, the prayer room and tent damage each had one respondent (1.4%) who experienced problems with these facilities.

CONCLUSION

Overall, this study has achieved all three objectives set out. The factors that attract visits and the level of satisfaction with the facilities and services of camping tourism at Murog Purog Camp Site Tambatuon Village Kota Belud, Sabah (MPCST) have been identified. Suggestions for improvements to the facilities and services of camping tourism at MPCST have also been determined. Furthermore, the study shows that camping tourism activities in Sabah, specifically in Kota Belud, are still new, so many aspects need to be studied to improve management, registration, facilities, services, safety, and other aspects related to camping tourism. Therefore, the role of various stakeholders is important in advancing the camping tourism sector to be more competitive at the international level. It is hoped that more researchers will be interested in investigating camping-related tourism in the future.

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DETERMINANTS OF RESIDENTS' SUPPORT FOR TOURISM DEVELOPMENT AT WORLD HERITAGE SITE, LONGMEN GROTTOS, CHINA

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Abstract

Heritage tourism has become increasingly popular in China, generating significant economic benefits for tourist destinations. Although the rapid growth of tourism in heritage sites boosts business opportunities, it also brings challenges, such as gentrification. The influx of new capital and investment in housing can disrupt the local community's social and economic structure, often forcing residents to move away due to rising living costs and the inability to cope with rapid changes, as observed in the Longmen Communities. This shift in demographics tends to be profit-driven and can influence how residents perceive the benefits of tourism and their support for its development. This study examines the factors that shape residents' perceptions of tourism benefits and their support for tourism development at heritage sites. Four main factors—community attachment, community involvement, community gains, and trust in government—were analysed to understand their influence on perceived benefits. A quantitative research method and systematic sampling were used for data collection. The study offers valuable insights into residents' support for tourism development and the protection of heritage sites based on their perceived benefits. The findings provide guidance for government officials, tourism planners, and policymakers on shaping local opinions to foster heritage tourism.

Keywords: Residents' support, world heritage site, Longmen Grottoes, China, tourism development

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INTRODUCTION

Over the past 20 years, the interest in how tourism affects World Heritage Sites (WHSs) has gradually grown (Landorf, 2009), and heritage tourism has become an increasingly popular form of tourism across many global destinations (Rogerson & van der Merwe, 2016). Tourism is an industry that encompasses visitors, businesses, and communities, all of which are stakeholders in tourism development (J. Williams & Lawson, 2001). A direct and reciprocal link between visitors and residents is crucial to the tourism trade process (Gabriel Brida et al., 2014). Successful development is regarded as the assistance of locals for tourism (Gursoy et al., 2010; Nunkoo & So, 2016). Furthermore, the extent to which people support tourism depends much on how they view the effects of tourist development on their neighbourhoods (Rasoolimanesh, Jaafar, & Barghi, 2017; Wang & Pfister, 2008). This paper aims to identify the relationship between community attachment, community involvement, community gains, and trust in government with residents' perceived benefits of tourism development at World Heritage Sites (WHS). The second objective is to assess the relationship between residents' perceived benefits of tourism development and their support for such development at WHS. The findings of this paper will shed light on how these four factors influence residents' perceived benefits and their support for tourism development at World Heritage Sites.

LITERATURE REVIEW

Heritage tourism and tourism impacts

Travelling to experience locations, artefacts, and activities that accurately depict the histories and cultures of the past and present is known as heritage tourism (Hargrove, C.M., 2011). Global recognition of a heritage site's brand image has transformed it into a popular destination for both international and local tourists (Rahman, 2018). During the past five decades, researchers have given increasing attention to the impacts of the tourism industry (Andereck et al., 2005; Ap, 1992; Eraqi, 2007; Vodeb et al., 2021; Zaei, M. E.2013) and these impacts can be divided into economic, socio-cultural, and environmental types (Andereck et al., 2005a; Gursoy et al., 2002; Milman & Pizam, 1988; Nunkoo & Ramkissoon, 2011). All influences possess positive as well as negative facets throughout the evolution of a tourism destination. According to the cost-benefit approach (Lee, 2013; Nunkoo & Ramkissoon, 2011), positive impacts have been described as 'benefits', while negative impacts are considered 'costs' (Amuquandoh, 2010; Gursoy et al., 2010).

Social exchange theory

Social exchange theory has been the predominant theoretical framework for numerous investigations, formally or implicitly. This is a broad sociological theory that concentrates on understanding resource exchanges between people and groups during interaction situations (Ap, 1992). People interact with one another to seek out valuable things, whether material, social, or psychological. The fundamental tenet of SET is that people form opinions about objects of interest based on their respective costs and benefits. The theory is interdisciplinary, originating in economics, anthropology, sociology, and social psychology (Cook et al., 2013; Redmond & Uk, M. V, & Uk, A. 2015). This thorough approach to the theory enables it to investigate local views regarding tourism from all angles, including economic, environmental, and socio-cultural ones (Ap, 1992; Matthew & Stockton, 2011).

Residents' perceptions of tourism impacts

Research on perceived tourist impacts is strongly tied to the consequences of tourism in general (Ngan Anh and Rahman, 2023). As these effects are difficult to quantify, researchers frequently investigate how residents in tourism communities perceive the impacts of tourism (Andereck & Vogt, 2000). Members of a local community stated their opinions on the perceived effects of tourism development on local people, and these opinions were positively associated with their assessments of the advantages of tourism (Andereck et al., 2005b; Ap, 1992; Ko & Stewart, 2002). Understanding the residents' perception of the local heritage is important in obtaining their support for tourism development. Residents represent a primary stakeholder group in tourism development (Gabriel Brida et al., 2014).

Factors influencing residents' perceptions toward benefits of heritage

Residents' perceptions of tourism development are intricate, various, and related to many aspects. Four determinants affect their perceptions of tourism benefits in world heritage sites. These factors are elaborated as follows:

i) Community attachment

Attachment reflects the psychological connection between a person and specific items (Thomson et al., 2005). In terms of residents' positive and negative impressions of WHS inscription and tourism development, Rasoolimanesh (2015a) discovered considerable beneficial consequences for community attachment and the sense of belonging. Therefore, community attachment in this study represents a person's feeling of rootedness and community belonging (Jurowski et al. 1994).

ii) Community involvement

Community involvement is the process of developing a framework that enables the full participation of all stakeholder groups in cooperative decision-making and joint ownership of obligations and benefits (Y. Li & Hunter, 2015; Moghavvemi et al., 2021b). According to Lee (2013) and Edwin (2017), community involvement in this study may empower residents, enhance their awareness of the potential impacts of heritage tourism, and boost their respect for their culture and values at the world heritage sites. Thus, it is important to investigate the community's involvement in WHSs.

ii) Community gains

Community gain refers to the benefits that the local community receives from tourism activities in their area, as well as local member gains, including economy, environment, and society (Jaafar et al., 2015). For community members, if individuals perceive enough benefits that can be gained from tourism growth in WHSs for their community, they could have a strong inclination to encourage the growth of heritage tourism. Otherwise, they will have a negative attitude towards tourism development (Charag et al., 2021b; Gursoy & Rutherford, 2004; Lankford & Howard, 1994b).

iv) Trust in government

Trust is crucial for social, political, and communal relationships (Bronfman et al., 2009). The concept of trusting the government in this study refers to the degree to which residents believe that their government is honest, competent, and accountable and that it is working in their best interest (Bouckaert & van de Walle, 2003). Nunkoo (2015) points out that the government cannot force local populations to have good attitudes towards the tourist sector, but it needs their support to achieve sustained growth. The Chinese government recognised that collaboration with communities and scenic locations is essential for historical tourism and world heritage sites, making trust in government a necessity for tourist growth.

Conceptual Framework

This study investigated the factors that can influence residents' opinions of the benefits of tourism and their willingness to support it. The conceptual framework for this study is based on Rasoolimanesh (2017b), Edwin Mohamed (2017b), and Lee (2013), with SET as the theoretical basis. Based on the literature review and the framework developed by three scholars, three community and government factors will be used to research residents' perceptions. The perceptions comprise community attachment, community involvement, community gains from these three community factors, and trust in government.

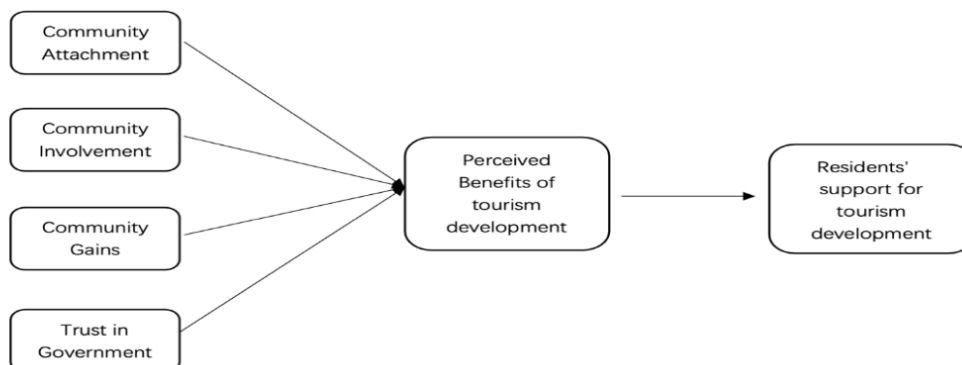


Figure 1: Conceptual framework adapted from Rasoolimanesh (2017), Edwin (2017), and Lee (2013).

METHODOLOGY

The study was conducted at the Longmen Grottoes Scenic Area, which included four main attractions: the West Mountain Grottoes, the East Mountain Grottoes, the Fragrant Hill Temple, and the White Garden. The target research population consisted of residents from the Longmen community, comprising 14,731 households. This quantitative research employed a questionnaire survey as the data collection instrument, with a sample size of 384 respondents, determined using the Raosoft software. Data collection was carried out through face-to-face and self-administered questionnaires. The questionnaire comprised 29 questions divided into four sections: Section A consisted of four questions related to demographic characteristics, Section B contained seven questions focused on residents' perceived benefits of tourism development, Section C consisted of 14 questions assessing four key factors, and Section D featured four questions regarding residents' support for tourism development.

ANALYSIS AND FINDINGS

Socio-demographic Profiles

Table 1 presents the data obtained from 380 respondents in the Longmen Community. Of these, 32.4% are male and 67.6% are female. The majority of respondents fall within the age range of 18 to 60, with 55.5% aged 18-25, 26.3% aged 26-40, and 14.7% aged 41-60. Only 3.4% are over 60 years old. Regarding educational background, 47.9% of the respondents hold a Bachelor's degree, followed by 15.5% with a high school education, 13.2% with secondary school education, 11.8% holding a Master's degree or other qualifications, and 2.4% with only primary school education. Lastly, 0.3% of the respondents reported having no formal education.

Table 1: Demographic profiles of the respondents.

Demographic Variables	N	Value	Number of respondents	Percentage (%)
Gender	380	Male	123	32.4
		Female	257	67.6
Age	380	18-25	211	55.5
		26-45	100	26.3
		46-60	56	24.7
		Over60	13	3.4
Education	380	No formal education	1	0.3
		Primary school	9	2.4
		Secondary school	50	13.2
		High school	59	15.5
		College	34	8.9
		Bachelor	182	47.9
Master and over	45	11.8		
Length of residency	380	1-5 Years	232	61.1
		6-10 Years	32	8.4
		11-15 Years	23	6.1
		16-20 Years	26	6.8
		Over 20 Years	67	17.6

N=Total number of residents.

Perceived benefits of tourism development

Table 2 presents the results for the perceived benefits, consisting of seven items with mean values ranging from 4.07 to 4.34. Overall, a significant majority of residents expressed strong support for the benefits brought by tourism development at the Longmen Grottoes. Each of these variables has a mean value exceeding 4.0, indicating that the residents of the Longmen Community clearly recognised the positive impacts of tourism. Specifically, tourism development was seen as contributing to an improved standard of living ($M=4.31$, $SD=0.721$), increasing employment opportunities ($M=4.3$, $SD=0.755$), enhancing public utilities ($M=4.28$, $SD=0.755$), attracting investments to the community ($M=4.07$, $SD=0.913$), fostering cultural exchange between visitors and locals ($M=4.14$, $SD=0.798$), promoting the preservation of local culture ($M=4.30$, $SD=0.696$), and positively impacting cultural identity ($M=4.34$, $SD=0.717$). These high mean values reflect the residents' strong perception of the benefits associated with tourism development.

Table 2: Descriptive analysis of the perceived benefits of tourism development.

NO.	Statements	M	SD
a	Developing tourism contributes to the standard of living in Longmen Street as a world heritage site.	4.31	0.721
b	Developing tourism increases employment opportunities in Longmen Street as a world heritage site.	4.30	0.755
c	Developing tourism improves public utilities in Longmen Street as a world heritage site.	4.28	0.755
d	Developing tourism has attracted many investments to our community in Longmen Street as a world heritage site.	4.07	0.931
e	Developing tourism enhances cultural exchanges between visitors and residents in Longmen Street as a world heritage site.	4.14	0.798
f	Developing tourism provides an incentive for the preservation of local culture in Longmen Street as a world heritage site.	4.30	0.696
g	Developing tourism positively affects the cultural identity of Longmen Street as a world heritage site.	4.34	0.717

Factors affecting residents' perceived benefits of tourism development Exploratory Factor Analysis (EFA)

In this study, four factors—community attachment, community involvement, community gains, and trust in government—were examined for their potential influence on the perceived benefits of tourism development. These factors were measured using 14 items, each demonstrating reliability with Cronbach's alpha values exceeding 0.7. An exploratory factor analysis (EFA) with varimax rotation was conducted to identify the underlying dimensionality of the construct. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is above the cut-off value of 0.6, confirming the suitability of the data for factor analysis, with all four factors exceeding 0.6. Additionally, Bartlett's test of sphericity yields a significance level of $p < .001$, which is below 0.05, further confirming that the data were appropriate for factor analysis (Lee Sejong et al., 1992).

Table 3: Results of explanatory factor analysis (EFA)

Independent Variables	Factors loadings	% of variance	'Cronbach's Alpha
CA-1	0.867	56.342%	0.881
CA-2	0.855		
CA-3	0.622		
CA-4	0.751		
CI-1	0.612	66.703%	0.806
CI-2	0.76		

Independent Variables	Factors loadings	% of variance	Cronbach's Alpha
CI-3	0.843		
CG-1	0.805	73.664%	0.893
CG-2	0.802		
CG-3	0.704		
CG-4	0.655		
TIG-1	0.748	79.345%	0.921
TIG-2	0.835		
TIG-3	0.838		

Source: Author's Calculation

Multiple regression analysis

Multiple regression builds upon simple linear regression by using two or more independent variables to predict the value of a dependent variable. This method helps forecast and evaluate the strength of the relationship between independent and dependent variables. The proportion of variance in the dependent variable that can be explained by the combined effect of all independent variables is represented by the coefficient of determination (R^2). According to Lorenzo-Seva et al. (2010), an R^2 value above 0.3 is desirable. However, a low R^2 does not always signify a weak relationship, and a high R^2 does not always imply a strong one (Kafle, 2019).

As shown in Table 4, the R^2 value is 0.440, which exceeds 0.3, indicating that the four independent variables (community attachment, community involvement, community gains, and trust in government) collectively explain 44% of the variance in the dependent variable (perceived benefits of tourism development). Additionally, the Durbin-Watson value is 2.065, within the acceptable range of 1.5 to 2.5, confirming that the variables in the dataset are independent and suitable for multiple regression analysis. This indicates that the model is free from multicollinearity issues and is well-constructed.

According to Table 4, the above result can be computed to the predicted line of regression equation:

$$[Y = b_0 + b_1 (X_1) + b_2 (X_2) + b_3 (X_3) + b_4(X_4) + e]$$

Additionally, the four independent variables significantly predict the perceived benefits of tourism development, as shown by the F -value of 75.322 ($p < 0.05$). This indicates a substantial model fit with high variance, demonstrating that these four factors do influence the perceived benefits of tourism development. The standardised coefficient beta (β) reflects the extent of change in the dependent variable for each 1-unit change in an independent variable, with β values being either positive or negative. These values can be compared to

identify which independent variables most strongly predict the dependent variable (Lorenzo-Seva, 2010).

According to Table 4, community gains emerge as the strongest predictor of perceived benefits of tourism development, as it has the highest β value among the four factors. The results indicate that there is a significant relationship between the independent variables (IVs) and the dependent variable (DV). Specifically, a 1-unit increase in perceived benefits of tourism would correspond to an increase of 1 unit in Community Involvement ($B = 0.130$, $SE = 0.047$), two units in Community Gains ($B = 0.253$, $SE = 0.057$), and two units in Trust in Government ($B = 0.209$, $SE = 0.052$).

Thus, the new equation:

$$Y = 1.538 + 0.130 (CI) + 0.253(CG) + 0.209(TIG) + e$$

Y: Residents' Perceived benefits of tourism development

b_0 : The Interception or Constant Value

b_1 : Community Involvement unstandardized coefficients value X_1 : (CI) The Community Involvement Slope

b_2 : Community Gains unstandardized coefficients value X_2 : (CIG) The Community Gains Slope

b_3 : Trust in Government coefficients value X_3 : (CIG) Trust in Government Slope

e: The error terms

Firstly, there is a significant positive relationship between community involvement and the perceived benefits of tourism development ($\beta = 0.158$, $p = 0.006 < 0.05$). This suggests that greater resident participation in tourism decision-making and planning leads to increased perceived benefits from tourism. Additionally, a strong, positive correlation exists between community gains and the perceived benefits of tourism development ($\beta = 0.281$, $p = 0.000 < 0.05$), indicating that the more the residents and their community benefit, the more positively they view tourism development. Lastly, trust in the government also shows a significant and strong relationship with the perceived benefits of tourism development ($\beta = 0.234$, $p = 0.000 < 0.05$). This finding implies that the more residents trust their government, the more they believe that tourism will be managed well and bring substantial benefits to them. On the other hand, community attachment does not show a significant correlation with the perceived benefits of tourism development in the Longmen Grottoes community ($\beta = 0.097$, $p = 0.062 > 0.05$).

Table 4: Results of multiple regression analysis of perceived benefit of tourism development.

Variables	Unstandardised Beta (<i>B</i>)	Std. Error	Standardised Coefficients Beta (<i>β</i>)	t	p
Perceived benefits of tourism development					
Constant	1.538	0.163		9.450	0.000
CA	0.087	0.047	0.097	1.870	0.062
CI	0.130	0.047	0.158	2.763	0.006
CG	0.253	0.057	0.281	4.454	0.000
TIG	0.209	0.052	0.234	3.992	0.000
Model summary: $R^2=0.440$ Durbin-Watson=2.065 F -value=75.322 $p=0.000$					

Residents' Support for Tourism Development

This study also assessed the level of local support for tourism development at Longmen Grottoes. A 5-point Likert scale was used, with five statements measuring the residents' support levels, ranging from low to high. The findings were analysed based on the mean score for local support for tourism. As shown in Table 5, the mean scores for each statement ranged from 4.24 to 4.30, indicating that most local residents support tourism development at Longmen Grottoes.

Table 5: Descriptive analysis of residents' support for tourism development

No.	Statements	M	SD
a	I believe that tourism should be actively encouraged in my community.	4.24	0.691
b	I support developing new tourist facilities to attract more tourists to Longmen Grottoes.	4.24	0.730
c	I support the local authorities' policies and decisions about tourism development.	4.30	0.692
d	I support tourism and would like it to become an important part of my community.	4.24	0.730

Note: M = mean value; SD= standard deviation 1= strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree

Multiple regression analysis examined the influence of perceived advantages and community support on tourism development. Based on Table 6, the perceived benefits statistically substantially predict residents' support for tourism development (F -value = 129.958, $p < 0.05$). The results can be computed to the predicted line of regression equation:

$$[Y = b_0 + b_1 (X_1) + e]$$

As indicated in Table 6, there is a significant positive relationship between residents' support for tourism development and their perceived benefits

($r = 0.524$, $p < 0.05$). This suggests that the more benefits residents perceive from tourism, the greater their support for its development. Additionally, the analysis shows that for each 1-unit change in perceived benefits, residents' support for tourism development increases by five units ($B = 0.524$, $SE = 0.064$).

$$Y = 2.030 + 0.524(\text{PBSD}) + e$$

Y: Residents' Support for Tourism Development

b_0 : The Interception or Constant Value

b_1 : Perceived benefits of tourism development unstandardized coefficients value X_1 : (PBSD) Perceived benefits of Tourism Development Slope

e: The error terms

Table 6: Findings from a multiple regression study of development support for tourism

Variables	Unstandardised Beta (B)	Std. Error	Standardised Coefficients Beta (β)	t	p
Residents' support for tourism development					
Constant	2.030	0.197		10.286	0.000
PBSD	0.524	0.046	0.506	11.400	0.000
Model summary: $R^2=0.254$ Durbin-Watson=2.023 F-value=129.958 $p=0.000$					

CONCLUSION

This study investigates the four factors that influence residents' perceptions of the benefits of tourism development. The primary aim is to determine the relationship between these factors and the perceived benefits of tourism, as well as the connection between these benefits and residents' support for tourism growth in Longmen Grottoes. The findings offer valuable insights for local government authorities responsible for tourism management. The results highlight the importance of community factors and government roles in promoting tourism development in Longmen Grottoes. It is recommended that the tourism development plans align with or enhance residents' views of their community to positively impact their perception of tourism's benefits and foster support for its growth. This study provides valuable insights but has certain limitations that future research could address. Firstly, it focused solely on a community near a World Heritage Site, highlighting the need to explore a broader range of community types. Furthermore, future studies should consider using qualitative methods to capture a more comprehensive understanding of residents' support for tourism development, their perceived benefits, and potential conflicting views on sustainable economic tourism (SET).

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UNDERSTANDING THE DYNAMICS OF SPORT TOURISM ON ISLANDS: CHALLENGES AND STRATEGIC PLANNING FROM EVENT ORGANIZERS' PERSPECTIVES

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Abstract

This study explores the challenges event organizers face in managing sporting events on island destinations and highlights the need for strategic planning to address unique logistical and operational issues. The qualitative research was conducted through semi-structured interviews with selected Malaysian sporting event organizers. The study found that the available tourism ecosystem, favorable destination image, accessibility, and sporting facilities availability are the key elements a sports tourism destination must have and are preferred by event organizers. In terms of challenges, organizing sporting events on islands involves overcoming logistical constraints, environmental impacts, high costs, and the need for cultural sensitivity, emphasizing careful planning and local engagement. The study's findings illuminate the importance of a comprehensive understanding of the tourism ecosystem, destination image, accessibility, and sporting facilities in shaping a thriving sports tourism destination in an island setting.

Keywords: Sport Tourism; Island Destinations; Event Organizers; Event hosting

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INTRODUCTION

Tourism and sports are increasingly recognized as interconnected forces driving economic growth and job creation for local communities and nations (Greenwell et al., 2024). This relationship extends beyond economics to social and cultural domains, with sporting events fostering cultural exchange and diversity (Tasci et al., 2018). Integrating sports into tourism enhances destination appeal and attracts a diverse range of travelers (Koenig-Lewis et al., 2018). Although sports and tourism were once seen as separate, has spurred significant scholarly interest and numerous studies (see Ahmad et al., 2019; Moradi et al., 2023; Teixeira et al., 2023).

These events are characterized by extended duration, extensive media coverage, diverse sponsorship, and economic opportunities for locals, offer substantial advantages to destinations (Ibrahim et al., 2016). As a result, the destination gains enhanced city visibility and a stronger image through event sponsorships while also tapping into revenue potential from participants and spectators (Getz & Page, 2016). Evidently, recent studies emphasize the importance of service quality and spectator satisfaction in devising effective marketing strategies for host cities (Chen et al., 2023; Mair et al., 2023).

Islands possess unique characteristics and challenges that differentiate them from mainland destinations. Despite its popularity, limited academic studies have explored sports event organizers' selection and promotion strategies on islands. A few existing studies focus on sports tourists' perceptions and the influence of sports tourism development on the island population (Hamdan & Yusof, 2014; Khor et al., 2015). As such, studying sports tourism within an island setting offers significant insights into tourism and sporting event dynamics.

Research highlights the need for specialized strategies in managing sports tourism on islands due to their geographical limitations and environmental considerations (Alsawafi, 2017; Tzetzis et al., 2014). Developing sustainable tourism practices that preserve natural beauty and cultural heritage is crucial for island destinations (Van Rheenen et al., 2024). Furthermore, islands often rely heavily on tourism as a primary economic driver, with sporting events strategically attracting international visitors and enhancing destination visibility (Van Rheenen et al., 2024). However, islands face unique infrastructure, transportation, and resource management challenges when hosting sporting events, necessitating effective partnerships and stakeholder collaboration (Kapareliotis & Voutsina, 2020).

Despite extensive research on sports tourism, literature exploring sports events from organizers' perspectives remains scant compared to participant-focused studies (Teixeira et al., 2023). Existing research primarily delves into the economic impacts of sports tourism, leaving a gap in understanding the planning and development strategies crucial for its success (see Koenig-Lewis et al., 2018;

Mascarenhas et al., 2024; Morfoulaki et al., 2023). Moreover, limited attention has been given to partnership dynamics and collaboration in organizing sporting events, particularly in islands (Pereira et al., 2020). This lack of comprehensive research hinders the formulation of effective policies and strategies for sustainable sports tourism development, especially in unique destinations like islands (Ziakas, 2023).

This study examines island unique perspectives and challenges in hosting sporting events. This study holds significant value in advancing our understanding of sports tourism within island contexts, a relatively underexplored area compared to mainstream sports tourism research. By focusing on islands, the study highlights unique challenges and opportunities that distinguish these destinations from mainland locations.

LITERATURE REVIEW

Sports events play a pivotal role as strategic instruments for drawing international visitors, leveraging their global appeal to elevate the prestige of destinations (Roche et al., 2013). These events generate economic benefits and contribute to societal well-being by fostering better psycho-social health among participants and spectators (Hunstdale, 2021). Effective management of sporting events is thus paramount, as it directly impacts visitor satisfaction and enhances the overall quality of the event experience (Teixeira et al., 2023).

Today, sports tourism has emerged as a catalyst for economic growth and employment opportunities in many countries (Manzoor et al., 2019). By attracting international visitors, sporting events stimulate the local economy through increased spending on accommodation, dining, transportation, and leisure activities. This influx of tourism revenue benefits businesses directly associated with the event, which affects the broader community, fostering job opportunities and supporting local enterprises (Getz & Page, 2016). Additionally, hosting prestigious sports events can boost destination awareness and attract future visitors seeking similar experiences (Moradi et al., 2023).

The symbiotic relationship between tourism and sports extends beyond financial gains, encompassing intangible benefits that enrich host communities. These benefits include heightened community spirit, national pride, cultural identity, increased sports participation, and an enhanced quality of life (Pfitzner & Koenigstorfer, 2016). However, hosting major sporting events also brings about significant social impacts on the host city, which can be positive or negative depending on event management and community engagement strategies (Moradi et al., 2023; Teixeira et al., 2023).

The allure of the positive impacts of sporting events has led to a growing trend among communities to vie for hosting rights (Gursoy et al., 2017a). This eagerness is mirrored by government officials and sports organizations, who

view these events as opportunities for economic growth and community engagement (Koenig-Lewis et al., 2018; Sant et al., 2019). Sporting events elicit emotional responses among attendees and stakeholders, fostering a sense of belonging and unity (Herstein & Berger, 2013; Puente-Díaz, 2018). They also contribute significantly to destination branding, tourism expenditure, and infrastructure development, making them attractive prospects for destination marketers and policymakers (Chen et al., 2023; Singh & Zhou, 2015; Puente-Díaz, 2018).

The planning and execution of mega sports events necessitate extensive infrastructural enhancements, from sports facilities to transportation networks (Snelgrove et al., 2008; Chen et al., 2018; Teixeira et al., 2023). These developments cater to the event's immediate needs and leave a lasting legacy for residents, enhancing the destination's overall appeal and competitiveness (Chen et al., 2023; Gursoy et al., 2017b; Eskiler et al., 2016). The optimistic image projection of host destinations through these events attracts academic interest, underscoring the need for deeper exploration of their impact on destination perception and visitor behavior (Kapareliotis & Voutsina, 2020; Tasci et al., 2018).

STUDY METHODOLOGY

This study employed an exploratory research design to gain insights into the challenges and benefits of organizing sporting events on islands. Using purposive sampling (Onwuegbuzie & Leech, 2015), it explored sports event organizers' perspectives, event types, and strategies to attract participants and sponsors. Semi-structured interviews were conducted to allow informants to express themselves freely (Creswell, 2014). Interview questions, adapted from Pouder et al. (2018), covered four sections (Table 1), including demographic profiles and key elements of island tourism as a sports destination. The interviews were done online to ensure the informants' health, safety and time constraints.

The study's informants are the Chief Executive Officer (CEO), the Chief Operating Officer (COO), a high-ranking officer with authority, and the owner of the sports organizing company. The informants must have experience hosting or handling medium-to large-scale (>500 participants) international sporting events on islands. Out of 23 invited companies, only 10 informants participated in this study. Notably, the data collection stopped at the saturation point (Bauer & Gaskell, 2011). Table 1 depicts the study informants' profiles.

Table 1: Study informants

No	Code	Job Title	Experience
1.	Informant 1	Founder	15 years
2.	Informant 2	Owner	17 years

No	Code	Job Title	Experience
3.	Informant 3	Founder	13 years
4.	Informant 4	Director	18 years
5.	Informant 5	Chief Executive Officer	11 years
6.	Informant 6	Owner / Founder	24 years
7.	Informant 7	Chief Executive Officer	12 years
8.	Informant 8	Chief Executive Officer	15 years
9.	Informant 9	Owner	16 years
10.	Informant 10	Head of Department	11 years

N=10

The interview data were transcribed and analyzed thematically (Braun & Clarke, 2006) to identify major themes from the informants' feedback. Pen portrait analysis was used for transcription, capturing not only the exact words but also significant details like hesitations and background noise to avoid bias. The transcripts were reviewed multiple times for accuracy, with audio recordings cross-checked. The data were then imported into NVivo Version 12.0 for coding, where themes and sub-themes were identified and appropriately categorized for interpretation.

STUDY FINDINGS

It is worthwhile to acknowledge that thematic analysis is utilized when interpreting the interview information (Flick, 2013). For consistency, the term 'informant' is used for all ten (10) selected individuals from different sports organizing companies. Four major themes emerged from the informants' responses: (i) Tourism Ecosystem, (ii) Destination Image, (iii) Accessibility, and (iv) Sporting Facilities and Services.

Key elements of a sporting island tourism destination

Tourism Ecosystem

The tourism ecosystem of a destination must provide comprehensive values that fulfill the objectives of sports events. Key informant remarks emphasized the importance of geographical suitability and the availability of necessary resources and services. For instance, one informant highlighted the necessity of evaluating the destination's suitability based on its geographical location for sports activities.

"...that's for sure...if we want to do an event, we must first evaluate what the destination can give us. So, the first thing we want to see is whether the destination is suitable or not in terms of its geographical location for us to do sports activities." (Informant 4)

“...most important that it has an international airport, it has the resources, international hotels, it has ground handling ability like in terms of logistic....it is a very good ecosystem in that sense, right.” (Informant 9)

These observations fit with the broader view of a tourism ecosystem, which includes key elements like international airports, diverse resources, top hotels, and efficient logistics. Together, these components create a vibrant tourism environment that enhances the appeal of a destination for sports event participants and spectators (Roche et al., 2013).

Destination Image

Destination image plays a crucial role in attracting participants to sports events, as it offers a unique destination experience beyond a mere city experience.

“I think organizing sports events on the island is more popular than in the big cities ...” (Informant 2)

“...if a sponsor were to come to me or an event organizer were to come to me and ask me which would be my prime location? I will always say island or remote areas. This is because I can provide a destination experience, which I cannot do in a city.” (Informant 8)

These insights highlight that a destination's image in sports events involves ambiance, natural beauty, local culture, and overall experience. This is key for event organizers and sponsors seeking venues that fit their brand and goals (Pfitzner & Koenigstorfer, 2016). An island's strong image, with its natural and cultural attractions, boosts its appeal and competitiveness in the global sports tourism market (Hua et al., 2019; Teixeira et al., 2023).

Accessibility

Accessibility is a critical factor for sports event organizers when selecting a destination. Informants noted that the airport and its global connectivity were significant advantages. Besides, the airport's proximity to key attractions further enhances the destination's accessibility.

“I think one of the most essential things for any island is it must have an international airport. It needs to be connected globally. (Informant 1)

“...Several island like Bali, Langkawi and Maldives uh, a perfect venue for sports tourism because of these three elements, the attraction, the facilities, and also the connectivity.” (Informant 3)

In my view, the destination must meet the requirements of any sporting event. For example, let's say, if we want to conduct a swimming event, the place must have swimming facilities or venues for people to swim such as pools, or beaches for that matter." (Informant 7)

The importance of accessibility extends beyond physical connectivity, including visa policies, ease of navigation within the destination, and inclusive facilities for diverse visitors. These factors collectively make a destination easily reachable and navigable, enhancing its appeal for sports tourism (Manzoor et al., 2019). Besides, this evolution reflects the broader impact of investing in sporting infrastructure, which stimulates local businesses, enhances destination appeal, and positions the location as a desirable hub for sports tourism. Effective alignment of sporting facilities with event hosting strategies ensures the success of individual events and fosters long-term destination growth and sustainability in the competitive sports tourism market (Chen et al., 2023).

The study findings align with the literature's emphasis on a robust tourism ecosystem, destination image, accessibility, and sporting facilities and services in shaping a successful sports tourism destination. Informants highlighted the significance of a vibrant tourism ecosystem, including factors such as international airports, diverse resources, international standard hotels, and efficient logistics. This resonates with the literature's emphasis on the holistic framework within which destinations operate, as articulated by Alsawafi (2017) and Tzetzis et al. (2014).

The informants' emphasis on destination image and the ability to offer a comprehensive destination experience reinforces the literature's discussion on the positive influence of hosting sporting events on a destination's image and visibility (Tasci et al., 2018; Getz & Page, 2016). Additionally, the importance of accessibility and well-equipped sporting facilities aligns with the literature's focus on specialized strategies and infrastructure needs for managing sports tourism on islands (Alsawafi, 2017).

Challenges of Organizing Sport Tourism Events on Islands

Organizing sporting events on islands presents a unique set of challenges that intertwine with the distinctive characteristics of such locations. One of the primary challenges identified is maintaining environmental sustainability. Islands often possess fragile ecosystems that large-scale events can significantly impact (Hernández-Delgado, 2015). As such, Event organizers must implement rigorous environmental management practices to mitigate negative impacts, including waste management and habitat protection.

Logistical issues are another significant challenge. Islands may have limited infrastructure, which can affect transportation, accommodation, and event setup. For example, the Bali Marathon has highlighted the difficulties in

managing transportation logistics and ensuring adequate accommodation for participants and spectators (Burbano & Meredith, 2021). This issue necessitates careful planning and coordination with local authorities to address infrastructure limitations.

Cultural sensitivity is crucial when organizing events on islands (Li et al., 2021). Integrating local customs and practices into event planning can enhance community support and participant experience. For example, the Caribbean Island of Saint Lucia incorporates local festivals and traditions into its annual Saint Lucia Jazz Festival, creating a culturally immersive experience that aligns with the island's heritage (McKay, 2020). Failure to respect local culture can lead to tensions and reduced community engagement.

Sporting events on islands can have significant economic implications (González-García et al., 2022). They can drive tourism, generate revenue, and create employment opportunities. However, the economic benefits must be balanced with potential costs, including environmental degradation and infrastructure strain (Ziakas, 2023). A study of the Seychelles International Fishing Competition illustrates how such events can stimulate local economies but also require careful management to ensure long-term sustainability (Cockerell & Jones, 2021).

The study identifies several key challenges faced by event organizers on islands, with a particular emphasis on logistical constraints, environmental impacts, economic factors, community and cultural considerations, and weather and climate conditions.

Transportation

Islands often grapple with transportation challenges due to limited infrastructure. The dependency on ferries, restricted flight options, and congested roads can impede the efficient movement of participants, spectators, and equipment. The informants corroborate this perspective:

“Coordinating transportation is a nightmare. With only a few main roads and limited ferry services, getting everyone and everything where it needs to be on time is a constant struggle.” (Informant 3)

“The cost of chartering additional ferries and organizing shuttle services for large events can skyrocket. This affects the event's budget and its overall feasibility.” (Informant 6)

A third interviewee further illustrates the logistical burden:

"We had some experience dealing with long delays because of the limited number of flights available. Participants were stuck in transit, which created a cascade of issues leading up to the event." (Informant 8)

Accommodation

Accommodation presents another significant hurdle. High tourist demand often results in limited room availability and inflated prices, complicating securing affordable lodging for event participants. According to the interviewees:

"Finding enough rooms at reasonable rates is nearly impossible during peak tourist season. We had to negotiate heavily and sometimes even settle for less ideal options." (Informant 1)

"We ended up overbooking several hotels just to accommodate our guests. This caused dissatisfaction and logistical nightmares." (Informant 2)

"Accommodation shortages directly impact our ability to attract international participants. When people can't find a place to stay, it discourages them from attending." (Informant 5)

Waste Management

Managing waste generated by large crowds is a critical issue. Many islands lack adequate infrastructure for efficient waste disposal and recycling. Below are the verbatim responses from the informants:

"Disposing of waste effectively on an island can be a logistical nightmare. Limited facilities mean that even small events can lead to significant environmental issues." (Informant 5)

"The local waste management infrastructure is not equipped to handle the volume generated by our event. We had to bring in additional resources, which was both costly and challenging." (Informant 8)

"Planning for waste management from the outset is essential. We had to engage with local authorities and implement robust waste reduction strategies to avoid overwhelming local systems." (Informant 10)

Economic Factors

Organizing events on islands often entails higher costs due to transportation expenses and limited local production. Besides, securing sponsorship and funding can be more demanding on islands due to their isolation and limited corporate presence. Below are the verbatim responses from the informants:

“The cost of importing goods and services to an island drives up our budget significantly. We have to be extremely diligent about cost management to stay within our financial limits.” (Informant 3)

“The logistical costs are magnified on islands. From transporting equipment to sourcing materials, every aspect of the event incurs higher expenses.” (Informant 4).

“Securing adequate funding is challenging. Many sponsors are reluctant to invest in island-based events due to perceived risks and higher costs.” (Informant 6)

“The geographic isolation of islands often makes them less attractive to major sponsors. We have to work harder to convince them of the event's value.” (Informant 7)

“We have to explore diverse funding sources and engage with local businesses to fill the gap left by larger corporate sponsors.” (Informant 9)

“Local sponsorship opportunities are limited. We often rely on small businesses and community-based funding, which can be unpredictable and insufficient.” (Informant 10)

Local Community Support

Gaining the support of local communities is crucial. Residents may oppose large events due to noise, congestion, and disruption concerns. Besides, respecting local customs and traditions requires careful planning and engagement with local stakeholders. The informants highlighted several legit issues:

“Community opposition is a real challenge. Local residents often feel that the noise and congestion from events disrupt their daily lives and affect their quality of life.” (Informant 1)

“Building positive relationships with local communities is essential. We have to ensure that the benefits of the event are visible and tangible for residents.” (Informant 2)

“Effective communication and community engagement strategies are key to minimizing opposition. We need to address concerns and demonstrate the positive impacts of the event.” (Informant 4)

“Cultural sensitivity is critical. We need to ensure that our events respect local traditions and practices to avoid offending residents and stakeholders.” (Informant 5)

“Incorporating local cultural elements into the event can enhance its appeal and foster positive relations with the community.” (Informant 7)

“Working with local cultural consultants helps us navigate the complexities of local traditions and ensures that our events are both respectful and engaging.” (Informant 8)

Weather and Climate

Islands are often subject to unpredictable weather conditions, including storms and hurricanes. This can disrupt plans and pose safety risks. The informants highlighted several concerns:

“Unpredictable weather is a major risk factor. Storms and heavy rains can severely impact our event schedule and pose safety risks for participants and spectators.” (Informant 5)

“We always have contingency plans in place for adverse weather. However, even with planning, unpredictable conditions can cause significant disruptions.” (Informant 9)

“Climate change is increasing the frequency and severity of extreme weather events. This adds another layer of complexity to our event planning and risk management.” (Informant 10)

The study highlights that logistical constraints and environmental concerns are primary challenges for event organizers on islands. Specifically, it identifies the high costs associated with transportation and accommodation as major financial burdens. Additionally, it focuses on the critical need for sustainable waste management practices to mitigate environmental impacts. The qualitative data reveal that these challenges are compounded by the need for community support and cultural sensitivity, which are often more pronounced in island settings.

The high costs associated with transportation and accommodation are identified as major financial burdens. Additionally, sustainable waste management practices are crucial to mitigating environmental impacts. Community support and cultural sensitivity are emphasized as critical factors in the success of such events. The findings align with existing literature, which highlights logistical and environmental challenges. Perkumienė et al. (2020) address transportation and accommodation issues as key logistical hurdles in island settings. Van Rheenen et al. (2024) and Makoondlall-Chadee et al. (2024) underscore the importance of environmental sustainability, particularly on ecologically sensitive islands. This study contributes to the literature by emphasizing community and cultural considerations more strongly than previous

research. Walters et al. (2021) acknowledge community support is growing significance in the context of island events, suggesting a heightened awareness of the need for cultural sensitivity and community engagement.

STUDY IMPLICATIONS

The study offers key insights for advancing sports tourism, particularly in island destinations. It highlights the need to understand the tourism ecosystem, including factors like airports, resources, and service standards, to boost destination competitiveness. It also emphasizes the importance of destination image, accessibility, and quality facilities in attracting sports tourism. Furthermore, it outlines the critical role of environmental sustainability in managing sporting events on ecologically sensitive islands. The study suggests integrating ecological impact assessments and community engagement into event management theories.

For industry stakeholders, the findings emphasize the importance of utilizing insights from the tourism ecosystem to boost the attractiveness of destinations through strategic infrastructure development and targeted marketing efforts. Ongoing investment in both facilities and service quality remains crucial. Event organizers are encouraged to tackle logistical challenges by working closely with local authorities to improve infrastructure. Successful events hinge on effective environmental management and robust community relations, both of which are key to maintaining the destination's appeal and viability.

CONCLUSION

The study provides valuable insights into the complexities of sports tourism on islands, contributing to the existing literature by identifying key success factors and emerging sports segments. This is particularly crucial for strategizing sustainable development aimed at long-term viability, as highlighted by the need for a comprehensive understanding of the interplay between sports tourism and local socio-economic dynamics (Azinuddin et al., 2023a; 2023b; González-García et al., 2022). The integration of these findings enhances the understanding of decision-making processes for sports tourism stakeholders, emphasizing the importance of destination competitiveness and the well-being of residents in small island contexts (Moradi et al., 2022). However, a significant gap remains in comprehending the organization of sporting events on islands. This gap highlights the necessity for further research into the unique challenges faced by these destinations, including social and cultural aspects, partnerships, and comparative analyses of different island contexts (Morfoulaki et al., 2023). Addressing these areas will enrich the academic discourse and provide practical insights for policymakers and stakeholders involved in sports tourism development (Yang et al., 2020).

Apart from this, no study is completely free of limitations. The first limitation is the study's sample size. The research was limited to only the top event organizers from different companies and only those hosting or managing medium- to large-scale international sporting events. Hence, the concern of whether the findings would be the same or different if the sports event organizers were further diversified from other backgrounds or locations arises to achieve significant results. Because of this limitation, the research results should be interpreted carefully because they will not represent the whole population of Malaysian sports event organizers. Besides, this study is limited to one single destination. Hence, there is a need for more comparative research on the organization of sporting events in different islands. This would allow for a better understanding of the factors that contribute to successful sports events and the challenges that are unique to different island contexts.

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A QUALITATIVE STUDY ON THE FACTORS INFLUENCING SOCIAL COHESION IN MUSCAT, OMAN

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Abstract

Social cohesion, which refers to connectedness and solidarity among groups in society, is crucial to achieving an inclusive and sustainable development. However, social cohesion is influenced by various factors that can be either physical or non-physical. Given the limited studies on promoting social cohesion in Oman, this research adopts a qualitative approach to identify those urban physical factors that influence social cohesion in the governorate of Muscat. Data were collected via semi-structured interviews with 12 experts in relevant fields in Oman. By reviewing government initiatives aimed at enhancing social cohesion, this study highlights the importance of health and education infrastructure, community and open spaces, affordable housing, and walkable neighborhoods in promoting social interaction and cohesion. Through a thematic analysis, this study identified 31 codes and 8 themes, namely, 1) land use and connectivity, 2) community and open spaces, 3) activity centers, 4) affordable housing, 5) access to facilities, 6) porous boundaries, 7) health and education infrastructure, and 8) walkable neighborhoods. The findings of this study provide nuanced insights into the interplay between social cohesion and urban physical factors and offer valuable perspectives for policymakers, urban planners, and stakeholders involved in sustainable urban development in Muscat.

Keywords: Social cohesion, Physical factors, Muscat, Social sustainability, Smart city

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INTRODUCTION

Social cohesiveness has become a significant priority for policymakers, scholars, and practitioners in recent decades as social structures have developed and shifted away from mere economic growth considerations and toward a holistic societal well-being (Castanho Silva, 2015; Kapoor et al., 2017; Mac Fadden et al., 2021; Moustakas, 2022). Social cohesiveness plays a critical role in achieving social sustainability in urban areas by enhancing the quality of life of their inhabitants (Zhang et al., 2021). Neighborhood architecture and design may also significantly contribute to promoting social cohesion (Mouratidis & Poortinga, 2020).

However, the extant policies for promoting social cohesiveness face several challenges due to the lack of a precise definition and analytical framework (Khaile et al., 2022). Social cohesion and sustainability can also be significantly influenced by neighborhood quality and social interaction (Liu et al., 2020; Narimah et al., 2024). Fostering social cohesiveness is essential in accomplishing social sustainability goals by enabling communities to flourish peacefully while preserving the values of justice, equality, and social well-being (Fatourehchi & Zarghami, 2020). The process of contextualization is also crucial due to the regional variations and wide array of elements involved in promoting social unity across nations.

The Omani society underwent a dramatic transition from a traditional, conservative society to a modern one as the country started to embrace globalization and introduce improvements in education, living standards, job market access, mass media, and communication (Al-Barwani & Albeely, 2013). The influence of globalization on individuals, families, and societies is noteworthy, spanning their employment, working conditions, income, social protection, culture, identity, inclusion/exclusion, and societal cohesiveness. Al-Barwani and Albeely (2013) identified two threats to Omani family cohesion, namely, internal threats (e.g., lack of democratic values and practices, lack of commitment to family roles, lack of cooperation and support among members, inflexible decision-making processes, and self-centeredness) and external threats (e.g., economic circumstances, social factors, peer pressure, media exposure, and global consumerism). They believed that having a strong cohesiveness will help Omani families face future difficulties. However, social cohesion in Oman has received limited research attention. According to Moustakas (2023), the literature on social cohesion has not shed much light on two key areas, namely, the neglect of governance and formal institutions and the idea of shared values. Therefore, a comparative analysis of these factors should be conducted across different cultural and geographical settings, and their policy implications warrant further exploration. Clarke et al. (2023) also highlighted some gaps in the present understanding of social cohesion and urban green spaces, with most studies focusing on developed nations and lacking diverse perspectives. By addressing these deficiencies, researchers can improve the current understanding of social

cohesion and encourage the creation of highly inclusive and resilient communities.

This study aims to assess the influence of urban physical factors on promoting social cohesion in Muscat and to evaluate the effect of the implemented policies and interventions on enhancing social cohesion and achieving social sustainability in Muscat.

LITERATURE REVIEW

Definition and Conceptualization of Social Cohesion

Early notions about social cohesiveness can be traced back to the 14th century after Ibn-Haldun introduced the concept of *asabiyyah*, which emphasized group emotion and solidarity (Alatas, 2006; Dragolov et al., 2016; Hassan, 2006). Modern historians, such as Emile Durkheim, expanded on this notion and identified mechanical and organic solidarity as essential to preserving social order (Durkheim, 1922). Despite the ongoing debates on the definition of this concept, contemporary work tends to focus on narrow conceptualizations and emphasize essential features, such as social ties, identity, common good orientation, shared values, equality, and quality of life (Dragolov et al., 2016; Schiefer & van der Noll, 2017). One of the definitions of social cohesion was proposed by Clarke et al. (2023), who defined this concept as “the combined reasons for members to remain within a social group, and likely involves a mix of neighborhood attachment, trust, sense of community, and social interactions.”

Theoretical Perspectives on Social Cohesion

Previous studies have investigated social cohesion from multiple perspectives as detailed below.

1. **Historical and Sociological Perspectives:** Some studies have examined the historical roots of social cohesiveness using the 14th-century texts of Ibn-Haldun as its earliest formulation. These studies emphasize the contributions of several academics, including Durkheim and Georg Simmel. Durkheim’s distinction between mechanical and organic solidarity, together with Simmel’s observations on social interactions, provide fundamental sociological perspectives on social cohesiveness (Moustakas, 2023).
- 2- **Multidimensional Model perspective:** Some studies view social cohesiveness as a multidimensional construct and emphasize the significance of subjective impressions and objective behaviors in comprehending this concept. They define three levels of social cohesion, namely, macro, meso, and micro social cohesion, which represent relationships at the societal, group, and individual levels, respectively. This perspective emphasizes the complexities of social cohesiveness and its manifestation across many social circumstances (Lalot et al., 2022).

Factors Influencing Social Cohesion

Social cohesiveness is influenced by a variety of factors, including group structure, sense of belonging, money, education, globalization, diversity, and income disparity. Education and income are particularly important in improving social relationships and public awareness, but globalization and economic disparity may be damaging to cohesiveness (Larimian et al., 2020). Henderson et al. (2016) identified the following factors that influence social cohesion:

1. **Perceived Trust and Shared Values:** In a neighborhood environment, social cohesiveness is defined by people feeling linked to one another, trusting one another, and adhering to common norms.
2. **Physical Disorder and Perceived Safety:** Low-income areas have lower levels of social cohesiveness compared with higher-income neighborhoods, which might be attributed to high levels of physical disorder that results in feelings of a hazardous environment and isolation from neighbors.
3. **Neighborhood Incivilities:** Low-income communities have a larger concentration of neighborhood incivilities, which may influence the residents' social cohesiveness and perceived stress levels.
4. **Gender Differences:** The interaction between the social environment and mental health outcomes may change according to gender.

METHODOLOGY

Research Design

The adopted research design introduces a framework for analyzing social cohesion in Muscat at the individual, community, and institutional levels (Fonseca et al., 2019). This framework highlights the interdependencies among these levels and the necessity for compatible norms and values to foster social cohesion. Key factors at the community level include access to facilities, activity centers, affordable housing, and community and open spaces, key factors at the individual level include attitudes, behavior, and perceptions toward health and education infrastructure, and key factors at the institutional level include land use and connectivity, neighborhood barriers, and walkable neighborhoods as shown in Figure 1.

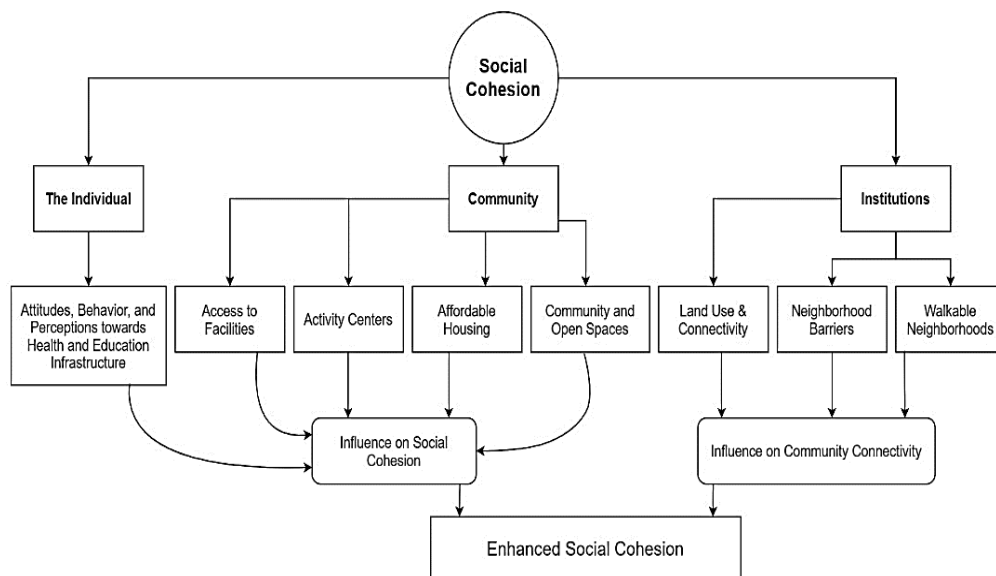


Figure 1: Conceptual framework.

Source: Moustakas, 2023; Sugandha et al., 2022; X. Fonseca et al., 2019

Study Area

The Muscat Governorate, the principal governorate of Oman located in the northern part of the country, covers a total area of 4,000 km² (Fig. 2). Muscat is the most populated governorate in Oman that accounts for 1.5 million of the 4.6 million people living in the country. This governorate has a population density of 325.6 people per km² (Amoatey et al., 2020; National Center for Statistics and Information, Sultanate of Oman, 2020).

Muscat's metropolitan area is bordered by the Oman Sea in the north and the Hajar mountain ranges in the south, and the built-up area in this region quadrupled over the past 30 years. Muscat is characterized by its functional division, with industrial districts and substantial residential regions occupying the gap between historic port cities and oasis communities. The new residential neighborhoods have free-standing homes on plots that are often enclosed by high-rising walls. This architectural form is radically antithetical to societal norms and to the traditional Omani culture. This form also results in an extensive utilization of space that may trigger functional segregation and extend travel distances (Scholz & Langer, 2019).

Oman's socioeconomic environment is characterized by a combination of factors, including shifts in its demographics, infrastructure, healthcare, and education systems. This country is home to 2,938,452 million young individuals, which introduce difficulties in controlling Oman's growing urbanization and the

migration of rural population to metropolitan areas (Oman's Ministry of Economy, 2020; The Education Council, 2018).

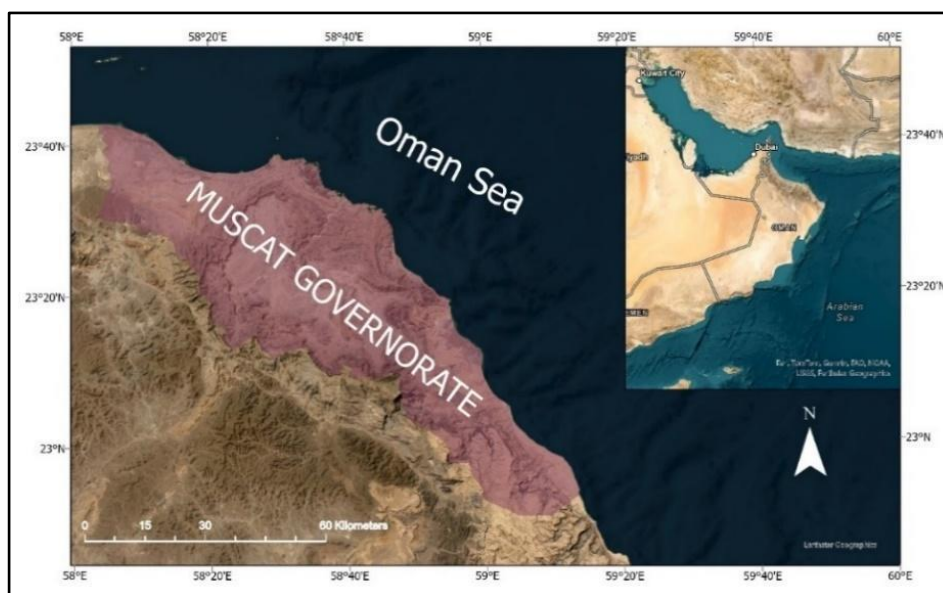


Figure 2: Map showing the location of Muscat.

Source: Authors, using ArcGIS Pro

Improvements in living standards and economic growth greatly depend on infrastructure development. The goal of Oman's investments in housing, utilities, telecommunications, and transportation is to promote sustainable growth and regional integration (Al-Hinai et al., 2024). The country's social policies prioritize justice, equality, and social cohesion and focus on welfare programs, such as healthcare, education, and social safety nets for diverse populations. Vision 2040 aims to promote well-being and offer social protection for all residents aside from focusing on social justice, high-quality services, and building social safety nets for future generations (Oman's Ministry of Economy, 2020).

Data Collection

This study applied a qualitative approach to investigate the influence of urban physical factors on social cohesiveness in Muscat. This approach allows for an in-depth examination of individuals' viewpoints, experiences, and meanings attached to social connections and interactions (Kurtenbach, 2024). A total of 12 urban planning experts were interviewed from October to November 2023. These participants were asked 17 questions regarding physical infrastructure factors. The demographic information of these participants are tabulated in Table 1.

Table 1: Demographic information of the participants.

Code	Position	Gender	Age	Education background	Professional background (Years)
P1	The Ministry of Transport, Communications, and Information Technology	Female	38	Master	16
P2	The Ministry of Housing and Urban Planning	Female	44	PhD	20
P3	Muscat Municipality	Male	44	Bachelor's	22
P4	Petroleum Development Oman (PDO)	Male	51	PhD	27
P5	The Ministry of Housing and Urban Planning	Male	44	Master	20
P6	PDO	Male	47	Master	23
P7	C3 Advisory	Female	40	Master	18
P8	Muscat Municipality	Male	50	Bachelor's	22
P9	Sultan Qaboos University	Female	38	PhD	17
P10	Muscat Municipality	Male	53	Bachelor's	31
P11	PDO	Male	40	Bachelor's	15
P12	Oman Medical Specialty Board	Male	52	PhD	27

Source: Data of interview consent form classified and arranged by author

Data Analysis

This study performed a thematic analysis based on the simple and conceptually flexible interpretive method of qualitative data analysis that enables the identification and exploration of patterns or themes within a given dataset. NVivo 14 was used for the thematic analysis.

RESULTS AND DISCUSSION

Themes Emerging from the Data Analysis

Eight themes related to physical infrastructure factors, namely, 1) land use and connectivity, 2) community and open spaces, 3) activity centers, 4) affordable housing, 5) access to facilities, 6) porous boundaries, 7) health and education infrastructure, and 8) walkable neighborhoods, were identified from the thematic analysis (Table 2).

Table 2: Themes related to physical infrastructure factors.

Themes	Files	References
Access to Facilities	12	41
Activity Centers	12	39
Affordable Housing	10	37
Community and Open Spaces	11	46

Themes	Files	References
Health and Education Infrastructure	12	88
Land Use and Connectivity	12	27
Porous Boundaries	11	35
Walkable Neighborhoods	12	52

Source: Author using NVivo 14

Attitudes, Behavior, and Perceptions Toward Health and Education Infrastructure

The participants highlighted how attitudes, behavior, and perceptions toward health and education infrastructure are influenced by certain factors, such as comparative perspectives, geographic proximity, and service quality. They also reached a consensus on the fundamental importance of health and education as pillars of society that are essential for societal development and productivity. Participant No. 5 said, *“It is considered of fundamental importance and is one of the main foundations in building any society as education and health are always the basic pillars in every society.”* In terms of behavior, proximity to health and education facilities influences behavior, and satisfaction varies according to location. Those individuals who are located closer to facilities tend to exhibit more positive behaviors. Participant No. 3 said, *“It is difficult to judge the behavior of community members. Some people are satisfied because of their proximity to these facilities, and there is another person who is not satisfied because the location of his home is far from those facilities.”* Participant Nos. 6, 7, and 9 highlighted the significant impact of service quality on behavior and perceptions. Satisfaction with high-quality services leads to acceptance and appreciation, while dissatisfaction with low-quality services may result in avoidance or seeking alternatives. Participant No. 9 said, *“If the health service provided is of high quality and I am satisfied with it, I will automatically feel internal satisfaction with this service.”*

Previous studies have emphasized the critical role of health and education infrastructure within city neighborhoods, with a particular focus on accessibility, quality of care, and resource availability (Bramley & Power, 2009; Landorf, 2011; Dempsey et al., 2008; Sugandha et al., 2022).

Impact of Access to Facilities on Social Interaction and Social Cohesion

Access to facilities in the neighborhood has a considerable influence on social interaction and cohesiveness. Participant Nos. 9 and 12 highlighted the importance of facilities, such as grocery stores, health centers, mosques, and schools, as places where community members can regularly interact and socialize with one another. Participant No. 12 said, *“This means that since we are in one neighborhood, we can meet in the grocery store, in the health center, in the mosque, or in school.”* Nevertheless, Participant No. 2 emphasized that ease of access to facilities significantly impacts social interaction. Having limited access,

such as requiring a car to reach facilities or the lack of pedestrian paths, can hinder people from meeting and interacting with one another. Participant No. 2 shared, *“Of course, it affects me greatly because, for example, if I must use a car to reach these facilities, this means that my opportunity to meet people is limited.”* With regard to the impact of access to facilities on social cohesion, Participant Nos. 3 and 4 noted that having easily accessible facilities within the neighborhood can foster social cohesion by providing opportunities for the community members to meet and interact with one another regularly. Participant No. 3 said, *“It affects your chances of meeting your neighbor or friend on the same path, thus affecting social cohesion.”*

These findings illustrate the significant impact of access to facilities on social interaction and social cohesion within communities, thus echoing the sentiments outlined in the literature (Alipour & Galal Ahmed, 2021; Sugandha et al., 2022).

Impact of Activity Centers on Social Cohesion and Engagement

Activity centers help promote social cohesiveness and involvement in communities by offering locations for events, meetings, and activities that bring the community members together.

Participant Nos. 3 and 9 emphasized the role of activity centers in fostering social cohesion through the organization of events and meetings that create opportunities for residents to interact, build familiarity, and strengthen their social bonds. Participant No. 3 said, *“Holding events in these facilities enhances the value of community cohesion by allowing community members to meet and familiarize themselves with one another.”* Other participants highlighted the importance of organizing diverse activities beyond sports to engage community members. Recreation and leisure activities serve as avenues for social interaction and engagement that bring residents together and foster their sense of community. Participant No. 8 said, *“Social cohesion is achieved through activities other than sports, of course, as they bring together a specific group. Recreation brings residents together for interaction.”*

These findings underscore the significance of activity centers in enhancing social cohesion and engagement, thus corroborating the emphasis of previous studies on community involvement and inclusivity (Larimian et al., 2020).

Influence of initiatives and measures on affordable housing

Participant Nos. 3 and 9 noted that recent initiatives have increased the number of housing options in the community, thus allowing individuals from various income groups to access affordable housing. Participant No. 3 said, *“It affected the quantity of available housing options.”* While some participants acknowledged these initiatives, they highlighted the need to assess the impact of

these initiatives following their implementation to determine their effectiveness in addressing the issue of affordable housing. Participant No. 2 said, “*We are currently in the implementation phase, but the impact of these initiatives can be measured after the implementation.*” Participant Nos. 6 and 9 anticipated significant positive impacts from these initiatives, including social stability, community satisfaction, increased productivity, and reduced societal burdens.

Previous studies have highlighted the relevance of housing diversity and quantity in fostering social sustainability within cities. For instance, Larimian et al. (2020) emphasized the need to provide a variety of housing alternatives, including inexpensive housing, to promote social inclusion and equity.

Policies and Interventions on Community and Open Spaces

Community and open space policies and initiatives seek to promote community engagement, improve open space quality, and encourage community connection and cohesiveness. Participant No. 12 argued that community participation is crucial to the success of interventions in open spaces and argued that instilling a sense of importance among residents for these spaces is vital to foster community involvement. This participant shared, “*Community participation is considered very important, but no community participation will arise when the importance of this space is not well understood.*” This statement echoes the emphasis of Sugandha et al. (2022) and Chen et al. (2024) on community engagement. Participant No. 2 highlighted the Vibrant Public Places Initiative, which aims to encourage community involvement in enhancing open spaces. This initiative involves certain activities, such as planting trees and developing parks, and encourages collaboration between government authorities and residents. Participant No. 2 shared, “*The Vibrant Public Places Initiative includes more than one aspect to encourage the community to plant trees... through the Owners Association platform on the Ministry’s website.*” Shirazi and Keivani (2018) argued that government policies on improving pedestrian walkways match the wider goal of boosting community contact and cohesiveness, which leads to the establishment of lively and sustainable landscapes. Government policies also focus on increasing the number of pedestrian paths in urban areas to promote community interaction and cohesion, which aligns with the Ministry of Health’s policy to create a vibrant, sustainable environment. Participant No. said, “*The trend in policies for public facilities is geared toward implementing walking paths in Muscat... The more the number of these facilities increases, the greater the interaction and community cohesion.*”

Integration Between Physical and Social Aspects of Land Use and Connectivity

A lack of integration is generally observed between physical and social factors in urban planning and land use plans that focus on accommodating an increasing

population instead of addressing social requirements. Some participants expressed their concerns regarding the lack of recreational facilities, social gathering areas, and community amenities in urban development projects. For instance, Participant Nos. 11 and 8 were dissatisfied with the lack of consideration for social aspects in urban planning and land use plans as they solely focused on accommodating the population without addressing recreational facilities and community needs. Participant No. 11 said, “*As for urban planning and land use plans in Muscat, they did not consider the social aspects sufficiently... without considering other aspects and recreational facilities for the community.*” Meanwhile, Participant Nos. 3 and 4 highlighted the lack of integration between physical and social aspects in land use planning and urban development. According to Participant No. 3, “*There is no integration.*” However, Participant No. 9 mentioned some community-driven efforts to create social gathering spaces and meet the diverse social needs within residential neighborhoods, which points to a gap in the formal planning and provision of such spaces. Participant No. 9 said, “*They were not able, in all honesty, even in the Muscat Governorate, to provide services or create a land use law and tool to support various social aspects... the community itself... tries as much as possible to organize these gatherings.*”

The findings from Participant Nos. 3, 4, 8, 9, and 11 on the integration of physical and social aspects of land use and connectivity are consistent with the findings from the literature, particularly related to compactness, service density, and diverse land use configurations (Alipour & Galal Ahmed, 2021; Larimian et al., 2020).

Physical and Metaphorical Barriers in the Neighborhood

Participant Nos. 3 and 6 suggest that metaphorical barriers, such as work location and housing affordability, have a greater influence on neighborhood choices compared with physical barriers. However, these barriers may have been significant in the past but are less of a concern now due to improved transportation and communication. Participant No. 6 said, “*The non-physical (metaphorical) barriers are now not a priority for the population... working conditions and proximity have become a priority.*”

Physical barriers (e.g., walls around houses) exist in Muscat, and gated neighborhoods are mainly observed in private or tourist projects for security purposes. Except for these gated communities, most neighborhoods in Muscat are described as open and accessible to everyone, thereby promoting community cohesion. Participant No. 6 said, “*Most of Muscat’s neighborhoods are open and do not have barriers.*”

The openness and accessibility of these neighborhoods help boost community engagement and togetherness. The viewpoints of Participant Nos. 3, 4, and 6 are consistent with the literature (Shirazi & Keivani, 2018; Sugandha et

al., 2022) and emphasize the changing dynamics of urban design. Previous studies have also underscored the importance of social mix and diverse land use configurations for inclusive communities.

Promoting Walkability in Neighborhoods

Pedestrian paths and walkways improve walkability in neighborhoods, which helps promote community cohesiveness, accessibility, and physical activity. The presence of pedestrian infrastructure naturally encourages inhabitants to stroll, thus promoting a sense of well-being and contributing to community health, which aligns with principles outlined in the literature (Appolloni et al., 2019; D'Orso & Migliore, 2020; Fonseca et al., 2022; Sugandha et al., 2022). Participant Nos. 1 and 11 stressed the importance of pedestrian paths in enhancing community participation, acquaintance, and cohesion. They argued that the availability of these paths naturally encourages residents to use them without the need for legislation. Participant No. 11 said, *"This comes naturally. When you find a walking path, you will go directly to it... Just implement it and you will see the result."* Pedestrian paths also significantly contribute to accessibility for various groups, including those with special needs and the elderly. They provide a means for walking, cycling, and using strollers or wheelchairs. Participant No. 4 said, *"Yes, it contributes very greatly... whoever has a wheelchair can use it."* In addition, Participant Nos. 5, 8, and 9 mentioned that pedestrian paths and sidewalks encourage residents to walk spontaneously, thus promoting physical activity and well-being. They serve as a refuge and tool that drives people to walk. Participant No. 8 said, *"These paths and sidewalks contribute to enhancing the residents' ability to walk... they encourage residents to walk spontaneously."*

CONCLUSION

Using a qualitative approach, this study explores how urban physical factors foster social cohesion in Muscat. Health and education are widely recognized as societal pillars that are essential for societal development. Certain facilities, such as grocery stores, health centers, mosques, and schools, are important areas where community members can interact and socialize with one another. Activity centers foster social cohesion by holding events that unite different community groups. However, Muscat lacks a variety of these centers, and their distribution across neighborhoods is highly uneven. Nevertheless, some initiatives have been launched to increase the number of housing options, thereby providing additional opportunities for individuals from various income groups to afford housing. Community members are also becoming increasingly aware of the importance of open spaces in bringing them together. Muscat also lacks integration between physical and social factors in its urban planning and land use plans, thus creating a gap in the governorate's urban planning. Metaphorical barriers, such as work

location and housing affordability, have a greater influence on neighborhood choices compared with physical barriers, and most neighborhoods in Muscat are characterized as open and accessible to everyone, thus promoting community cohesion. Pedestrian paths are undoubtedly critical to enhancing community participation, acquaintance, and cohesion. However, Muscat lacks pedestrian walkways in its neighborhoods. This research contributes insights into social sustainability and social cohesion in Muscat, which have been neglected during its stages of urban planning.

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THE MODERATING INFLUENCE OF DOMESTIC TRAVELER PERCEIVED RISK IN FAMILY TOURISM

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Abstract

Risk is fundamental in the choice evaluation and behaviour of tourists. Understanding tourists' shifting preferences towards a destination is imperative in the post-COVID era. Compared to other types of tourism, literature on family tourism travel behaviour has been limited, especially for outbound family tourists shifting to domestic destinations for holidays. This study used 220 samples for data analysis with Smart PLS 4.0. The findings show that perceived destination image directly affects the intention to travel domestically. The perceived risk significantly moderates this relationship. Enhancing the destination's image by emphasising its unique qualities and mitigating unfavourable conditions by establishing a secure environment is crucial.

Keywords: Family travel, travel motivation, perceived destination image, perceived risk, intention to travel domestically

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INTRODUCTION

The tourism industry has witnessed a growing emphasis on family tourism in recent years. Family tourism has emerged as a substantial and constantly expanding market for 30% of worldwide leisure travel. Family travellers represent more than one-third of all leisure travellers in the United States (World Metrics, 2023). According to Expert Market Research (2024), family tourism expenditures are projected to grow at a compound annual growth rate of 4.7% until 2032. Its growth rates are expected to exceed those of other essential components of customer operations in the tourism industry (Li et al., 2020). It encompasses travelling and embarking on holiday adventures with family members for leisure, recreation, and bonding. They indicate that families are a key market segment for tourist destinations, as they make up a significant proportion of leisure travellers in many countries. This highlights the family's role in fostering interest in tourism-related activities, allowing family members to participate in leisure and tourism (Hassan, 2021).

Understanding how perceived risk influences the relationship between family travel motivation, family-perceived destination image, and the intention to travel for family tourism can provide valuable insights for destination marketers and policymakers. The perceived risk associated with a destination has been identified as a significant moderating factor in the relationship between these variables. Perceived risk, which can encompass concerns about safety, security, and potential negative experiences, can influence an individual's willingness to travel to a particular destination.

Thus, this study adopts the concepts of travel motivation and perceived destination image to examine their effect on behavioural intention, defined as the intention to travel domestically. Additionally, risk perception is hypothesised to moderate the relationship between family-perceived destination image and intention to travel domestically.

LITERATURE REVIEW

Family Travel Motivation and Intention to Travel Domestically

The concept of travel motivation and intention to travel are critical factors that influence individuals' decisions to embark on trips to specific destinations. According to Douglas (2024), travel motivation stems from a desire to take leisure vacations to reduce stress, enjoy nature, admire beautiful landscapes, and learn new things. This can be influenced by internal factors such as personal desires, aspirations, and interests and external factors like cultural attractions, natural landscapes, or social influences (Hin et al., 2024). The concepts of push and pull motivation, as defined by Crompton (1979), suggest that people are pulled to specific destinations by external factors and pushed to travel by internal factors. Push factors refer to the socio-psychological motivations that encourage

people to travel, originating from intrinsic human desires. In contrast, pull factors attract individuals to a particular destination once they have decided to travel.

Nowadays, families view vacationing as a chance to spend quality time and strengthen bonds, resulting in increased happiness and togetherness (Schänzel, 2021). Such trips provide children's education and learning opportunities and create positive memories. Escaping the daily routine and nurturing familial relationships are also crucial aspects of family travel, which can increase the sense of belonging among family members. Family travel can also help with conflict resolution, problem-solving, and strengthening relationships while relaxing from work pressures. Through leisure and travel, families can participate in activities, socialise, and meet new people, strengthening their unity (Cheung et al., 2021).

Malaysia focuses on domestic tourism, of which family tourism is a part (Mohtar & Azizi, 2020). The country is renowned for its vibrant tropical climate, pristine beaches, rich local cuisine, lush rainforests, and multicultural heritage, making it a popular tourist destination for global travellers (Arokiasamy, 2021). The market for family vacations is expected to grow as the pandemic has redefined what tourists seek in a holiday. The emphasis on relaxation, wellness, safety and sustainability will drive this expansion (Peluso & Pichierri, 2021). Destinations that can adapt to these new preferences will benefit the most in the evolving tourism market.

A study of Korean tourists discovered that the pandemic had influenced tourists' preference for short-haul destinations (Sohn et al., 2021). Meanwhile, in a Polish study, tourists who preferred to travel altered their behaviour by avoiding crowded spots, abstaining from international travel, and opting for domestic travel (Balińska & Olejniczak, 2021). Family tourists consider domestic self-drive tourism safer than international tourism (Yeoman et al., 2022). According to Matiza (2022), this is referred to as the "home is safer than abroad bias". Thus, based on the above studies, the hypothesis is as follows:

H₁: Family travel motivation positively influences the intention to travel domestically.

Family Travel Motivation and Family Perceived Destination Image

Attributes and perceptions about a destination usually impact travel motives to that destination (Kim, 2014). According to Crouch and Ritchie (2011), destinations that are well-known for their scenic value and natural beauty should make the most of these advantages to gain a competitive advantage. A beautiful landscape with natural surroundings is one of the selling points of any tourist

destination. It has been generally accepted in the literature that destination image influences tourist behaviours (Bigne et al., 2001).

Studies have shown that travel motivation influences destination image (San Martín & Del Bosque, 2008), tourists' attitudes toward destinations (Lam & Hsu, 2006), and destination choice (Kim & Lehto, 2013). In the post-pandemic era, family travel motivation and destination image play a critical role in domestic travel decisions, supporting family health. They contribute to family cohesion and overall well-being. Thus, based on the above studies, the hypothesis is as follows:

H₂: Family travel motivation positively influences family perceived destination image.

Family Perceived Destination Image and Intention to Travel Domestically

In tourism literature, many studies have examined destination image as a multidimensional construct consisting of cognitive and affective components about the place (Sotiriadis, 2015), by which an individual evaluates the different aspects and characteristics of a destination according to their impressions and feelings (Carballo et al., 2021; Shehab et al., 2023). Cognitive and affective destination images strongly influence behaviour intention (Souiden et al., 2017)—a positive or negative destination image results in positive or negative behavioural intention. Past research on destination image outcomes revealed that a destination's cognitive and affective evaluations significantly influence pre-visit and post-visit travel behaviour (Baloglu, 2000).

The overall destination image might be rated positively or negatively based on the features associated with the destination (Baloglu, 2000). Endah et al. (2017) identified a positive correlation between perceived image and the intention to travel or visit. Most tourists choose destinations with the most favourable image (Lin et al., 2007). The image of a destination is crucial in destination selection and directly influences tourists' travel intentions (Bonn et al., 2005). Based on this rationale and literature review, the following hypotheses are proposed:

H₃: Family-perceived destination image positively influences the intention to travel domestically.

The Moderating Influence of Risk Perception

This study incorporates perceived risk as a moderating variable, as the literature suggests that risk perception influences visitor behaviour. Travellers with lower perceived risk are more likely to visit or recommend destinations (Chaudhuri, 2000), while those with higher perceived risk show varied attitudes and

preferences (Gladwell, 1990). Differences in risk perception align with diverse values, cultural backgrounds, and behavioural intentions. Research indicates that crises impact tourists' attitudes and travel choices (Karl, 2018), with the pandemic intensifying psychological stress and altering risk perception and responses (Bavel et al., 2020).

Perceived risk can create positive or negative images in the traveller's mind and have great significance in the tourist's decision to visit or avoid those destinations. Hsieh et al. (2016) discovered that risk perception influences travellers' decision-making highly. According to Kim et al. (2008), perceived risk creates barriers to consumer decision-making and influences tourist destination selection. Choosing a tourist destination often involves various perceived risks, ranging from disappointment with the expected experience through the waste of precious vacation time to the fear of physical harm due to disease, crime, or terror. Previous research suggests that customers' perceived risk can moderate among various variables such as satisfaction, willingness to spend, perceived crowding, and intention to revisit (Yin, 2020). Based on this rationale and literature review, the following hypotheses are proposed:

H₄: Risk perception moderates the relationship between family-perceived destination image and intention to travel domestically

METHODOLOGY

The target population of this research was all Malaysian family travellers. A quantitative study was conducted in Malaysia to investigate the risk perception that acts as a moderating factor for family travellers to travel domestically during the post-pandemic period. The sampling design was purposive. Inclusion criteria include adults aged 21 and above who used to travel abroad with family in the past five years (2019-2023) and have visited any domestic destination for leisure holidays at least once in the past six months.

The context selected for this research is domestic destinations in Peninsular Malaysia: Langkawi, Penang, Melaka, Johor, and Terengganu. These five destinations provide diverse experiences that cater to family interests, making them suitable for family holidays. Each destination offers various attractions suitable for different age groups within the family. Furthermore, these destinations garnered positive reviews and recommendations, further justifying their suitability for family travel (Zamri, 2022).

Due to the absence of a sampling frame, the study employed a non-probability purposive sampling technique (Chen & Tsai, 2007). Empirical data were collected via online platforms (WhatsApp and email) and face-to-face interactions (onsite). Data collection spanned approximately three months, from mid-October 2023 to mid-January 2024. A total of 240 questionnaires were

gathered, 70 collected electronically and 170 via paper-based methods. Ultimately, 220 responses were considered valid. Data analysis was conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM). A two-stage procedure with two main steps assessed the research model. The first stage tested the convergent validity, discriminant validity, and composite reliability of the constructs and their measurement items. The next stage tested the hypothesised relationships between the constructs.

RESULTS AND FINDING

Demographic Profile

The demographic profile of the study respondents includes information on gender, occupation, education level, age, ethnic group, household monthly income, financial sources, and family status. The survey had 220 participants. Of the 220 participants, 59.1% were female and 40.9% were male. Regarding occupation, 55% were employed in the private sector, 25.5% in government positions, 11.8% were self-employed, and 7.7% were employed in other occupations.

The educational background revealed that 69.5% had tertiary education (Diploma/Degree), 28.2% had higher degrees (Master/PhD), and a small fraction held professional certificates (1.4%) or secondary education qualifications (0.9%). The age distribution showed that 54.1% were 41-50, 27.3% were 31-40, 10.9% were 51-60, 4.1% were 61-70, and 3.6% were 21-30.

The ethnic composition was primarily Bumiputera (72.3%), followed by Chinese (18.2%) and Indian (9.5%). In terms of household monthly income, 35% earned MYR12001 and above, 31.4% earned MYR9001-12000, 16.4% earned MYR6001-9000, 14.5% earned MYR3001-6000, and 2.7% earned below MYR3000. Most families had double incomes (66.4%), while 33.6% had single incomes. The majority of respondents were part of a nuclear family (73.6%), with other family statuses including single parents (4.5%), couples without children (5%), three generations living together (3.6%), empty nesters (1.4%), and others (11.8%).

Assessment of the Measurement Model

Initially, the measurement model was examined to assess the validity and reliability of the instruments, following the guidelines of Hair et al. (2022). Subsequently, the structural model was analysed to test the developed hypotheses. For the measurement model, loadings, average variance extracted (AVE), and composite reliability (CR) were evaluated. The criteria required loading values to be ≥ 0.5 , AVE to be ≥ 0.5 , and CR to be ≥ 0.7 . As shown in Table 2, the AVEs are all above 0.5, and the CRs exceed 0.7 (Hair et al., 2022). Discriminant validity was then assessed using the HTMT criterion proposed by

Henseler et al. (2015). Based on this criterion, as summarised in Table 1, discriminant validity was achieved on all constructs, with values below 0.85.

Table 1: Discriminant Validity (HTMT Ratio)

Constructs	1	2	3	4
Intention to Travel				
Perceived Destination Image	0.514			
Risk Perception	0.543	0.76		
Travel Motivation	0.541	0.795	0.739	

Table 2: Measurement Model Assessment.

Construct	Items	FL	AVE	CR
TM	TM1	0.693	0.529	0.917
	TM2	0.695		
	TM3	0.606		
	TM4	0.788		
	TM5	0.823		
	TM6	0.813		
	TM7	0.78		
	TM8	0.855		
	TM9	0.503		
	TM10	0.638		
PDI	PDI_CI1	0.796	0.649	0.965
	PDI_CI2	0.698		
	PDI_CI3	0.79		
	PDI_CI4	0.822		
	PDI_CI5	0.834		
	PDI_CI6	0.848		
	PDI_CI7	0.881		
	PDI_CI8	0.768		
	PDI_CI9	0.784		
	PDI_CI10	0.718		
	PDI_CI11	0.802		
	PDI_AI1	0.906		
	PDI_AI2	0.928		
	PDI_AI3	0.928		
PDI_AI4	0.961			
ITD	ITD1	0.898	0.868	0.952
	ITD2	0.947		
	ITD3	0.949		

Construct	Items	FL	AVE	CR
RP	RP_HPR1*	-	0.503	0.947
	RP_HPR2*	-		
	RP_HPR3*	-		
	RP_HPR4	0.833		
	RP_HPR5	0.865		
	RP_FINR1	0.987		
	RP_FINR2*	-		
	RP_FINR3	0.820		
	RP_SPR1	0.844		
	RP_SPR2*	-		
	RP_SPR3	0.863		
	RP_SPR4	0.809		
	RP_SR1	0.883		
	RP_SR2	0.913		
	RP_TR1	0.976		
	RP_TR2	0.975		
	RP_TR3*	-		
	RP_FUNR1	0.987		
	RP_FUNR2	0.986		
	RP_DR1	0.911		
	RP_DR2	0.92		
	RP_DR3	0.917		
	RP_DR4	0.922		
	RP_DR5	0.898		
	RP_TRAVELR1	0.838		
	RP_TRAVELR2	0.657		
RP_TRAVELR3	0.863			
RP_TRAVELR4	0.835			

Note(s): * Items removed due to low loadings

Assessment of the Structural Model

The hypothesis testing results in Table 3 illustrate the relationships among travel motivation (TM), perceived destination image (PDI), risk perception (RP), and intention to travel (ITD). H1 indicates that higher motivation leads to higher travel intention ($\beta=0.314$, $p=0.001$). H2 confirms that travel motivation positively influences perceived destination image ($\beta=0.735$, $p<0.001$). H3 reveals that a better destination image boosts travel intention ($\beta=0.254$, $p=0.006$). Lastly, H4 highlights a significant moderating effect of risk perception, where higher risk perception weakens the positive impact of destination image on travel intention ($\beta=-0.13$, $p=0.031$). These findings emphasise the roles of motivation and image in travel decisions while acknowledging risk perception as a critical moderating factor.

Table 3: Hypothesis testing of the study

	Relationship	Beta (β)	t-value	p-values	Decision
H ₁	TM -> ITD	0.314	3.198	0.001	Accepted
H ₂	TM -> PDI	0.735	16.664	0.000	Accepted
H ₃	PDI -> ITD	0.254	2.505	0.006	Accepted
H ₄	RPx PDI -> ITD	-0.13	1.865	0.031	Accepted

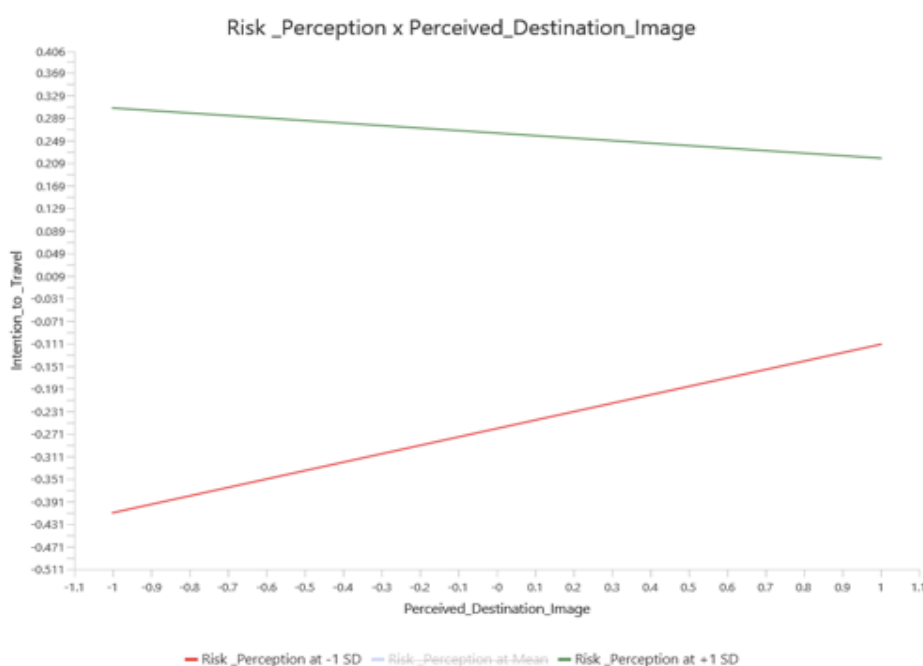


Figure 1: Moderating effect of risk perception on perceived destination image and intention to travel relationship

Figure 1 demonstrates the moderating role of risk perception in the relationship between perceived destination image and intention to travel. The red line represents individuals with low-risk perception (-1 SD), and it has a positive slope, indicating that as the perceived destination image improves, their intention to travel rises substantially. The green line, on the other hand, shows individuals with high-risk perception (+1 SD), and it has a negative slope, indicating that their inclination to travel lowers as the perceived destination image improves. This suggests that while a positive destination image increases travel intention for low-risk perception, it has the opposite effect on those with high-risk perception, stressing the need to resolve safety issues to effectively promote travel intention.

CONCLUSION

This research has comprehensively analysed the moderating influence of perceived risk on family tourism in the post-pandemic period. The findings underscore the significance of travel motivation and perceived destination image in shaping the intention to travel domestically among family tourists. The study's conclusions are justified by robust data analysis and align with existing tourism behaviour and risk perception literature.

The findings indicate that travel motivation substantially enhances the perceived destination image and the intention to travel domestically. Key intrinsic and extrinsic motivators—such as the desire for relaxation, family bonding, and exposure to new environments—play a pivotal role in shaping family travel decisions. Furthermore, the strong positive correlation between destination image and travel intention underscores the importance of cultivating a favourable destination image to attract family tourists. These insights highlight the need for destinations to actively manage and promote an appealing image to encourage family tourism.

However, the study also uncovered that the perceived destination image does not mediate the relationship between travel motivation and intention, indicating that these factors independently influence travel decisions. This is a critical insight for destination marketers, emphasising the need to address motivational factors and destination image to boost tourism separately.

The moderating effect of risk perception is particularly significant in the context of post-pandemic family tourism. The analysis demonstrates that high-risk perception can weaken the positive impact of a favourable destination image on the intention to travel. This finding is crucial for tourism stakeholders, as it underscores the necessity of implementing and communicating effective safety measures to mitigate perceived risks. Destinations that convincingly demonstrate their safety protocols are more likely to convert positive perceptions into actual travel plans, especially among family tourists prioritising safety.

The findings of this research offer valuable contributions to several key stakeholders. For destination marketers and policymakers, the study highlights the importance of promoting travel motivation by emphasising intrinsic and extrinsic benefits, such as relaxation, family bonding, and educational opportunities for children. Enhancing the unique attributes of destinations, including natural beauty, cultural attractions, and family-friendly amenities, is crucial. Given the significant moderating effect of perceived risk on travel intentions, addressing safety concerns is paramount. Implementing and effectively communicating rigorous safety measures and health protocols to potential tourists is essential for reducing perceived risks.

Tourism industry stakeholders can use these insights to develop targeted marketing strategies catering to family tourists' needs and concerns.

Creating tailored packages that address motivational factors and safety concerns can attract more family tourists. Furthermore, tourism businesses can develop products and services aligned with family tourists' motivational drivers, such as family-centric experiences promoting bonding and education. In the academic community, this research opens avenues for further exploration of the interplay between travel motivation, destination image, and perceived risk. Future studies could investigate these relationships in different cultural contexts or among other types of tourists, broadening the understanding of tourism behaviour. The theoretical contributions of this research highlight the independent roles of travel motivation and destination image, as well as the moderating influence of perceived risk, providing valuable insights to refine existing models of tourist behaviour.

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HERITAGE AWARENESS STRATEGY ON THE UNESCO-LISTED KEDAH HERITAGE ASSETS AMONG SCHOOL STUDENTS IN KEDAH, MALAYSIA

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Abstract

As Malaysia's oldest state, Kedah has a long and illustrious history. Its innumerable heritage assets deserve to be protected as part of a conservation effort for the sake of the country's history and future generations. Lack of heritage-awareness among the community may result in the utter loss of heritage evidence, impeding the identity and pride in local communities as well as economic opportunity in the tourism industry. The aim of this paper is to develop a holistic 'awareness strategy framework' on UNESCO-listed Kedah heritage assets (KHAs) among school students in Kedah. Two (2) objectives have been established, namely: 1) to discover the principles of the provision of heritage-awareness strategy for heritage assets with global status, and 2) to ascertain the state of heritage-awareness level among school students on KHAs. A mixed-method analysis was employed involving a literature review and a state-wide survey with 676 school students to assess their awareness on KHAs and related matters. The data revealed alarming results, denoting low awareness on KHAs among the respondents. The findings further offer several recommendations on the appropriate strategy and action plans to enhance heritage-awareness. It is deemed that the implementation must begin with the establishment of a dedicated management body empowered under the state's statutory act, which will be responsible for heritage-awareness creation via its public education system.

Keywords: Heritage-assets, Heritage-awareness, Heritage-education, Heritage-interpretation, Heritage-values

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INTRODUCTION

Located on the western coast of Malaysia’s northern peninsula, Kedah can be considered to represent the country’s whole history, (Figures 1 and 2). Kedah was where the beginning of human civilization in Southeast Asia took place, as evidenced by the existence of the Sungai Batu civilization in Bujang Valley, Merbok. The area was also used as the Ancient Kedah Kingdom’s iron smelting industry since 788 B.C. (Saidin, 2019; Hasfarisham *et al.*, 2021).



Figure 1: Map of South East Asia showing the location of Malaysia
 Source: Google Image (2020)



Figure 2: Map of Malaysia showing the location of Kedah State.
 Source: Google Image (2020)

The Langkawi Archipelago of Kedah is rich in intrinsic geological resources and is the only location that still preserves evidence of the earliest episodes that evolved over Malaysia’s nature history circa 600 million years ago

(Komoo & Ali, 2003). The Langkawi's rock formation relates to the story of the beginning of Peninsular Malaysia.

Conservation is important for protecting historical values and highlighting evidence of civilization progress. As Kedah offers abundant historical cultural and natural heritage assets to be explored and researched, conservation and preservation efforts are important in the interest of the country's history and future generations. Thus, it is crucial to have good management and maintenance practices to ensure the long-term care of Kedah heritage assets (KHAs). Strategic management and effective legislation will lead to sustainable heritage assets, that will ultimately foster social and economic benefits for generations to come.

LITERATURE REVIEW

Definition of Heritage

Heritage means any asset or group of assets, natural or cultural (tangible or intangible), that a community recognizes for its value as a witness to history and memory while emphasising the need to safeguard, protect, adopt, promote, and disseminate such heritage. ICOMOS (1982) defines heritage as "the combined creations and products of nature and man, in their entirety, that make up the environment in which we live in space and time. Heritage is a reality, a possession of the community, and a rich inheritance that may be passed on, which invites our recognition and our participation."

Simply put, heritage refers to whatever we want to sustain for the next generations. UNESCO helps in the management of assets with outstanding universal values (OUV) by giving recognition inscription of global status. Whether tangible or intangible cultural heritage, or natural heritage elements, heritage stakeholders must capitalise these assets for sustainability, the people's identity, alongside economic reasons.

Heritage-Awareness, Heritage-Interpretation, Heritage-Education, and Their Interrelationship

ICOMOS (2008) delineates that to create heritage-awareness, heritage-interpretation and presentation should be an integral part of the conservation process for enhancing the public's awareness of specific conservation problems encountered at the site and explaining the efforts being taken to protect the site's physical integrity and authenticity. Tilden (1977) outlined the six (6) principles known as 'Principles of Interpretation'. His definitions of heritage-interpretation are inclined towards the use of 'communication process' and 'planned activities' as tools for interpretation. Therefore, the presentation of heritage assets to visitors is crucial for them to know and understand such heritage assets being experienced. People differ in the way they perceive, process, and recall information, and these individual cognitive differences influence their

experience, performance, and knowledge acquisition when performing cultural-heritage activities. The human-cognition factor should be considered as an important personalisation factor within cultural-heritage contexts (Raptis & Avouris, 2019). Heritage-interpretation and presentation must ensure that visitors of various backgrounds are able to ‘embrace’ the values of heritage assets being presented. ‘Value’ has always been the reason underlying heritage conservation (Torre, 2002). Heritage-value is often the source of heritage-interpretation that keeps the people’s spirit to appreciate, love, and feel obliged to maintain and sustain such heritage assets. Thus, having good storytelling for heritage interpretation and presentation would become an effective tool to enhance understanding of heritage assets and provide access to collective heritage awareness, (WanShamsuddin *et al.*, 2022).

Awareness is a crucial component in the safeguarding of heritage assets (Karadeniz, 2020). It refers to the quality or state of being aware and concerns the knowledge and understanding that something is happening or exists. Furthermore, awareness is about having knowledge about the situation, condition, or values of an asset and skills or the ability to care and act to prolong the asset’s existence. Skills are often acquired through experience or education. In this regard, having awareness alone is insufficient to ensure heritage assets sustainability; rather, it requires adequate knowledge and relevant skills on how to sustain the assets. Heritage-awareness with knowledge encompasses the ‘ability’ and ‘motivation’ factors to ensure the local community’s willingness to be involved in conservation efforts and sustain heritage assets (Rasoolimanesh & Jaafar, 2016).

There are four (4) interdependent phases that complete the asset’s whole life-cycle process, namely ‘identification of heritage-asset’, ‘purposeful heritage-interpretation’, ‘nurturing of heritage-education’, and ‘heritage-awareness creation’. This research looks into the aspect of sustainable heritage conservation in the form of ‘caused and effect’ for heritage-awareness creation, i.e.:

- 1) Heritage-awareness is a result of heritage-education;
- 2) Heritage-education centres around purposeful heritage-interpretation, heritage-value and meaningful presentation, as well as effective management knowledge and skills; and
- 3) Heritage-awareness leads to a sustainable heritage asset.

Heritage and Conservation Management (HCM) – UNESCO’s Insight

UNESCO was established to promote peace via education, science, and culture. As the only United Nations (UN) agency mandated to promote culture, UNESCO’s programs recognise ‘culture’ as a driver for sustainable development. It also contributes to the achievement of the Sustainable Development Goals

(SDGs) defined in Agenda 2030, which were adopted by the UN General Assembly in 2015 (UNESCO, 2023).

As of January 2024, the performance of Kedah in UNESCO concerning the world shared heritage assets is as follows:

- 1) The Langkawi UNESCO Global Geopark (hereinafter known as LUGGp), which was inscribed in 2007;
- 2) The UNESCO's Memory of the World Register - Correspondences of the Late Sultan of Kedah (1882-1943) or Sultan Abdul Hamid Correspondences Collection (hereinafter known as MoW-SAHCC), which was accorded on 4 September 200; and
- 3) The UNESCO's ICH (USL), i.e. the UNESCO's List of Intangible Cultural Heritage in Need of Urgent Safeguarding, '*Mek Mulung*', a traditional Malay Theatre of Kedah, Malaysia, which was inscribed on 5 December 2023 (Ministry of Tourism, Arts and Culture or MOTAC, 2023).

UNESCO's (2008) operational guidelines for the management plan of world heritage sites posit that good management of heritage-awareness should include the following criteria:

- i. The representation of purposeful 'heritage-interpretation' in place via effective means of communication;
- ii. The statement of 'heritage-value' in terms of assets function/position is well expressed to the community, enhancing reasons for it to be in existence;
- iii. The presence of collaboration/shared responsibility among stakeholders for the protection and conservation of heritage assets; and
- iv. The availability of awareness programs involving students/young people.

Furthermore, a study by UNESCO showed that 'lack of governance', 'lack of legal framework', as well as 'inappropriate management activities' impose negative impacts on World Heritage properties, thus highlighting a priority need to address these factors (Ishizawa & Jo, 2023).

Heritage and Conservation Management (HCM) - Scenario in Malaysia

In Malaysia, the HCM of heritage assets is controlled by relevant constitutional acts. The NHA 2005 (Act 645) (hereinafter known as NHA) of Malaysia was gazetted on 31 December 2005 and came into effect on 1 March 2006. Act 645 provides the definitions of heritage categories, namely cultural tangible, intangible, and underwater, as well as natural and living person. Managing diverse issues for heritage conservation projects is crucial for ensuring the long-term protection of heritage assets. Most significant risk factors can be mitigated

prudently by adhering to Sections 40 (1) - (6) of the National Heritage Act 2005 (Act 645) (Baharuddin *et al.*, 2022). Meanwhile, the Town and Country Planning Act 1976 [Act 172] (TCPA) concerns the proper control and regulation of town and country planning in Peninsular Malaysia. Heritage and conservation-related planning clauses (the protection, preservation, and enhancement of ancient monuments and lands alongside buildings of historic or architectural interest) can be observed in TCPA.

To date, aside from NHA, Johor, Melaka, Sarawak, Sabah, and Penang are the only five (5) states out of thirteen (13) states in Malaysia that have statutory provisions concerning heritage. Similar to other states with the absence of state heritage enactment, Kedah refers to NHA for all heritage-related matters.

The management of LUGGp lies within the established Langkawi Geopark Management Plan, Action Plans 2012-2030 (PPLG) (Halimaton Saadiah Hashim *et al.*, 2012). Up till 2023, the PPLG document becomes a vital source of reference, which offers the opportunity to see how ‘heritage-awareness’ strategy is treated in the policies and development plan of Langkawi. Furthermore, Langkawi Development Authority is the organisation behind the successful development of LUGGp. The UNESCO Global Geopark Council Chairman, Guy Martini (2022), further stressed the need for a management structure to be in place to support the successful development of a geopark.

RESEARCH METHODOLOGY

This research was done through literature review, interview session, personal communication, and students’ heritage-awareness-assessment. The mixed-method analysis was employed since awareness concerns what one knows, how well one knows it (quality), and how many others know about it (statistic) (Said, 2011). The primary data was gathered through a survey known as students’ heritage-awareness-assessment, which was administered during the fieldwork stage.

The participants of this study were selected from twenty-four (24) schools located across the twelve (12) districts of Kedah. Each district was represented by two (2) schools—i.e., a primary school and a secondary school. These schools were randomly selected based on 50% for each school type, namely twelve (12) rural schools and twelve (12) urban schools. This study only examined the perception of heritage-awareness from 600 students in total, targeting 25 students aged 11 to 12 years old and 16 to 17 years old from each school.

The questions were measured using various student-friendly methods, including short-answer responses, check boxes, and multiple choices. Table 1 outlines the narrative rating and scale coding for the short-answer responses.

Table 1: Awareness Level – Narrative Rating and Scale Coding

	Scale coding	Baseline level	Definition
Acceptable Awareness Level	5 points (pass)	Very high knowledge	Describe with major details; meet all essential attributes
	4 points (pass)	High knowledge	Show high knowledge in the description; meet the major attributes
	3 points (pass)	Moderate knowledge	Able to describe the basics; meet several of the major attributes
Poor Awareness Level	2 points (fail)	Little knowledge	Describe too briefly; meet half or less of the criteria
	1 point (fail)	Very little knowledge	Inappropriate answer
	0 point (fail)	No knowledge	Unable to describe

Source: Authors (2024)

Since the heritage-awareness-assessment involved young school students, due consideration was given to the ethical aspects. An application for consent to conduct the research was made to the Ministry of Education Malaysia via the Educational Research Application System Version 2.0. The same set of heritage-awareness-assessment survey was employed for both primary and secondary school students, which was conducted from October 2021 to March 2022. During this period, the ‘*Mek Mulung*’ status was still in the ongoing evaluation process for nomination into the list of intangible cultural heritage in need of urgent safeguarding elements, which was reflected in the questionnaire.

RESULTS AND DISCUSSION

Section A – Demographic Profile

A total of 676 school students from the twelve (12) districts of Kedah participated in this survey. The respondents were aged between 11-12 and 16-17 years old, representing the two (2) separate groups of primary and secondary school students, respectively. The targeted respondents were 50 students per district.

Section A1 - Location or District

Table 2 shows the respondents’ demographic profiles. The majority of them came from the Langkawi (n=89), Yan (n=75), and Kuala Muda (n=68) districts.

Table 2: Overall Sampling Population by District

No.	District in Kedah	n (%)
1.	Baling	57 (8.4)
2.	Bandar Baharu	42 (6.2)
3.	Kota Setar	44 (6.5)
4.	Kuala Muda	68 (10.1)
5.	Kubang Pasu	40 (5.9)
6.	Kulim	47 (7.0)
7.	Langkawi	89 (13.2)

No.	District in Kedah	n (%)
8.	Padang Terap	55 (8.1)
9.	Pendang	59 (8.7)
10.	Pokok Sena	52 (7.7)
11.	Sik	48 (7.1)
12.	Yan	75 (11.1)
	Total	676 (100)

Source: Authors (2024)

Overall, 676 primary and secondary school students participated in the survey and represented the school student community in the state of Kedah.

Section A2 - Age of Respondents

Table 3 shows the age composition of the respondents where 52.4% of them (n=354) were between 11 to 12 years old while 47.6% (n=322) were between 16 to 17 years old.

Table 3: Students' Age Composition

No.	Age	n (%)
1.	11 – 12 years old	354 (52.4)
2.	16 – 17 years old	322 (47.6)

Source: Authors (2024)

Section A3 - Nationality of Respondents

Table 4 shows the respondents' nationality where all of them (100%, n=676) were Malaysian students located in the state of Kedah.

Table 4: Nationality of Respondents

No.	Nationality	n (%)
1.	Malaysian	676 (100)
2.	Non-Malaysian	0 (0)

Source: Authors (2024)

Section B – Knowledge on the UNESCO-listed KHAs

Section B contained questions regarding knowledge of the two (2) UNESCO-listed KHAs, namely LUGGp and MoW-SAHCC. The respondents were required to answer the questions using short-answer responses, which were then evaluated using the narrative rating scale.

Section B1 – Knowledge on LUGGp

For the question “What do you understand about geopark?”, 15.5% (n=105) of the respondents provided no answer, 22% (n=149) gave inappropriate answers, while 47.0% (n=318) had little knowledge about the question. Whereas, 7.3% (n=49), 5.8% (n=39), and 2.4% (n=16) of the respondents had moderate, good,

and high knowledge regarding the question, respectively. It was also observed that most respondents had very little knowledge of LUGGp with a mean value of 1.73 and a standard deviation of 1.134.

Concerning the question “Where is Langkawi Geopark located?”, the results showed that 0.7% (n=5) of the respondents had high knowledge, followed by 0.6% (n=4), 67.8% (n=458), 16.3% (n=110), and 2.8% (n=19) of respondents with good, moderate, little, and very little knowledge of the question, respectively. On the other hand, 11.8% (n=80) of the respondents did not answer the question. The result further indicated that the respondents had little knowledge about this question, with a mean value of 2.45 and a standard deviation of 1.035 (Table 5).

Table 5: Knowledge on LUGGp

No.	Statements	n (%)						Mean (SD)
		0	1	2	3	4	5	
1.	What do you understand about geopark?	105 (15.5)	149 (22.0)	318 (47.0)	49 (7.3)	39 (5.8)	16 (2.4)	1.73 (1.134)
		(84.5)			(15.5)			
		Poor awareness level			Acceptable awareness level			
2.	Where is Langkawi Geopark located?	80 (11.8)	19 (2.8)	110 (16.3)	458 (67.8)	4 (0.6)	5 (0.7)	2.45 (1.035)
		(30.9)			(69.1)			
		Poor awareness level			Acceptable awareness level			

Source: Authors (2024)

When asked about the concept of ‘global geopark’, it was observed that only 15.5% of the respondents demonstrated an acceptable awareness level while 84.5% of them had poor knowledge regarding this question. Meanwhile, the respondents’ responses about the location of Langkawi Geopark revealed that many of them (69.1%) had an acceptable awareness level and only 30.9% had a poor awareness level.

Section B2 – Knowledge on MoW-SAHCC

For the question “What do you understand about the memory of the world register?”, 32.4% (n=219) of the respondents had very little knowledge regarding the topic, followed by 28.6% (n=193), 3.6% (n=24), and 0.7% (n=5) of respondents with little, moderate, and good level of knowledge, respectively. Only 0.1% (n=1) of the respondents demonstrated high knowledge level while the remaining 34.6% (n= 234) did not answer the question. The results also suggested that most respondents lack the knowledge on world documentary heritage, with a mean value of 1.04 and a standard deviation of 0.929.

Meanwhile, the question “Where are the Letters of the Late Sultan Abdul Hamid Halim Shah, Kedah located or kept?” received no response from 21.1% (n=136) of the respondents. This was followed by 54.9% (n=371) of respondents who had very little knowledge about this question, 13.8% (n=93) with little knowledge, 4.3% (n=29) with moderate knowledge, 3.8% (n=28) with good knowledge, and only 3.1% (n=21) with high knowledge. It was also found that the majority of respondents had very little knowledge about this question, with a mean value of 1.26 and a standard deviation of 1.134 (Table 6).

Table 6: Knowledge on SAHCC

No.	Overall Statements	n (%)						Mean (SD)
		0	1	2	3	4	5	
1.	What do you understand about the Memory of the World Register?	234 (34.6)	219 (32.4)	193 (28.6)	24 (3.6)	5 (.7)	1 (.1)	1.04 (.929)
		(95.6%)			(4.4%)			
		Poor awareness level			Acceptable awareness level			
2.	Where are the Letters of the Late Sultan Abdul Hamid Halim Shah, Kedah located or kept?	136 (21.1)	371 (54.9)	93 (13.8)	29 (4.3)	26 (3.8)	21 (3.1)	1.26 (1.134)
		(89.8%)			(11.2%)			
		Poor awareness level			Acceptable awareness level			

Source: Authors (2024)

Such result is highly alarming as less than 5% of students are knowledgeable about MoW. The majority of the respondents (89.8%) demonstrated poor awareness level towards the question “Where are the Letters of the Late Sultan Abdul Hamid Halim Shah, Kedah located or kept?” with only 11.2% of them had an acceptable awareness level about the topic. The result reflects the insufficient promotion of such topic to the public.

Section C – Students’ Perceived Knowledge (General) About *Mek Mulung*

Section C analysed the respondents’ short-answer responses to determine their knowledge regarding *Mek Mulung*, which is a National Heritage nominated for UNESCO’s ICH (USL).

The results found that 38.0% (n=257) of the respondents had zero knowledge about the question “What do you understand about *Mek Mulung*?”, followed by 27.1% (n=183), 23.1% (n=156), 1.2% (n=8), and 10.7% (n=72) of respondents with little, moderate, good, and high knowledge about this statement. The mean value of 1.88 and the standard deviation of 1.595 further showed that the respondents had inadequate knowledge about *Mek Mulung* (Table 7).

Table 7: Knowledge on the National Heritage of *Mek Mulung* in Kedah

No.	Statements	n (%)						Mean (SD)
		0	1	2	3	4	5	
1.	What do you understand about <i>Mek Mulung</i> ?	211 (31.2)	46 (6.8)	183 (27.1)	156 (23.1)	8 (1.2)	72 (10.7)	1.88 (1.595)
		(65.1)			(35)			
		Poor awareness level			Acceptable awareness level			

Source: Authors (2024)

Overall, more than half of the respondents (65.1%, n=440) had poor awareness level and only 35% (n=236) of them had acceptable awareness level. The mean value of 1.88 reflected that most students have inadequate knowledge about *Mek Mulung*. The results indicated that more efforts must be done to improve the situation. To realise the objective of preserving *Mek Mulung*, JWN has specified several action plans in the submission of nomination form to UNESCO. Among the key activities include: 1) Conducting Research and Documentation, 2) Improving Legal Protection, 3) Promoting and Dissemination, 4) Recognition, and 5) Raising Awareness (ICH UNESCO website, 2023).

IMPLICATIONS OF RESULTS

The alarming results of heritage-awareness-assessment require urgent attention from all heritage stakeholders of the state. More efforts and goal-oriented strategies must be formulated to advocate such issue.

Focus Areas for the Heritage Management of KHAs

By adopting UNESCO's approach to the conservation management plan (CMP) for WHS, the following aspects of heritage-awareness can be incorporated as the focus areas for the heritage management of KHAs (Table 8):

Table 8: Possible Focus Areas for the HCM of KHAs

UNESCO's approach for CMP	Possible focus areas for the HCM of KHAs derived from UNESCO's approach
1) Raising public knowledge, understanding, and recognition on the necessity of safeguarding cultural and natural resources.	Raising stakeholders' awareness, appreciation, and shared responsibility towards safeguarding cultural and natural heritage-assets.
2) Strengthening the role of heritage-assets in community life.	Provision of purposeful interpretation and presentation about the HV of KHAs and capacity building in the heritage-education of relevant stakeholders who are responsible for HCM.
3) Increased participation of local communities in heritage protection and presentation.	Active reaching out activities and observe 'bottom-up approach' involving local community and relevant stakeholders.
4) Emphasis on how excitement for heritage can be sparked to the wider public, particularly among young people.	Appreciation of shared common values for the HCM of KHAs with easy access to heritage-education among school students in Kedah.

Source: Authors (2023), adopting from UNESCO's approach for CMP

The identified possible focus areas for the HCM of KHAs are elaborated further in the Public Education Strategy Framework (Table 9).

The Awareness Creation Enabler

The authors also seek necessary attributive factors that lead to 'awareness creation'. Eight (8) components were identified from the data that form the life-cycle process, namely:

- 1) Establishment of management structure (dedicated team)
- 2) Importance of purposeful interpretation
- 3) Sharing of heritage-education among the public
- 4) Collaborative effort among stakeholders
- 5) Reaching out activity
- 6) Ties to academics and universities for research and publication
- 7) Heritage-education infrastructure or memory institute
- 8) Aspects of financial tool (fund sourcing)

The key components of awareness creation listed above are interconnected that should form the job functions for the management body in order to complete the life-cycle process of a heritage asset.

Much Needed Common Shared Values

An integrated governance system implies that there is a need to find shared values as a binding agent of social relations at the organisational, institutional, and individual levels. Developing common values is a process that must be

strengthened by building a more effective approach, strategy, and public education action (Saidin *et al.*, 2015). Kedah has been long known as ‘the rice bowl of Malaysia’. Paddy (or ‘*padi*’ in Malay) is Kedah’s agricultural heritage that becomes the state’s icon and economic identity. The status of Kedah as the nation’s rice producer stands as a symbol of its uniqueness than other states in Malaysia (Gin, 2012).

Inquisitive semantics is an approach to study the meaning of proverbs that involves data, theory, cognition, philosophy, and reasoning to attain a deeper and more comprehensive understanding of their meaning (Subet & Nasir, 2019). Through this approach, the authors used the relationship of ‘Kedah people – ‘*padi*’ farming – heritage’ to create the ‘P-A-D-I concept’. Such abbreviation illustrates the shared values among the people of Kedah, namely the spirit of ‘Preservation, Administration (Management), and Defence (Protection) of Inheritance (heritage-asset), or The Spirit of P-A-D-I.

A Proposed Framework for the Management of KHAs

For this purpose, the established Langkawi Geopark Management Plan, or PPLG (2012), is used as a reference. Even though it is meant for the HCM of the Langkawi district, the strategy is indeed suitable for all categories of heritage and can fit the whole HCM agenda for the state. The proposed organisation chart for management body shall include a board of trustees overseeing five (5) main committees, each annotated with respective job functions identified previously. These main committees are the ‘Overall Coordination Committee’, ‘Public Education Committee (PEC)’, ‘Community Involvement Committee’, ‘Asset Development and Promotion Committee’, and ‘Heritage Conservation Works and Scientific Committee’.

To achieve the research aim, ‘awareness creation strategy among students’ will be a job-function of the ‘Public Education Working Committee’ (PEWC) that comes under PEC. PEWC’s task is to ensure that awareness creation strategy is incorporated into heritage-education at schools in Kedah.

SIGNIFICANCE OF THE OUTCOMES

‘Public Education’ Strategy Framework on KHAs

The author proposes establishing a management organization known as the Kedah Heritage Assets Trustee (KHAT) to oversee a state-wide heritage agenda. The implementation of programs for heritage-awareness creation among young children lies in the Public Education Strategy Framework. Based on the data gathered from the research activities, two (2) principles, five (5) main focuses, and six (6) strategies have been developed and detailed as awareness strategies (Table 9). By incorporating these strategies into their educational approach, schools can help students foster understanding and empathy towards their cultural and natural heritage.

Table 9: Public Education Strategy Framework on KHAs

Principles, Main Focuses, and Strategies for Heritage-Education in Kedah		
Principle	Principle 1: Nurturing and enculturation of the spirit of P-A-D-I (Preservation, Administration, and Defence of Inheritance) underlying all programs for heritage-education among the community in Kedah.	
	Principle 2: Heritage-education empowers the local community in the knowledge and skills aspects for the conservation, management, and development of sustainable heritage-assets of Kedah.	
Main Focus	Focus 1 – Appreciation of the spirit of ‘P-A-D-I’ that forms shared common values about KHAs across all stakeholders, including school students in Kedah.	2 strategies
	Focus 2 – Provision of purposeful interpretation, presentation, and information about the heritage-values of KHAs to all stakeholders, including school students in Kedah.	1 strategy
	Focus 3 – Raising stakeholders’ awareness, appreciation, and responsibility towards KHAs, including among school students.	1 strategy
	Focus 4 – Capacity building of relevant education stakeholders/government agencies (such as school teachers) who are responsible and have an interest in heritage-education.	1 strategy
	Focus 5 - Monitoring the effectiveness of school educational programs about KHAs.	1 strategy
Focus 1	Strategy 1 – Mainstreaming the education about KHAs and HCM in formal education across the primary, secondary, and tertiary levels of education.	<i>(List of recommended action plans is available but not included in this article)</i>
	Strategy 2 – Making the conservation of KHAs a priority in informal and non-formal education.	
Focus 2	Strategy 1 – Develop mechanisms and tools to strengthen information about KHAs.	
Focus 3	Strategy 1 – Diversify programs and activities related to the promotion of KHAs.	
Focus 4	Strategy 1 – Implement capacity-building programs for responsible agencies/stakeholders that involve the implementation of programs/activities/projects for knowledge, awareness, and management of heritage-assets.	
Focus 5	Strategy 1 – Implement a system for monitoring the implementation of public educational programs about KHAs.	

Source: Author (2023), adapted from PPLG (2012)

This paper offers significant contributions as it is the first in the research area to, 1) Conduct a state-wide students’ heritage-awareness-assessment in Kedah; and 2) Scrutinize the necessary attributes or mechanisms for heritage-awareness creation and recommended awareness strategy of KHAs among students.

CONCLUSION

As Kedah rapidly develops, it is critical for the state to protect its rich historical, cultural, and natural assets while promoting the practice of sustainable HCM. It is crucial for the heritage-awareness creation that lies in the state's heritage-education strategy to be based on the proposed Public Education Strategy Framework on KHAs. The recommended action plans must also be put into effect. However, the designing of a roadmap for HCM in Kedah should consider the two (2) proposed long-term plans:

- 1) Advocate the establishment of Kedah State Heritage Enactment to empower the HCM of KHAs.
- 2) Establish a dedicated management body (i.e., KHAT) to navigate the management of heritage and conservation of KHAs.

The Kedah state government must commit to assisting communities within each district in charting their own path towards heritage-awareness enhancement. Finally, the findings of this research offer a long-term resolution that answers the question of what it takes for Kedah to successfully protect its significant heritage-assets, today and in the future.

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**TRANSFORMING COASTAL SPACES INTO EVENT DESTINATIONS:
A CASE STUDY OF SUMPANG BINANGAE, BARRU REGENCY-
INDONESIA**

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Abstract

The existing tourism literature offers a limited exploration of coastal areas as venues for organising tourism events. This study aims to (1) assess the current condition of coastal areas from a tourism and event perspective and (2) propose strategies for planning and implementing international events that support tourism development in these regions. The research draws on observations and interviews conducted with fifteen informants, including government officials from the regional tourism board and community members in the Sumpang Binangae sub-district, Barru Regency, Indonesia. Thematic analysis revealed significant opportunities for hosting international tourism events in Sumpang Binangae. However, challenges persist due to the limitations of utilising coastal areas for such events. The study identifies three types of outdoor events—maritime-based, cultural-based, and modern-based—that local stakeholders can effectively plan and organise. It proposes a framework for leveraging coastal areas as locations for international tourism events, emphasising the importance of applying the principles of inseparability, perishability, intangibility, and heterogeneity in event management. Additionally, the study highlights the potential for local residents to become event planners and organisers through targeted training and infrastructure development. This research contributes to the advancement of event planning in marine tourism destinations.

Keywords: Barru Regency, Coastal Area, Sumpang Binangae, Tourism Events

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INTRODUCTION

The local governments of Indonesia have undertaken various initiatives to attract tourists to their regions, with event organisation being a key strategy employed by many stakeholders (Junaid et al., 2023). Competition among destinations intensifies as travel becomes more convenient. Events have emerged as a significant motivator for tourists, either as participants or spectators, and have evolved into a powerful marketing tool for managing and developing tourism (Getz, 2008; Getz & Page, 2016; Rahayu, 2018). This is because tourists' participation in events can enhance the travel experience and provide opportunities for social interaction (Brown et al., 2011; Jago & Shaw, 1998; Richards, 2019). These events allow tourists to connect with local residents, which can positively impact their perceptions of a destination. As such, well-planned and organised tourism events have the potential to greatly improve the image of a region (Wong et al., 2018), making them a strategic tool for attracting visitors.

The academic community has shown increasing interest in researching tourism events. For example, Ismail and Iriani (2021) explored the relationship between hosting tourism-related events and travellers' destination choices. Yuliani and Fedri (2019) found that the implementation of the Minangkabau Travel Mart event positively impacted West Sumatra's tourism branding. Meanwhile, Yustina and Sukana (2021) identified the environmental, sociocultural, and economic benefits of hosting a tourism event in Taman Kumbansari, Denpasar, Bali. Finally, research in Winchester, England revealed that local communities welcomed events as they supported and preserved community culture and the local economy (Seraphin et al., 2018). Overall, there is a growing body of research on the impact of tourism event management towards local communities.

However, limited studies have examined coastal areas as venues for hosting events. Therefore, this paper focuses on Barru Regency as the research setting, given the commitment of its local government to leverage tourism as a strategy for regional development. The Sumpang Binangae Village in Barru Regency is one of the areas where the local government has adopted a tourism-based approach to coastal development. Despite domestic tourists visiting these coastal areas, the short duration of their stay has not significantly benefited the local community. To maximise the potential of these coastal areas, it is essential to organise events that enhance the tourist experience and boost the local economy. Based on this premise, this study aims to (1) assess the current condition of coastal areas from a tourism and event perspective, and (2) propose opportunities for planning and implementing events that support tourism development in these regions. The research contributes to the growing body of knowledge on tourism events in coastal areas.

LITERATURE REVIEW

Events play a crucial role in achieving social, cultural, and corporate goals as they are organised to foster collective experiences that align with specific group or organisational objectives (Bowdin et al., 2006). Since the 1980s, events have been closely tied to tourism, serving as powerful tools to attract visitors, enhance destination appeal, and contribute to regional development (Getz, 2008). Aside from their ability to range from local to international in scale, events provide destinations with the flexibility to cater to diverse tourist motivations, thereby strengthening their tourism potential.

Among the different types of events, festivals are perceived as unique due to their deep cultural connections and community involvement. Rooted in local traditions, festivals often embody a community's identity and reflect aspects such as ethnicity, language, and lifestyle, which appeal to tourists seeking authentic cultural experiences (Yuliza & Pramayoza, 2022). Beyond their cultural significance, festivals contribute to economic growth by enhancing local quality of life through tourism revenue and employment opportunities (Seraphin et al., 2018). Similarly, sports events attract a mix of active participants and spectators, offering them memorable experiences that positively influence their perception of the destination (Perić et al., 2019). These events, whether cultural or sports-related, collectively enrich the destination's appeal and foster lasting connections between tourists and local communities.

Organising successful events requires a structured approach that includes planning, organising, directing, and controlling each aspect to meet the desired objectives. Event management must address four key characteristics: inseparability, perishability, intangibility, and heterogeneity. These attributes underscore the need for real-time coordination and attention to participant experiences as events are often transient, specific to particular moments, and vary in how they are perceived by each attendee (O'Toole, 2005; Trošt et al., 2012).

Coastal areas offer distinct advantages for tourism events due to their natural beauty, cultural richness, and appeal as leisure destinations (Junaid, 2021). These areas have grown in popularity for beach and coastal tourism, attracting visitors through scenic landscapes, diverse activities, and vibrant local cultures (Hengky, 2023). Coastal tourism also stimulates the local economy by supporting micro-businesses like cafes, restaurants, and creative enterprises, thus providing vital income sources for residents (Mustain, 2024). Hosting events in coastal regions, whether maritime-themed or culturally oriented, presents valuable opportunities to further enhance local economies and attract more tourists. However, successful event management in these areas requires strong collaboration between community members, government, and private stakeholders to address logistical challenges and ensure sustainable, positive outcomes for everyone involved (Azinuddin et al., 2022; 2023).

In summary, tourism events are integral to regional development, offering diverse opportunities to engage visitors, strengthen community identity, and stimulate economic growth. When carefully planned and supported by collaborative efforts, events can transform destinations and contribute meaningfully to their tourism and economic landscapes.

RESEARCH METHODOLOGY

This study utilised qualitative data to analyse the current conditions in the coastal area of Barru Regency, Indonesia. A qualitative approach guided the authors in identifying and proposing strategies for event planning in coastal areas. The data were collected through field notes from two field observations at Barru Regency in August and September 2022. The observations focused on the physical condition of the area, providing an overview of the current state and examining the residents' activities and available facilities that could support the organisation of tourism events. These observations serve as the primary data for proposing event planning and implementation opportunities at the research site. During these research visits, informal interviews were also conducted with 15 informants that comprised government officials from the regional tourism board, residents and traders operating around the coastal area. Key information and insights from the informants were documented. All data were collected after obtaining consent from the South Sulawesi provincial and local governments.

The selection of Sumpang Binangae's coastal area as the research location was based on three justifications. First, despite the physical development of waterfronts, these coastal areas are yet to be fully optimised for tourism purposes. With proper management, Sumpang Binangae's coastal area has the potential to become a tourist destination. Second, while some community members in the Sumpang Binangae sub-district have attempted to develop tourism-related businesses, they still face challenges, particularly concerning income generation. Encouraging community efforts, including event management, can help address these obstacles. The local government is also advocating for the creation of a tourism icon in Barru Regency. Third, the Sumpang Binangae sub-district has garnered the local government's attention as a potential tourist area; however, achieving this goal requires strategic efforts, including event organisation.

Thematic analysis was employed to process the qualitative information. The analysis involved several stages: (1) thoroughly reading and understanding the data; (2) identifying key themes or information within the qualitative data; and (3) interpreting the data by presenting findings and extracting meaning. This process served as a qualitative data reduction technique to distil essential themes from the collected information (Altinay & Paraskevas, 2008; Junaid, 2016). All thematic analysis and data interpretation procedures were conducted with

consistent reference to relevant theoretical frameworks and research objectives. Finally, conclusions were drawn based on the results of the qualitative data analysis.

This study contributes to the development of event planning and organisation concepts by utilising coastal areas as event venues. Coastal areas can host outdoor events by applying core event principles and characteristics. The findings reinforce the concepts of inseparability, perishability, intangibility, and heterogeneity in event management. Additionally, with proper training and the utilisation of available infrastructure, local residents can take on the role of event organisers in tourism destinations.

ANALYSIS AND DISCUSSION

An Overview of the Sumpang Binangae Sub-District of Barru Regency

The coastal area of the Sumpang Binangae sub-district was analysed to formulate recommendations for planning and organising tourism events in Barru Regency. The local government of Barru Regency has built the Sumpang Binangae Beach platform with various targets and objectives (Figure 1), including to support community activities that uphold regional development. This is because the coastal area of Sumpang Binangae is prone to be affected by high waves in certain months. Therefore, the development of the coastal area, including the Sumpang Binangae Beach platform, serves as a wave barrier to mitigate such issue.

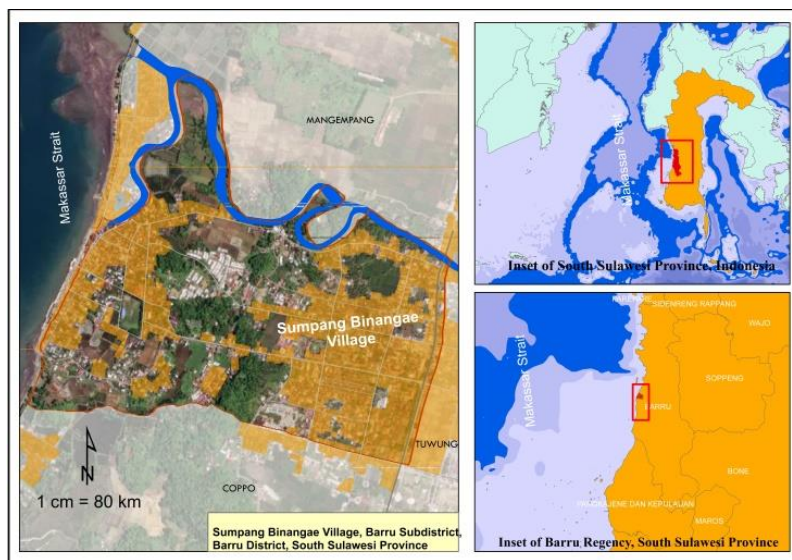


Figure 1: Map showing the location of the Sumpang Binangae sub-district, Barru Regency, Indonesia

Source: Masri Ridwan, 2024

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Figure 2. The Sumpang Binangae Beach Platform and Coastal Area in Barru Regency
Source: Authors, 2022

Furthermore, the coastal area serves as a location for fishermen to host fish auctions and trading activities, which are patronised by nearby residents (Figure 2). The Sumpang Binangae Beach platform is also a photography spot for residents and tourists. Additionally, local residents use the location to sell food and soft drinks as a way to earn additional income apart from conducting other daily activities, such as fishing.



Figure 3. Zone three and four at the Sumpang Binangae sub-district
Source: Authors, 2022

The residents' traditional activities are prominently visible around the coastal area of Sumpang Binangae Beach. Beyond the locals' trading activities, visitors from outside Barru Regency can explore the beach and observe community practices related to fishery and other livelihoods. The coastal area has

become a significant source of income for the local population while serving as a place to relax and appreciate the natural beauty of the sea. The community utilises this coastal space for various activities aimed at improving their welfare. The local government has also recognised the potential of the Sumpang Binangae coastal area by making it a hub for several events. In August 2022, the Meompalo Karellae festival—a cultural celebration linked to the La Galigo script, a cultural heritage of South Sulawesi—was held here (disparpora.barrukab.go.id). In September 2022, the 'To Berru Cultural Festival' took place at the Sumpang Binangae Beach Pavilion (TribunBarru.com). Additionally, various community organisations have chosen this pavilion for their activities. For example, in February 2022, the Regional Assembly of the HMI Alumni Corps in Barru Regency organised joint gymnastics to celebrate the organisation's anniversary (mediationenergy.co). Local stakeholders in Barru Regency have been leveraging the Sumpang Binangae coastal area for events that benefit the community and their welfare. However, the community acknowledges that the range of activities in this coastal area remains limited, contributing to the often-quiet atmosphere of the Sumpang Binangae Beach platform.

An Existing Condition of Sumpang Binangae Coastal Area

The Sumpang Binangae area comprises of coasts and local residences. The authors divide the Sumpang Binangae area into four zones: the recreation zone and tourist attraction (southern part); the Sumpang Binangae Beach platform zone (main venue); the fishery activity and trading zone (northern part); and the residences zone where the community live. Figure 4 presents an overview of the Sumpang Binangae coastal area in Barru Regency.



Figure 4. General description of Sumpang Binangae’s coastal area and the division of regional zones
 Source: Authors, 2024

Zone One is the coastal area used for recreational activities. Batu Beach in Barru Regency is a popular destination for beach tourism activities among local residents and domestic tourists due to its well-maintained facilities and designation as a beach tourism attraction. Residents use the area between Zones One and Two to dock their boats upon returning from fishery activities. Tourism stakeholders can take advantage of the location between Zones One and Two to hold event activities. Zone Two is where all activities related to events are centred. Using the regional budget, the regional government has held two main events in Zone Two. The community also uses Zone Two to do informal activities. During the observation, the authors met with Tamiya Race Lover, an association whose members share a mutual interest in miniature, electric-powered race cars produced by the Japanese company Tamiya. The community members often utilise the spaces on the Sumpang Binangae pavilion to conduct group activities like miniature car races and competitions. However, the use of Zone Two by tourism stakeholders is only partially optimal because event organisation is highly dependent on the local government as the activity planner.

Zone Three is a coastal area where fishermen dock their boats upon returning from the sea. Residents also use this area as a location for selling

various types of local products, which eventually becomes a morning traditional market. Conversely, this traditional market has the potential to become a tourist attraction and improve tourists' experience while visiting Barru Regency. The market is in close proximity to the fish auction location, enabling the fishermen's catches to be sold directly to buyers. In the tourism context, fish auction locations can serve as tourist attractions that are based on marine products. Several destinations in Indonesia have become culinary centres based on fish auctions, including the Lappa fish auction in the Sinjai Regency, South Sulawesi and the Beba fish auction (culinary tourism) in the Takalar Regency, South Sulawesi.

Zone Four is where the locals' residences are located. In this zone, residents use their homes for various types of businesses, such as cafes, restaurants, and trading. It is hoped that residents will become essential to planning and organising events in the Sumpang Binangae area. The highway in Sumpang Binangae is an important area to support the event. Regarding the crowds passing by residents and vehicles, the actual conditions in the Sumpang Binangae highway area can be categorised as yet to be crowded. This is because the road is not an axis that connects one region to another. The width of the highway is about 12 meters, which can be used for various purposes when organising events.

The Opportunity for Planning International Tourism Events

The coastal area of Sumpang Binangae is the primary location of the authors' study in planning tourism events within the sub-district. The primary location for tourism events is the Sumpang Binangae Beach, which is a physical development in the form of a waterfront. The local government, through the Barru Regency Tourism, Sports, and Youth Office, often holds tourism events at the Sumpang Binangae Beach. However, the community expressed their concern regarding limited number of activities held at Ujung Batu Beach. This is aligned with the observation results, portraying a scarcity of visitors and quiet beach areas. A resident said that such conditions occur at night and during the day as well.

These conditions indicate the importance of planning and organising events, particularly at the Sumpang Binangae Beach. The purpose is to provide opportunities for residents in the Barru Regency to benefit from the existence of the Sumpang Binangae Beach. The arrival of visitors to the Sumpang Binangae sub-district is an opportunity for many small and medium businesses to promote and sell their products. Furthermore, it allows passing travellers to experience the unique features and qualities that the Barru Regency has to offer and consider it a tourism destination worth visiting. Well-planned events can prompt visitors to make Barru Regency their leading destination. The authors propose a number of

potential events that can be held in the coastal area of Sumpang Binangae (Tables 1, 2, and 3).

Table 1: Proposed events based on maritime potential

<i>Events based on maritime potential</i>			
No	Proposed Event	Reasons for Organising the Event	Opportunity for Organising the Event
1	Festival of maritime culture	Coastal community life can be an attraction for tourists by holding festivals. Various activities can support the festival, such as culinary based on maritime culture, dances, and performances.	Events can be held in Zone Two of the coastal areas by using other zones.
2	Festival of traditional boats	Barru Regency is synonym to marine life. Traditional boats can be tourism products and provide opportunities for traditional boat competitions and exhibitions.	The coastal and sea areas of Sumpang Binangae can be the main location for this activity.
3	Festival of Spermonde archipelago	Barru Regency and its surrounding destinations are part of South Sulawesi, which is famous for the Spermonde archipelago. It will be an exciting event focusing on exhibitions and publications about Spermonde.	Using coastal areas as activity venues will be relevant to the Spermonde Archipelago theme. However, tourism stakeholders must plan the activities according to the program's themes and objectives.
4	Traditional games festival	Traditional games tend to be lost. Hence, efforts are needed to bring them back so that the younger generation will better understand their culture.	The Sumpang Binangae Beach platform is an ideal location for such activities. These activities should involve culture lovers and the younger generation.
5	Festival of local culinary	Barru Regency and its surrounding destinations have local culinary delights with sales value that should be promoted. It can also promote economic transactions for local people and a love for local culinary delights.	The Sumpang Binangae beach pavilion is an ideal location for such activities. However, the local government must act as the planner and companion for the community and organisers so that the event can run according to the expected goals.

<i>Events based on maritime potential</i>			
No	Proposed Event	Reasons for Organising the Event	Opportunity for Organising the Event
<i>Events based on cultural and natural potential</i>			
6	Barru Tamiya race	During the authors' visit, a group of Barru youths utilised the beach platform to do their hobby of racing Tamiya cars.	Barru Tamiya race
7	Nine ball competition	A community group in Sumpang Binangae manages billiards and they are enthusiastic about this activity.	Nine ball competition
8	Sports event	Sports events have been proven effective in attracting domestic and foreign tourists. Many destinations in Indonesia have made sporting events as the main attraction for tourist visits, such as fun runs.	Sports event
9	Kites festival	Kite is a traditional game that can be an attraction for tourists. Various delegations from countries around the world or the archipelago can support the implementation of this event.	Kites festival
10	Competition of creativity and innovation of tourism village	The Barru Regency's local government advocates tourism villages as a strategy to develop regional tourism. Other areas in Indonesia can participate in the publication and exhibition of creative tourism village products.	Competition of creativity and innovation of tourism village.

Source: Authors, 2024

As proposed in Table 1, planning and organising events cannot be separated from the roles of the government, tourism industry, and local communities. The regional government, through the local tourism office, becomes the central planner and actor because it has the budget and power to regulate the implementation of events. Therefore, local governments can schedule event planning and budgeting activities. Other stakeholders also play an essential part of realising the various planned events. The government is one of many stakeholders that organises all activities. Hence, there should be a regulatory mechanism to manage the Sumpang Binangae Beach platform properly and focus more event activities on that location.

Mechanisms for Planning International Tourism Events

Tourism events are important attractions for visitors to an area and coastal areas that can host such events are crucial in the strategic planning and organisation of tourism initiatives. The Sumpang Binangae Beach has several advantages that make it an ideal location for hosting events. It is strategically close to the city of Barru Regency and offers ample space for events of various scales, from international to local. The coastal vicinity of the Sumpang Binangae sub-district has been actively utilised by residents to establish a variety of tourism businesses, including the Ujung Batu Beach, several café ventures, food and beverage micro-enterprises, and the Padongko Beach, which is celebrated as a key tourist attraction. Furthermore, the proximity of Bola Pitue, a traditional house illustrative of Barru Regency, enhances the cultural appeal of Padongko Beach. The area is characterised by a vibrant maritime culture with locals known for their warm hospitality and support towards tourism activities within Barru Regency. This hospitable environment is reinforced by the local government, particularly the Regional Board of Tourism, which actively promotes community engagement in developing regional tourism, further highlighting the potential offered by Sumpang Binangae Beach as a prime location for tourism events.

Accordingly, a framework is outlined to enhance tourism development in the Barru Regency through strategic planning and organising of events, particularly capitalising on the potential of the Sumpang Binangae Beach platform. While the local government has tapped into the attraction of Sumpang Binangae Beach by holding annual events, there is a recognised need among tourism stakeholders for a more robust calendar of events to bolster the destination's appeal. A proposed mechanism for the effective planning and organisation of such events includes the establishment of a local organisation. This body would act as an extension of the local government, specifically managing Sumpang Binangae, similar to the arrangement seen with the Ujung Batu Beach's management by the local organisation Pokdarwis Tunas Bahari. Furthermore, the regional government is suggested to offer training aimed at enhancing the skills needed for tourism area management and event management. This organisation, in coordination with various stakeholders, would play a pivotal role in not only planning and organising events but also in promoting Sumpang Binangae as an ideal event venue.

In the digital economy era, technology integration and access to digital markets, including social media, are crucial (Mior Shariffuddin et al., 2023; Mohd Salim et al., 2024). Local governments and institutions increasingly leverage technology for event promotion with social media playing a significant role in managing and promoting events. Academic research has demonstrated that event managers who actively use social media for promotion are more likely to achieve successful event outcomes (Sigala, 2018a, 2018b). Consequently, event

organisers can effectively utilise digital marketing strategies to enhance the promotion of events in Sumpang Binangae.

The successful planning and organisation of events should prioritise the processes of planning, organising, directing, and monitoring (Yuliza & Pramayoza, 2022). These processes can be conducted by local institutions chosen by the local government. In cases where no agency is responsible for managing the event venue, the Regency Tourism Office can take on the role of event organiser, representing the community in a community-based and sustainable tourism approach. Purnamawati (2021) emphasises the importance of the community in achieving the goals of community-based tourism, creating opportunities for local residents to earn income through tourism.

Events are interconnected and involve various stakeholders (inseparability). The Barru Regency Tourism Office and local agencies must collaborate and coordinate with relevant stakeholders to plan events. The participation of other stakeholders is essential for the local government to execute the event. For instance, conducting an event at the Sumpang Binangae Beach platform should involve both internal and external participants from Barru Regency (perishability). External participants, categorised as domestic tourists, can promote Barru Regency by participating in events. Both residents and event participants gain unique experiences when taking part in events (heterogeneity). Consequently, event organisers should prioritise providing optimal service to the participants. Management training focusing on customer service is essential in the event planning and organising process to ensure a unique experience for the participants. While event participants partly depend on delegations from outside the Barru Regency area, domestic and foreign tourists also visit destinations in the South Sulawesi province.

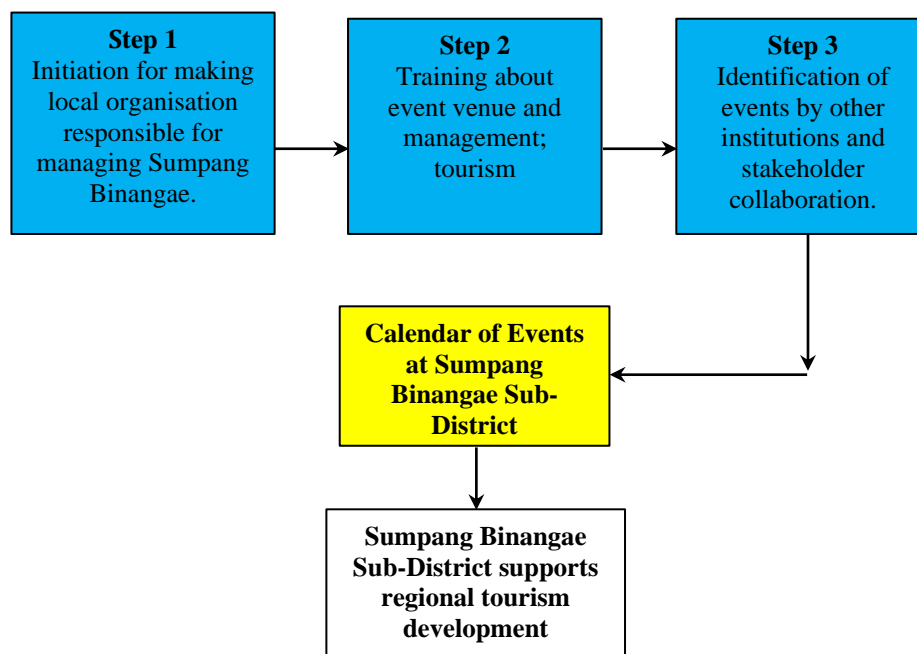


Figure 5. Scheme for event planning at the coastal area of Sumpang Binangae Sub-District in Barru Regency
Source: Authors, 2024

CONCLUSION

The efforts of the local government in Barru Regency to build the Sumpang Binangae beach are evidence of their concern for building infrastructure that can support regional tourism. This study illustrates that limited activities or events in the coastal area are one of the factors that must be maximised in terms of platform utilisation to support regional tourism. From a tourism perspective, having a calendar of events that includes all events held in Barru Regency, especially at the Sumpang Binangae Beach platform, is necessary. However, this goal has not been achieved well because tourism stakeholders have yet to optimise the infrastructure. Even though the local government has held an event on Sumpang Binangae Beach, it has yet to support the Barru regency's tourism development fully. The actual conditions show that the coastal area of the Sumpang Binangae sub-district has the opportunity to become the location for holding various events. Strategic locations, spaces for holding outdoor events, the marine life of local communities, the hospitality of residents, and support from relevant stakeholders in planning and organising events are opportunities for holding events in coastal areas.

This paper has described three types of events: maritime-based events, maritime-based events related to culture, and events based on current conditions. There are three stages to planning and organising events in coastal areas. Forming a local organisation that functions as an event planner and organiser is the first step for the local government of Barru Regency. Training for stakeholders is crucial in offering provisions to local institutions to prepare outdoor events and tourism activities in coastal areas. Identifying events and collaborating with internal and external stakeholders is the third stage in compiling a Sumpang Binangae coastal area event calendar. The implementation of a tourism event is not solely the role and task of the local government but involves various stakeholders in tourism destinations.

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CONSERVATION AND REVITALIZATION OF TRADITIONAL CHINESE VILLAGES: A CASE STUDY OF JINXI COUNTY, CHINA

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Abstract

China's heritage protection system encompasses material, intangible, and traditional village heritage. A combination of tangible and intangible cultural resources produces traditional villages. How to revitalize these villages has become a significant issue, as they represent the inheritance of agricultural civilization. In the northeastern part of Fuzhou City, Jiangxi Province, the proportion of traditional villages is highest in Jinxi County. Using a combination of field surveys and in-depth interviews, this article clarifies the process of conserving and revitalizing traditional villages in Jinxi County. It shows that the layout, architectural features, and integrating of multiple cultural elements embodied in the villages construct Jinxi's sense of place. These villages are also components of the ecotourism industry and are thus essential to revitalizing rural economies. From initiatives such as the "Rescuing Old Houses Action" to the implementation of "Ancient Village Financial Loans," various government and social capital investments provide financial support to protect traditional villages. Furthermore, a diverse governance model has been established, involving active participation from government entities, village committees, villagers, development companies, and social organizations. The conservation and revitalization of traditional villages in Jinxi County is a noteworthy example, demonstrating the synergies among government initiatives, community involvement, and financial investments to preserve cultural heritage.

Keywords: Traditional Villages, Value Characteristics, Conservation and Revitalization, Governance Models, Jinxi County

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INTRODUCTION

Since the mid-1990s, rural areas in China have faced significant challenges due to rapid industrialization and urbanization. The migration of the youth and middle-aged workforce to urban areas has resulted in the decline of many villages, particularly in traditional villages, causing population hollowing, cultural decline, and land idleness (Green, 2018; Li et al., 2019; Liu et al., 2022). Additionally, some unscientific construction practices, such as using non-traditional materials, demolishing old buildings, and excessive tourism, have caused damage to architectural integrity and traditional lifestyles (Sun, 2017; Zhang, 2017). Studies show that traditional villages hold historical value and are recommended as heritage tourism resources supporting urban development (Ahmad & Ramli, 2022). Traditional architecture, as a critical element, attracts tourists (Ibrahim et al., 2022). Protecting these villages preserves cultural heritage and promotes balanced tourism and urban-rural development.

After 2012, the Chinese administration began to issue a sequence of policies to make traditional villages effectively protected, reasonably utilized, and efficiently governed. In July 2023, the Ministry of Housing and Urban-Rural Development released the first batch of referable experiences for protecting and utilizing traditional villages, covering provinces with dense distributions of traditional villages, such as Jiangxi, Yunnan, Guizhou, and Anhui.

Focusing on Jinxi County, a region with many traditional villages in Jiangxi Province, the objectives of this paper are (i) to highlight the value attributes of traditional villages about tourism; (ii) to analyze financial sources for the preservation and revitalization of traditional villages; and (iii) to clarify the governance models that involve various stakeholders. The outcome of this paper will provide insights and case studies for similar initiatives elsewhere.

LITERATURE REVIEW

Study on the Conservation and Advancement of Traditional Villages in Jinxi County

Studies on the conservation and advancement of traditional villages have intensified since the establishment of the village protection system in China in 2012. Studies have focused on analyzing spatial layouts and characteristics (Hu et al., 2021; Li et al., 2020), public spaces' transformation and optimization (Chen et al., 2018; Feng & Zhao, 2016), and developing evaluation systems and methods (Wang & Sun, 2021). Ancient villages in southern Anhui (Wannan) and Huizhou ancient villages have been focal points of scholarly research (Li et al., 2017).

Due to the later initiation of traditional settlement protection efforts in Jinxi County, more research is needed on the conservation and advancement of traditional villages, as current research primarily concentrates on the following facets. First, field research on typical traditional villages is conducted to determine their value and structural characteristics (Fan & Zhong, 2017; Yang &

Long, 2021). The second covers local practices of cultural heritage protection and development (Wang et al., 2021; Wu, 2020). After nearly ten years of local practices, the conservation and improvement of traditional villages in Jinxi County have successfully revitalized tangible heritage and government effectiveness. Systematic investigations and research are needed to summarize experience.

Jinxi County

Established in 994 AD during the Chunhua era of the Northern Song Dynasty, Jinxi County is located northeast of Jiangxi Province, between the Wuyi Mountains and the Poyang Lake plain (Yao & Cai, 2020). Regarding natural geographical conditions, Jinxi has a mild climate and fertile soil, leading to prosperous agriculture and earning the historical designation of "Grain Production Base in Eastern Jiangxi." Regarding historical and cultural aspects, Jinxi has a longstanding tradition of cultural reverence and educational importance, resulting in numerous talents. In the core region of Linchuan culture, Jinxi County has been deeply influenced by this cultural heritage, becoming a national base for the woodblock printing industry and flourishing in commercial trade based on the Fuhe River in the Qing Dynasty.

Furthermore, Jinxi County historically had a relatively slow economic development compared to other regions in Fuzhou since ancient times, which is the main reason behind the preservation of many traditional villages (Chen et al., 2018). Most of these traditional villages were established during the Song Dynasty, prospered in the Ming Dynasty, and were stable and perfected during the Qing Dynasty, earning them the title of living fossils of well-preserved Ming and Qing-style Gan architectural settlements (Wu, 2020).

Traditional settlement conservation in Jinxi County began relatively late, with Zhuqiao Village added to Jiangxi's historical villages list in 2009. Since then, development has accelerated. The county now boasts one regional historical city, two historical districts, one national historical town, six national historical villages, and 57 Traditional Chinese Villages. The quantity of traditional villages ranks first in Jiangxi Province. Their spatial distribution is shown in Figure 1. These settlements feature well-preserved spatial structures, high-quality traditional buildings, and valuable historical documents, embodying the essence of traditional settlements in the central region of Jiangxi Province (Yao & Cai, 2020).

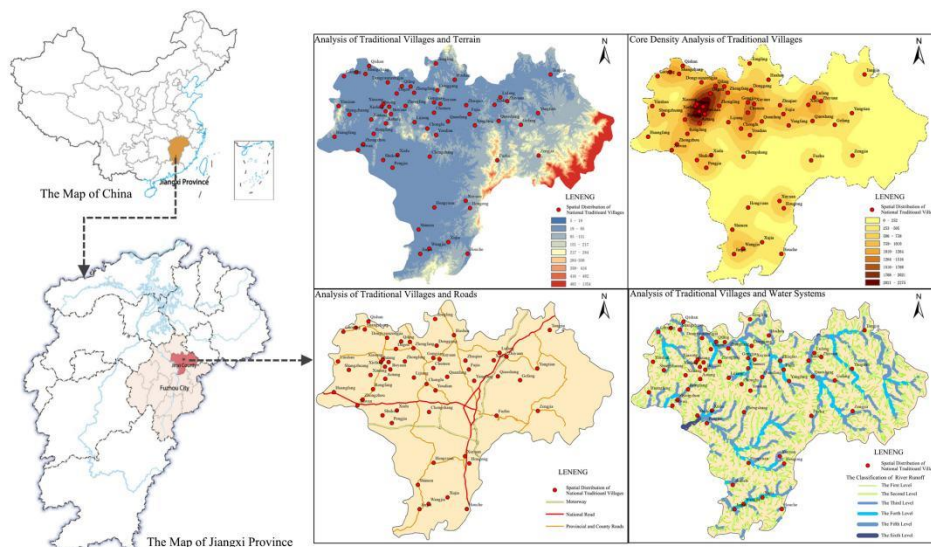


Figure 1: The Location of Jinxi County, China, and the Spatial Spread of Traditional Chinese Villages in Jinxi County
 Source: Author (2023)

RESEARCH METHODOLOGY

The data and materials for this study were mainly gathered through fieldwork, in-depth interviews, and the study of documents from June 2021 to September 2022. The fieldwork included active observation, drawings, and photographs. The primary qualitative research methods focused on investigating the attributes of the physical environment in traditional settlements and the implementation procedures. A purposive sampling method was used to select seven participants, ensuring diversity in backgrounds and involvement during the implementation phase. The primary information of the seven interviewees is shown in Table 1. Furthermore, the management methods, implementation plans, rules, and regulations for preserving and enhancing traditional villages were acquired through an analysis of policy documents released by the local government.

Through extensive field investigation, our research probed into three questions: (i) What heritage resources and values do traditional villages depend on to enhance the tourism industry? (ii) What financing sources are available to preserve and enhance traditional villages? (iii) What are the anticipated benefits of the protective practice that local people expected, and what are the actual outcomes achieved on the ground? To address these questions, the interviewees we have chosen mainly include (i) experts studying the preservation of indigenous cultural heritage in Jinxi; (ii) government administrators overseeing traditional village preservation and advancement initiatives; and (iii) local villagers who have consistently participated in protective efforts. This paper

adopts a qualitative research method of thematic analysis to organize interview data. According to the fieldwork mentioned above, we gained a thorough understanding of the development of preservation and sustainable utilization techniques in traditional villages in Jinxi County.

Table 1: Interviewees' demographics

ID	Age	Occupation	Role
IV1	55-60	The director of the Cultural Relics Research and Conservation Center	The expert specializes in safeguarding cultural artifacts in Jinxi County and has participated in assessing the value of numerous traditional villages and conducting research on traditional building construction.
IV2	50-55	The head of the Old House Management Office	Involved in the "Rescuing Old Houses Action" in Jinxi County.
IV3	40-45	The director of Rural Development and Revitalization Investment Group	Responsible for transferring traditional village operating rights and financial loans for ancient villages.
IV4	35-40	The inheritor of Jinxi woodblock printing intangible cultural heritage	A returning adult who repairs old buildings and promotes intangible heritage culture experiences.
IV5	60-65	The former village secretary of Youdian	A local cultural heritage conservator and the First, we need to protect the historic building in Youdian village.
IV6	45-50	The hotel owner and tour guide in Zhuqiao village	Integrating accommodation with the surveying and mapping of ancient architecture courses of universities.
IV7	40-45	A local cultural tourism company owner	Involved in developing rural cultural tourism in Lufang village.

Source: Author (2023)

ANALYSIS AND DISCUSSION

The Heritage Conservation Value of Traditional Villages in Jinxi County

Traditional villages in Jinxi County exhibit unique settlement characteristics, creating a cohesive ecosystem with the natural environment. Situated in varied landscapes, some villages are in hilly areas by water bodies, while others are on plains encircled by farmland. These types of site selection are highly conducive to developing traditional agriculture. Despite years of development, the spatial configuration of streets, alleys, and architectural styles remains preserved. Notably, these villages often feature defensive layouts with gatehouses at cardinal points (Chen et al., 2018), resembling fortresses (Figure 2), as seen in Beikeng and Chenghu Villages, enclosed by continuous exterior walls. According to IV1, a local cultural heritage expert, this defensive design stems from two main reasons: (i) Many of these villages are single-surname villages, where the entire clan of several hundred households is considered one village, constituting a large

family. (ii) During invasions of mountain bandits, this layout served as a defense mechanism against external threats.



Figure 2: The Defense Pattern with Gatehouses of Village Construction
Source: Author (2018)

Ceremonial buildings and Gan-style residential architecture are a form of essential tangible cultural heritage that shape the local identity of Jinxi and serve as the core carriers for rural cultural tourism development. Clans in China are historically a self-governing social structure in rural areas, typically formed around familial relationships (Shen & Chou, 2022), and the villagers with the same ancestor and surname laid out their residential buildings around ancestral temples, forming a spatial form of "cohabitation of clans." Ceremonial buildings encompass ancestral halls, academies, stages, and archways, creating the spiritual space of the village's "cohabitation of clans." For instance, the Lu clan organizes the yearly ancestor worship event in the ancestral hall of the Lu family in Lufang Village on Lunar New Year's Day (Figure 3), drawing numerous tourists. IV1 stated that the ancestor worship ceremony enhances visitors' comprehension of the local culture. Traditional residential buildings are distinctive Gan-style houses with Jiangxi characteristics shaped by the natural environment and village layout. These dwellings primarily adopt a courtyard-style layout (Huang, 2008), using the "Jin" as the basic structural unit, with the typical floor plan often following the "one bright, two dark" three-space pattern (Figure 4).

In addition, traditional villages in Jinxi County incorporate various cultural elements such as the Philosophy of the Mind, business guild culture, and clan culture. Lufang Village is famous for Lu Jiuyuan, a key philosopher from the Southern Song Dynasty, and now is a recognized site for family tradition and education in Jiangxi. During the Ming and Qing dynasties, Zhuqiao and Huwan Villages were significant centers for woodblock printing, significantly influencing the Jiangxi business guild with their widespread trade. These

historical cultures have inherited cultural values and strengthened the sense of belonging among the local villagers.

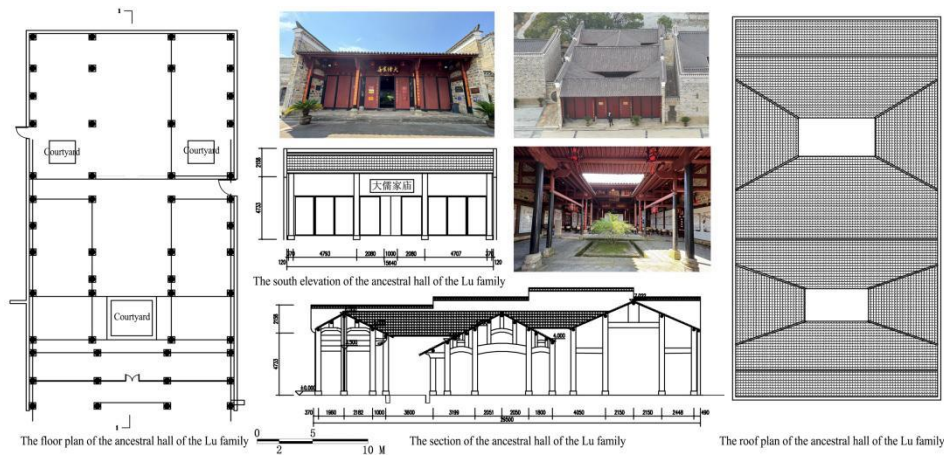


Figure 3: Mapping the Lu Family's Ancestral Hall in Lufang Village
 Source: Author (2023)

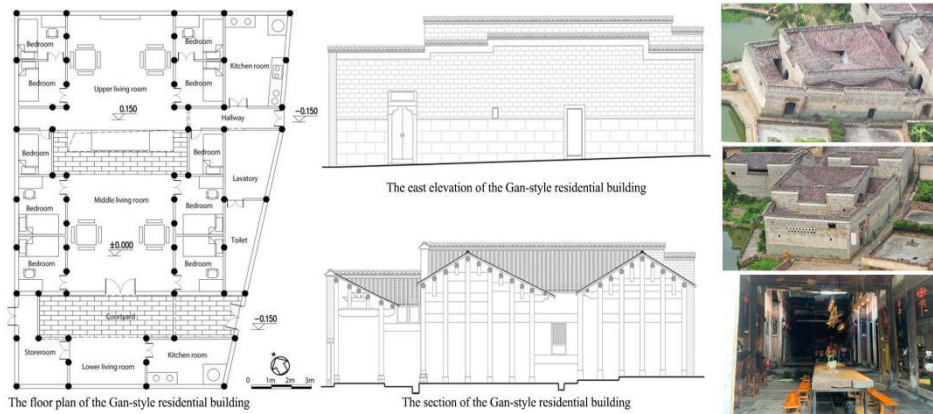


Figure 4: Mapping of the Gan-style residential building in Zhuqiao Village
 Source: Author (2023)

Conservation and Revitalisation Funds

The primary task of protecting traditional villages is preserving and renovating traditional buildings, which require substantial funds for restoration. From the "Rescuing Old Houses Action" to the "Ancient Village Financial Loans," Jinxi County has made valuable explorations on raising conservation funds.

The "Rescuing Old Houses Action" Project

The "Rescuing Old Houses Action" project, funded by the Ministry of Finance and managed by the Chinese Cultural Heritage Foundation, concentrates on preserving traditional villages. It began with a successful pilot in Songyang County, Zhejiang Province, in 2016 and expanded to Jinxi County, Jiangxi Province, in 2018. The project, completed over two years, involved a total investment of 80 million yuan. The Foundation contributed 40 million yuan, with Jinxi County providing matching funds of 24 million yuan, and property owners self-raised 16 million yuan. Property owners identified as impoverished were paid a full subsidy for renovating their old houses. IV2, the head of the Old House Management Office, stated:

"The "Rescuing Old Houses Action" project has renovated 750 ancient dwellings in the county. Some renovated ancient dwellings have been revitalized and transformed into homestays, restaurants, and private museums, creating a certain economic value."

Jinxi County developed specific policies for effective project implementation, such as the "Implementation Plan for the Rescuing Old Houses Action in Jinxi County" and the "Financial Management Measures for the Rescuing Old Houses Action in Jinxi County." Based on these policy documents and building upon the implementation plan of the "Rescuing Old Houses Action" project in Songyang County (Zhang et al., 2021), the author has summarised the collaborative relationships among various parties in the project (Figure 5). The collaboration framework includes the following stakeholders: (i) The owners of old houses, the leading force in the project, selecting craftsmen to assist them in completing project applications, renovation plans, budget preparations, and construction organization. (ii) The "Old House Office," which offers help and guidance to villagers in various procedural aspects of the project, playing a supporting and supervisory role. (iii) The Design Research Institute, as the technical support team of the project, focuses on the technical direction of project implementation and the training of local craftsmen. In addition, the foundation provides funds and oversees progress. The foundation also engages the media to enhance the project's visibility, ensuring a well-functioning system involving property owners, government, foundation, and technical teams.

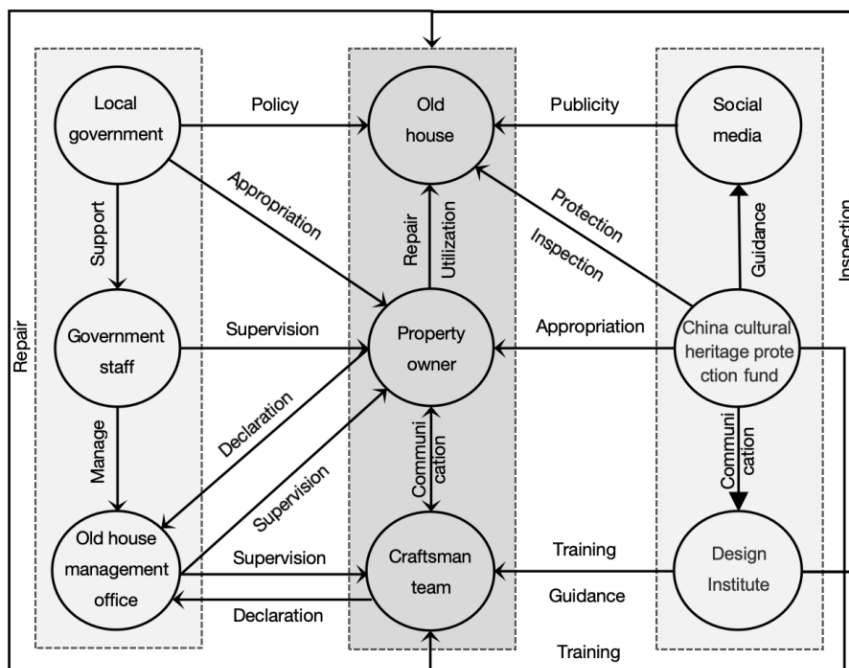


Figure 5: Work Relationship Diagram of "Rescuing Old House Action" in Jinxi County

Source: Author (2023), based on the police documents about the "Rescuing Old Houses Action" project

The "Ancient Village Financial Loan" Project

Besides the special funds supported by the central government, social capital's participation is a crucial driving force for revitalizing traditional villages. In 2020, Jinxi County launched the innovative "Ancient Village Financial Loan," intended to stimulate social capital's enthusiasm to actively renovate and utilize ancient villages and traditional buildings. IV3, the director of Rural Development and Revitalization Investment Group, introduced the "Ancient Village Financial Loan" operation process, which uses old houses with clear property rights as collateral (Figure 6).

First, the Jinxi County government established a dual certificate system for old buildings' property and operating rights. Through the "Jinxi County Ecological Product Trading Centre," the old buildings' property rights registration system is improved. Second, as the property owners of old buildings, villagers can voluntarily entrust the old buildings to the village committee. The committee then transfers the operating rights to the county's tourism investment or development company. After entrustment, the property rights of old buildings remain unchanged, and investors can use part of the operating rights of old buildings as collateral to apply for loans from banks.

With the expansion of China's domestic demand market, local talent is required in rural regions (Shen & Chou, 2022). Youthful abilities can significantly boost innovative business advancements in rural areas (Kao et al., 2018). Implementing the 'Ancient Village Financial Loan' has attracted some youth to return to their hometowns for entrepreneurship. IV4, a returning adult and the inheritor of Jinxi woodblock printing's intangible cultural heritage, repaired his old house and rebuilt it into the Qin Tian Academy. The academy is open to visitors free of charge and provides reading spaces and books. Furthermore, IV4 leased and renovated old houses, turning them into homestays and traditional skill workshops, such as Jinxi woodblock printing craftsmanship. Revising old houses has also stimulated employment opportunities for other local villagers.

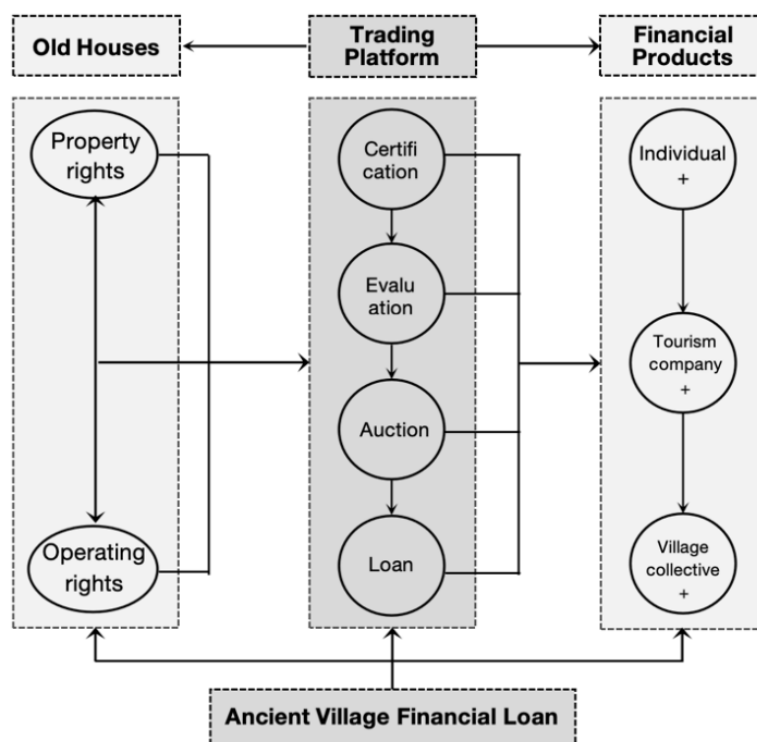


Figure 6: Diagram of " Ancient Village Financial Loan " in Jinxi County
Source: Author (2023), based on the police documents about the " Ancient Village Financial Loan " project

The Governance Models

In modern society, as traditional villages transform from a single residential purpose to a versatile role encompassing dwelling, tourism, and research, the phenomenon of diversification in rural governance stakeholders has emerged

(Feng, 2013), which include local governments, development companies, village councils, ordinary villagers, and cultural experts (Wang et al., 2021). Some Chinese scholars have analyzed through case studies the roles of various participating subjects in the rural governance process, categorizing rural governance models into government-led, development company-led, and village council-led (Sun & Zhang, 2021; Wang et al., 2021). According to surveys of the implementation process of preserving and developing traditional villages in Jinxi County, it has been found that its governance model generally follows the patterns of typical rural governance but also exhibits uniqueness.

Zhuqiao Village: the local government-led model

Zhuqiao Village was established in the early Ming Dynasty. In ancient times, the village was also one of the leading production centers for Jinxi woodblock printing. In 2010 and 2012, Zhuqiao was designated the Historical and Cultural Village and the Traditional Chinese Village by the Chinese Ministry of Construction and the National Cultural Heritage Administration. The rural governance process in Zhuqiao can be segmented into three phases:

Initially, under the clan family's influence, villagers autonomously organized living spaces around ancestral halls, forming a spatial pattern with traditional Chinese kinship characteristics.

During the second phase, the village's historical significance prompted the local government to implement heritage protection measures. They employed cultural specialists to restore ancestral halls and academies and established legislation to protect them. The village committee was crucial in informing villagers and harmonizing their interests for project success.

In the third stage, the focus shifted to revitalizing the village through investments in traditional buildings and the living environment. Rural tourism facilities were also developed, and various tourism initiatives were enhanced, leading to Zhuqiao Village being recognized as a national 4A-level tourist attraction in December 2017. The following year, a tourism development company was brought in to manage the scenic area.

The comprehensive protection of Zhuqiao Village, from financial investment to the concrete implementation of preservation, has been led by government departments. The cultural experts, local elites, villagers, and development companies support the governance activities of the local government. Under this governance model, Zhuqiao Village has achieved a unified village protection plan. It has also become one of the most mature villages in rural tourism development in Jinxi County, inspiring a group of villagers to return to their hometown for entrepreneurial opportunities. IV6, a local hotel owner and tour guide in the hamlet, converted her new residence into a three-story lodging. She refurbished her ancient residence, constructed during the Qing Dynasty, to accommodate up to 60 households.

Youdian Village: the village council-led model

Youdian village was established during the early Ming Dynasty. It has preserved over 36 ancient buildings and seven ancient streets from the Ming and Qing periods. Youdian was designated as the Traditional Chinese Village in 2016 and the Historical and Cultural Village in 2018 by the Chinese Ministry of Construction and National Cultural Heritage Administration. The rural governance process in Youdian village can be segmented into two phases:

During the village protection phase, IV6, the former village secretary of Youdian, first realized the village's value and proposed protecting historical buildings. In 2015, he took the lead in repairing his old house, actively mobilizing villagers to restore their houses and coordinating with social forces to donate funds to restore historical buildings. In 2018, the village became among the first in Jinxi County to implement the "Save Old Houses Action" project. Thirty-six residences constructed in the Ming and Qing periods were restored.

During the village revitalization phase, the village became a pilot village for whole-village trusteeship in 2020. The Rural Development Revitalization Investment Group, a dedicated department of the local government, signed a trusteeship agreement with the village. The group applied for mortgage loans using part of the operating rights of old houses and carried out environmental improvement and revitalization of traditional buildings in the village. In 2021, prestigious Chinese universities, including Tsinghua University, Peking University, and Wuhan University, renovated three old houses in Youdian Village, combining cultural heritage with digital technology for display. The village has become the basis for outdoor educational programs of these universities, carrying out ancient village visits, ancient building surveying, sketch teaching, and cultural folk experience activities.

The village council played a crucial role in the early protection stage by integrating various funds to restore historical buildings. The local government was the primary investor in the revitalization and utilization stage. Simultaneously, universities supported the preservation and showcasing of the significance of old buildings through restoration design.

Lufang Village: the development company-led model

Lufang village was built during the Five Dynasties and is listed as one of the fifth batch of Traditional Chinese Villages. In 2015, Lufang Village used special funds for rural construction to renovate the village's living environment. In 2019, to commemorate the 880th anniversary of Lu Xiangshan's birth, the village was leased entirely by a tourism development company. The company invested more than 20 million yuan to initiate the restoration project of ancient buildings, including the restoration of 6 ancient buildings, the construction of 5 water-based homestays, and the development of related tourism. IV7, the local cultural tourism company owner, said:

“The village tourism company development has expanded the villagers' employment opportunities. The company employees comprised many villagers, including two managers, three guides, eight salespeople, five security guards, and ten cleaners.”

In Lufang Village's rural governance, the tourism company has invested in acquiring the right to use traditional buildings. The Village Council coordinates the acquisition matters between the company and the villagers, while the government invests in improving the village's living environment. The village has formed a model with the development company leading, while the government, village committee, and villagers offer collaboration.

CONCLUSION

Protecting traditional villages is primarily a public welfare undertaking and is not easily profitable in the short term. Jinxi County has many traditional villages, and the rich historical heritage poses significant economic and technological pressures on conservation efforts. However, through practical experience in recent years, Jinxi County has accumulated substantial expertise in preserving and revitalizing traditional villages, achieving notable success.

Protection values: Jinxi's historical and cultural heritage, including its traditional village layout, Gan-style architectural traditions, and diverse cultural elements, shapes its unique identity and contributes to the ecotourism industry, which is crucial for rural economic development.

Conservation and revitalization funds: From the "Rescuing Old Houses Action" to the "Ancient Village Financial Loans," local governments have actively applied for special funds from the central and provincial governments, which are critical to protecting traditional villages. At the same time, the involvement of social capital is a significant driving force for revitalizing and utilizing traditional villages.

Governance models: Jinxi's government of traditional villages involves local government, development companies, village councils, and social organizations to preserve and rejuvenate these villages. This effort has taken three main forms: government-led, development company-led, and village council-led.

This article mainly explores the historical significance of traditional villages in Jinxi, the financial sources for their preservation and revitalization, and governance models. Challenges have arisen during the protection and revitalization process, such as the departure of young people from the village, inadequate participatory depth, tourism experience, and a lack of citizen involvement. In-depth research is required to examine the practical factors involved in adopting different governance models and their impact on the rural revitalization of ancient villages.

ACKNOWLEDGEMENT

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CHALLENGES AND OPPORTUNITIES FOR IMPLEMENTING INNOVATIVE GREEN TOURISM PRACTICES: EVIDENCE FROM INDONESIA

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Abstract

Indonesian urbanisation has led to increased pollution, waste, and a reduction in green spaces, resulting in environmental and public health problems. Implementing green tourism, which focuses on sustainability, conservation, and community engagement, as an integral part of future sustainable urban tourism planning can help address these issues. Given the strength of the concept, it is the aim of this research to explore the challenges and opportunities for innovative green tourism practices in major cities in Indonesia, offering practical solutions to promote sustainable urban tourism. The research methodology involved conducting semi-structured interviews with 8 informants and holding focus group discussions with 15 informants, drawn from policymakers, local communities, and tourism operators, respectively. Using thematic analysis revealed patterns and key topics that encapsulate major issues, including poor infrastructure, inconsistent policy enforcement, little public knowledge, and short-term economic pressures. Technological innovation, policy reform, and community engagement can overcome these obstacles. International case studies like Singapore and Copenhagen show how multi-stakeholder approaches and technology may improve urban sustainability. Addressing infrastructure and regulatory deficiencies, engaging communities, using technology, and encouraging public-private partnerships are needed to implement green tourism in Indonesia. Indonesia can balance environmental protection with economic and social well-being by enacting comprehensive legislation and boosting awareness, creating a sustainable and resilient tourism economy. This research gives policymakers and stakeholders concrete information to promote green tourism and sustainable urban development in Indonesia.

Keywords: Green Tourism, Innovation, Sustainability

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INTRODUCTION

Urbanisation and its environmental impacts pose significant threats to urban sustainability. In Indonesia, rapid urban growth has intensified issues such as pollution, waste accumulation, and the loss of green spaces, thereby jeopardising public health. Addressing these challenges requires the adoption of green tourism, which promotes sustainability, conservation, and community engagement. Recent studies underscore the importance of green tourism in urban areas, advocating for eco-friendly living and environmental stewardship (James, 2023). To mitigate carbon emissions and enhance sustainability, large cities must embrace green tourism. Evidence shows that green tourism can effectively reduce air pollution, improve waste management, and preserve green spaces, thereby benefiting urban environments (Ramaiah & Avtar, 2019). However, implementing green tourism in major urban centres is often hindered by stakeholder resistance, high costs, and the need for a robust policy framework (Ershad Sarabi et al., 2019).

This research highlights the necessity for innovative green tourism strategies in large Indonesian cities. Urban areas in Indonesia face significant challenges related to air pollution, waste management, and the loss of green spaces due to development (Ismail & Amin, 2020; Li et al., 2019). The absence of comprehensive policies and inadequate stakeholder coordination exacerbate these problems, indicating a need for effective methods and policies to promote green tourism. Solutions to these challenges often involve crafting and implementing policies that engage government agencies, business entities, and local communities. Effective green tourism requires collaboration, integrating sustainable practices into urban design, and incentives for businesses to adopt green measures. As such, this paper proposes solutions based on successful case studies and empirical evidence from previous research. For instance, green tourism regulations in Singapore and Copenhagen highlight how multi-stakeholder approaches can enhance urban sustainability (Soma et al., 2018). These cities have established comprehensive green tourism frameworks featuring stringent environmental regulations, financial incentives for sustainable practices, and active community involvement in tourism planning and management.

Besides, technological advancements, such as smart waste management systems and green infrastructure, have also contributed to urban sustainability. IoT-based waste management systems in some European cities have improved waste collection and reduced pollution (Pardini et al., 2019). Additionally, green roofs and vertical gardens have mitigated the urban heat island effect and improved air quality in densely populated areas. Although there is extensive literature on urban green tourism strategies, especially in the context of highly developed nations, developing countries like Indonesia require more focused

research, given their niche socio-economic and environmental contexts. As such, this research aims to address this gap by examining the obstacles and opportunities for green tourism in Indonesia and offering practical implementation options. The study discusses the challenges and drivers of green tourism in Indonesian cities, proposes policy-based strategies involving all key stakeholders, and suggests collaborative approaches for fostering sustainable urban tourism in Indonesia.

LITERATURE REVIEW

Theories in the Realm of Green Tourism

A range of theories contributes to understanding sustainable tourism growth and the need for innovative green tourism practices. One key theory is the Theory of Planned Behaviour (TPB), which posits that tourists' intentions toward sustainable tourism are shaped by their attitudes, perceived behavioural control, and subjective norms. Integrating social responsibility and environmental knowledge into the TPB framework provides a deeper insight into tourists' green behaviours (Ismail et al., 2023). This approach fosters sustainable beliefs through education and awareness. Engaging tourism stakeholders is crucial for enhancing sustainability, community welfare, and environmental protection (Luongo et al., 2023). The Social Exchange Theory explores the dynamics between local communities and tourism development, highlighting that the perceived benefits influence residents' support for sustainable tourism. Research indicates that tangible benefits, such as improved quality of life and economic gains, increase community support for sustainable tourism. Therefore, tourism planners should actively involve local communities to address their needs and integrate their feedback. Greater ownership and involvement lead to more sustainable tourism development, benefiting visitors and residents (Han et al., 2023). Finally, the Stakeholder Theory emphasises the role of various stakeholders in advancing green tourism. It asserts that collaboration among local communities, businesses, and governments is essential for achieving sustainable tourism goals. Tourism planning should reflect the interests and perspectives of all stakeholders. This inclusive approach can enhance environmental, social, and economic policies, leading to a more sustainable and responsible tourism industry that supports environmental and human health (Gosling et al., 2023).

Innovation and Green Tourism

Innovation and green tourism are increasingly interconnected as the travel sector seeks environmentally responsible solutions to mitigate its impact. Innovation drives sustainable tourism by reducing pollution and fostering economic growth. To achieve sustainable development goals, tourism stakeholders must prioritise innovation, which not only protects the environment but also boosts the economy

(Ahmad et al., 2022). Another important concept is the development of "smart tourism destinations," which leverage digital technologies to manage tourism activities. This approach aligns with the smart city paradigm by utilising information and communication technologies (ICTs) to enhance both tourism and sustainability (Sonuç & Süer, 2023). Innovative technologies enable destinations to better meet guest needs and improve operational efficiency. The integration of ICT transforms tourism services and enhances stakeholder interaction, leading to more sustainable solutions (Sustacha et al., 2023). In the competitive global economy, adopting smart tourism practices is essential.

Moreover, integrating green digital technologies with green human resource management (GHRM) is vital for advancing green tourism. This relationship is highlighted by the increasing recognition of GHRM as a strategic approach that enhances employee engagement and aligns with broader sustainability goals in the hospitality industry (Nurimansjah, 2023; Haeruddin et al., 2023). Digital technologies can enhance service quality and streamline operations for these enterprises, thereby promoting sustainable tourism (Mior Shariffuddin et al., 2023). The research underscores that focusing on GHRM and digital innovation is crucial for developing sustainable tourism practices that align with global sustainability goals. Environmentally responsible tourism methods are essential for achieving these objectives.

Green Tourism Practices

Tourists who prioritise environmental sustainability are more likely to engage in green tourism. As environmental awareness grows, these tourists increasingly choose eco-friendly accommodations and support regional conservation efforts (Luongo et al., 2023). In green tourism, local residents' support for sustainable tourism initiatives is equally important. When residents perceive financial benefits and improvements in their quality of life, they are more likely to support and actively participate in green tourism. This reciprocal relationship underscores the need for tourism planners to consider the social and economic impacts of tourism on local communities to foster the growth of green tourism (Han et al., 2023; Yanti et al., 2023). Additionally, individual sustainable actions, such as minimising waste or supporting local businesses, can influence broader community practices. As more tourists embrace green tourism, they can inspire local residents to adopt similar practices, creating a culture of sustainability that benefits both visitors and the local community. This communal commitment to sustainable tourism not only enhances environmental protection but also preserves cultural heritage, ultimately fostering a more sustainable and harmonious relationship between tourism and local communities (Han et al., 2023; Luongo, 2023).

RESEARCH METHODOLOGY

This qualitative study explores the complex dynamics of green tourism in Indonesia. The descriptive approach enables an in-depth examination of the challenges and drivers of green tourism. The research employs semi-structured interviews and focus group discussions with policymakers, local communities, and tourism operators to capture diverse perspectives and experiences, which are crucial for analysing the potential and obstacles to developing sustainable tourism in Indonesian urban centres. Triangulation of data sources derived from both approaches enhances the robustness of the findings and ensures a comprehensive investigation. For this study, the three cities of Bandung, Jakarta, and Makassar were chosen as the research setting. Bandung, Jakarta, and Makassar are justified as research contexts for studying green tourism in Indonesia due to their diverse urban dynamics, economic significance, and geographical representation (refer Figure 1).

Bandung's focus on creative industries and sustainable urban planning contrasts with Jakarta's complex challenges as the capital city, including severe air pollution and waste management issues. Makassar, as a major urban centre in eastern Indonesia, adds a coastal and regional perspective, highlighting challenges in coastal tourism and environmental preservation. These cities represent different regions of Indonesia, offering a comprehensive view of the varying conditions and challenges across the country. Their significance in policy-making, tourism, and economic development, combined with the unique environmental challenges they face, make them ideal for analysing the hurdles and opportunities in implementing green tourism across different urban contexts in Indonesia.

Data collection involved in-depth, semi-structured interviews with tourism stakeholders in the cities of Bandung, Jakarta, and Makassar to explore their views on green tourism practices, challenges, and opportunities. The number of informants for each city of Bandung, Jakarta, and Makassar includes 1) one civil servant from the Tourism Office, 2) one representative from a hotel or tourism business, 3) one representative from a travel agency, and 4) one member from a tourism activist community. The total number of respondents who participated in the semi-structured interview phase was 12. The semi-structured format provides flexibility, allowing for the exploration of emerging themes. Additionally, focus group discussions were conducted to gather collective insights and facilitate dialogue among 15 participants from various spectrums of tourism stakeholders across the three cities of Bandung, Jakarta, and Makassar on green tourism issues and solutions.

Interview guides and conversation prompts were created to ensure consistency and thoroughness in data collection. Piloting these tools helped refine the questions and methods, ensuring clarity and relevance. The data collection

process involved scheduling interviews and focus groups, obtaining consent, and recording sessions for subsequent analysis. Strict protocols were followed to ensure data security and confidentiality. Thematic analysis was employed to identify patterns and themes within the data, revealing key challenges in green tourism. Data coding involved developing themes and categories and organising and analysing findings in several steps: transcription, coding, and thematic analysis. Iterative comparisons were used to refine categories and interpretations. NVivo software was utilised to organise and analyse the qualitative data. The research also includes a thorough review of Indonesian green tourism literature and policy documents, contextualising regulatory frameworks and sustainable practices. This literature review aims to identify knowledge gaps in green tourism and highlight successful case studies that can serve as models for other regions.

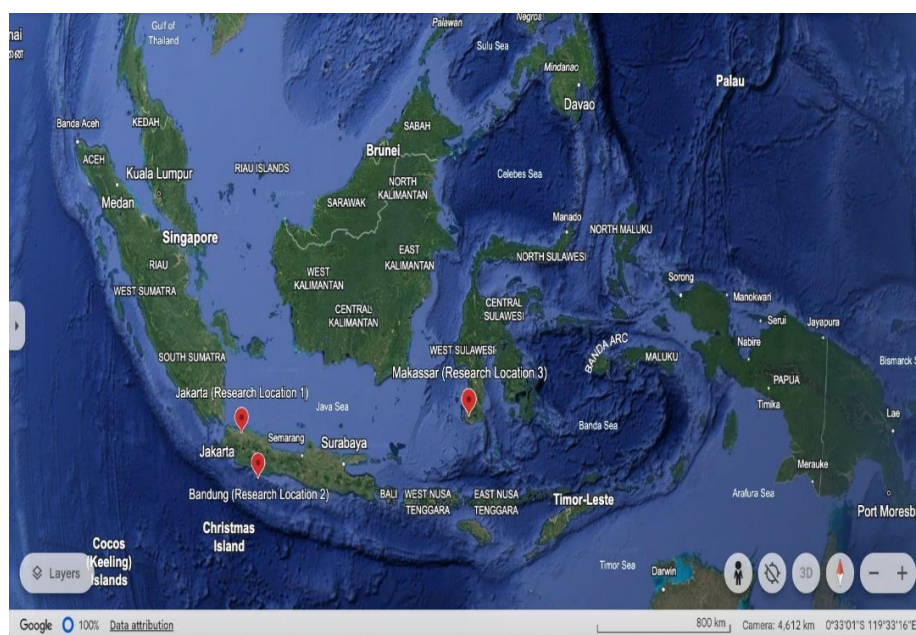


Figure 1: Research Location of Three Cities

ANALYSIS AND DISCUSSION

Challenges of Green Tourism Implementation

Based on the results of interview data processing using the NVivo application, the following results were obtained:

Table 1: Challenges of Green Tourism Implementation in Bandung

Stakeholders	Key points
Government	Lack of public awareness
Entrepreneur	High investment cost Lack of government support
Community	Limited budget Lack of government coordination with the private sector

Table 1 illustrates the challenges and stakeholder involvement in implementing green tourism in Bandung. The government faces the need for public awareness and robust policy support, while green technology entrepreneurs require funding and incentives. Local communities struggle with limited resources and inadequate coordination between the government and the private sector. A significant barrier for the government is the general public's lack of understanding of green tourism's long-term environmental and economic benefits, often due to insufficient education and information. To address this, the government can enhance awareness through educational programmes, training, and outreach initiatives, as community involvement is crucial for the success of sustainable tourism (Gumede & Nzama, 2021; Chan et al., 2021).

From a business perspective, high investment costs pose a major obstacle to adopting green tourism practices. Many small and medium-sized enterprises (SMEs) in Bandung's tourism sector struggle to secure the necessary funding for infrastructure, green technology, and staff training (Soderholm, 2020). To overcome this, there is an urgent need for more flexible and accessible financing options for SMEs, along with government and international funding to support initial investments in sustainable practices. Additionally, businesses face challenges related to insufficient government support, such as a lack of fiscal incentives, restrictive regulations, and bureaucratic hurdles. Enhanced government policy support, including clear legislation, financial incentives, and easier access to best practices, could significantly boost green tourism adoption among entrepreneurs (Maniu et al., 2021).

Tourism activists also encounter financial challenges, as green tourism initiatives require substantial funding, which is often scarce in local communities. To address this, collaboration among communities, governments, and the private sector is essential for mobilising funds and resources. Effective partnerships can help green tourism initiatives overcome budget constraints (Clark et al., 2018). Furthermore, miscommunication between the government and the private sector hampers progress, leading to overlapping policies, inefficiencies, and a lack of programme synchronisation. Improved communication and cooperation among all stakeholders are crucial to overcoming these challenges, with government-private sector forums serving as a platform to enhance coordination and collaboration in promoting sustainable tourism (Gargano, 2021).

Table 2: Challenges for Green Tourism Implementation in Jakarta

Stakeholders	Key points
Government	<ol style="list-style-type: none"> 1. Comprehensive policy on green tourism 2. Implementation of existing policies 3. Community education
Entrepreneur	<ol style="list-style-type: none"> 4. Lack of public awareness of green tourism 5. Budget constraints 6. Resistance to green tourism business practices 7. Lack of coordination between sectors
Community	<ol style="list-style-type: none"> 8. Low financial support 9. Mindset change 10. Lack of understanding about green tourism

Table 2 highlights the significant challenge Jakarta faces due to the absence of well-defined green tourism policies. The lack of clear and established policies hampers the promotion and implementation of sustainable tourism practices across all stakeholders. While various green tourism policies exist, their implementation remains inadequate, often obstructed by bureaucratic hurdles and poor collaboration between ministries. This is further exacerbated by a lack of supervision and evaluation in policy enforcement (Bouckaert et al., 2022).

Another critical issue is the insufficient public awareness and education about green tourism. The government must enhance public education through campaigns and programmes to foster a broader understanding and adoption of sustainable tourism practices (Roxas et al., 2020). Additionally, many tourism entrepreneurs lack a clear understanding of green tourism, which prevents them from adopting sustainable strategies. To address this, businesses need training and workshops that emphasise the benefits and practical aspects of green tourism implementation. Financial constraints are another barrier, particularly for small and medium-sized enterprises (SMEs), which often struggle to secure the necessary funding to adopt green tourism practices (Calisto et al., 2021). Resistance to business transformation is also prevalent, with many companies fearing the costs and complexities associated with changing their operations. Furthermore, the lack of inter-sectoral cooperation, such as between the tourism and environmental sectors, poses a significant obstacle to green tourism development (Khan et al., 2020).

Local communities often desire to support green tourism but lack the financial resources to do so. Empowering local economies and providing financial assistance are essential to overcoming this issue. A key challenge is also transforming the mindset of community members, many of whom do not fully grasp the long-term benefits of green tourism. Therefore, improving education and socialisation regarding the environmental and communal advantages of green tourism is crucial. Finally, there remains a widespread lack of understanding and implementation of green tourism practices in many areas, underscoring the need for better education and awareness campaigns (Khalid et al., 2019).

Table 3: Challenges of Green Tourism Implementation in Makassar

Stakeholders	Key points
Government	<ol style="list-style-type: none"> 1. Awareness and understanding by the community and business actors 2. Budget constraints 3. Coordination between parties 4. Business resistance to innovation
Entrepreneur	<ol style="list-style-type: none"> 5. High initial investment in green technology 6. Lack of government incentives and support 7. Customer demand for use of environmentally unfriendly technology
Community	<ol style="list-style-type: none"> 8. Lack of government and business support 9. Limited resources 10. Low public awareness of green tourism

Green tourism is gaining momentum globally as a response to environmental crises. However, its implementation in Makassar is complex, involving various stakeholders, including the government, businesses, and local communities, as outlined in Table 3. The Makassar administration faces significant challenges due to widespread ignorance about green tourism among the public and private sectors. Education and awareness are essential for fostering sustainable tourism, yet many residents and businesses in Makassar are hesitant to engage in green tourism because they do not fully understand its long-term benefits (Cheng et al., 2019). The execution of sustainable policies is further hindered by budget constraints and poor coordination among involved parties. The Makassar government struggles to secure adequate funding for green tourism initiatives, and the lack of effective cooperation between the government, private sector, and civil society hampers the development of a comprehensive green tourism strategy (Malik et al., 2021).

Businesses in Makassar also encounter difficulties in adopting green tourism technologies. The reluctance to implement these technologies stems from concerns over high costs, the need for operational adjustments, the significant initial investment required for green technology, and the absence of sufficient government incentives. Financial incentives and supportive policies are crucial to encouraging the adoption of green technologies. Another critical issue is the low awareness and support for green tourism within local communities. Active community involvement is vital for the success of green tourism, yet Makassar’s communities have limited resources and require support from both the government and private sector. The low level of public awareness about green tourism makes it challenging to build grassroots movements that could drive sustainable practices (Torres-Delgado et al., 2023).

Opportunities for Green Tourism Implementation

Table 4: Opportunities for Green Tourism Implementation in Bandung

Stakeholders	Key points
Government	<ol style="list-style-type: none"> 1. Increased private sector and community cooperation 2. Implementation of routine monitoring and evaluation 3. Implementation of incentives and sanctions
Entrepreneur	<ol style="list-style-type: none"> 4. Mutually beneficial collaboration 5. Resource sharing opportunities 6. Can accelerate innovation
Community	<ol style="list-style-type: none"> 7. More and more environmental programmes

From a government perspective, there are several key opportunities for implementing green tourism, as highlighted in Table 4. First, enhancing cooperation between the private sector and local communities is crucial. Public-private partnerships can significantly accelerate the adoption of sustainable tourism practices by improving resource utilisation and fostering policy innovation (Azinuddin et al., 2022). Second, the implementation of regular monitoring and evaluation is essential for supporting green tourism. Continuous oversight allows for more targeted strategic adjustments and increases transparency in managing tourist destinations. Third, the government can encourage commitment to environmentally friendly practices by introducing incentives for positive actions and sanctions for non-compliance. For green tourism entrepreneurs, forming win-win partnerships is key. By collaborating, tourism businesses can optimise resource usage and enhance the competitiveness of their destinations (Azinuddin et al., 2023). Opportunities for resource sharing are also significant; local businesses can reduce costs and improve efficiency through shared resources. Additionally, green tourism presents a chance for product and service innovation, allowing entrepreneurs to adopt green technologies and best practices from other sectors (Kuo et al., 2022). Moreover, increasing environmental awareness programmes within local communities offers a valuable opportunity for green tourism. These programmes can educate residents on the importance of environmental and cultural preservation, thereby enhancing the overall tourist experience. As Shafieisabet and Haratifard (2020) suggest, community involvement in environmental initiatives can strengthen the relationship between tourists and local communities while also bolstering the destination's reputation for sustainability.

Table 5: Opportunities for Green Tourism Implementation in Jakarta

Stakeholders	Key points
Government	<ol style="list-style-type: none"> 1. Upgrading of waste treatment facilities 2. The use of environmentally friendly transportation is required 3. Development of more green open spaces
Entrepreneur	<ol style="list-style-type: none"> 4. Application of environmentally friendly technology 5. Public-private collaboration 6. Increased consumer awareness and demand
Community	<ol style="list-style-type: none"> 7. Increased public education and awareness 8. Collaboration with government and businesses 9. Infrastructure and financial development

Table 5 highlights the growing relevance of green tourism opportunities in Jakarta, particularly as urbanisation intensifies and sustainability awareness rises. Based on interviews with three key stakeholder groups—government, business, and community—several key opportunities have been identified. From a government perspective, policy and infrastructure development are crucial to supporting green tourism. Recent studies, such as Obersteiner et al. (2021), emphasise that improved sewage treatment systems can significantly reduce the environmental impact of mass tourism, while responsible waste management in large cities further supports sustainable tourism. The implementation of green transportation options, like electric buses and bike lanes, is also vital. The Jakarta government can leverage these policies to enhance green tourism initiatives. For entrepreneurs, the adoption of green technology plays a pivotal role. Research by Nieti et al. (2019) shows that renewable energy systems and clean water treatment technologies can increase efficiency and reduce costs, making businesses more sustainable. Public-private partnerships offer additional benefits, as co-financing and information sharing can foster sustainable tourism practices, as demonstrated by Heijer and Coppens (2023). Moreover, growing consumer demand for green products and services incentivises entrepreneurs to adopt more sustainable business practices.

Local communities are essential in raising awareness and education about green tourism. Educational programmes that empower communities to protect their environment and cultural heritage are important. Collaboration among communities, government, and businesses is key to success. Programmes that involve local communities in destination development can boost community participation and support for sustainable tourism. Additionally, infrastructure development and financial support from government and non-government organisations can enhance the capacity of communities to independently manage green tourism destinations.

Table 6. Opportunities for Green Tourism Implementation in Makassar

Stakeholders	Key points
Government	<ol style="list-style-type: none"> 1. Infrastructure upgrades 2. Education and incentive programmes 3. Partnership with the private sector
Entrepreneur	<ol style="list-style-type: none"> 4. Green technology investment 5. Digital education and promotion 6. Public-private partnership
Community	<ol style="list-style-type: none"> 7. Expanding education programmes and environmental awareness campaigns 8. Partnerships with schools and organisations 9. Create opportunities for financial and logistical support

Makassar's tourism potential underscores the importance of green tourism as a pathway to sustainable development. Table 6 outlines various strategies for establishing green tourism in Makassar, based on stakeholder interviews. A key requirement for green tourism is robust infrastructure, which the Makassar government prioritises. This includes the construction of green facilities such as efficient public transportation and bike lanes. Additionally, education and incentive programmes are essential for businesses and communities. For instance, offering green training and tax incentives to enterprises that adopt green technologies can encourage broader participation. Research by Paiano et al. (2020) highlights that investing in green technologies, like energy management systems and waste treatment, can significantly reduce the tourism sector's carbon footprint. However, in Makassar, there is a notable lack of entrepreneurs who recognise the competitive advantage of such investments. Digital education and promotion are also crucial, as is using digital platforms to inform tourists about the benefits of green tourism.

Partnerships between the government and the private sector are seen as vital for successfully implementing green tourism (Azinuddin et al., 2023a; 2023b). In Makassar, such collaborations can expedite the adoption of green technologies and support the development of sustainable tourism programmes, including those that prioritise environmental conservation and local culture.

Communities in Makassar can actively contribute by expanding educational programmes and campaigns focused on environmental conservation. Collaborations with schools and local organisations will help disseminate information and inspire community-level action. Finally, financial support is essential. Tambovceva et al. (2020) emphasise the importance of financial and logistical backing in promoting green tourism. In Makassar, such support could come from government grants, private investments, or international partnerships, enabling tourism industry players to implement sustainable solutions without the burden of high initial costs.

CONCLUSION

Implementing green tourism in Indonesian cities such as Bandung, Jakarta, and Makassar face significant challenges from various stakeholders. In Bandung, the key issues are a lack of public awareness, high investment costs, and limited budget and coordination. Jakarta struggles with non-comprehensive policies, resistance to green business practices, and inadequate public education. In Makassar, challenges include low awareness among the public and businesses, budget constraints, and a lack of government incentives. Despite these challenges, several opportunities can support the successful implementation of green tourism. These include enhancing cooperation between the public and private sectors, implementing regular monitoring and evaluation, providing incentives, and fostering collaboration between businesses and communities. The government can improve waste treatment facilities, promote environmentally friendly transportation, and develop green open spaces. Businesses can adopt green technologies and engage in public-private partnerships, while local communities can contribute by increasing education and awareness about green tourism. To address these challenges and capitalise on the opportunities, it is crucial to focus on improving coordination, collaboration, and partnerships among stakeholders. Additionally, increasing public awareness and education about green tourism, providing financial support and incentives for entrepreneurs, and developing environmentally friendly infrastructure will be essential for advancing green tourism in these cities.

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**THE VALUE OF ARTS AND CULTURE:
A CASE STUDY ON CREATIVE PLACEMAKING IN
HIN BUS DEPOT, PENANG, MALAYSIA**

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Abstract

The arts and cultural sector are essential in sustaining George Town, Penang's UNESCO World Heritage Status. Creative placemaking incorporating the power of arts and culture can add value to the city's public space design. It involves revitalising abandoned public spaces to enhance neighbourhoods and strengthen local communities. This study aims to discover community participation and awareness in arts and culture. They are taking Hin Bus Depot, a creative hub in the heart of George Town, as the case study examines the impacts of creative placemaking projects on the community. In this context, creative placemaking is the approach that integrates arts and culture into a public space to enable transformation while also building character and quality of place. To test the hypothesis that arts and culture can positively impact the community, an online questionnaire survey was distributed to the locals and visitors of Penang. Respondents were asked about demographics, engagement, and awareness of arts and culture. The results showed the community's positive relationship with arts and culture and the success of Hin Bus Depot in bringing beneficial impact. The community's engagement in arts and culture has increased, contributing to the support of George Town's local arts scene. The concept of creative placemaking should be considered to promote better urban design in the future.

Keywords: Arts, Cultural, Engagement, Awareness, Creative Placemaking, Hin Bus Depot

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INTRODUCTION

Placemaking is a relatively new concept in Penang, but it is gaining momentum and has become an increasingly important part of the community. The COVID-19 pandemic made people realise the importance of public and green spaces across the cities. When people are restricted from travelling as freely as possible before, they will appreciate their local context. Although the pandemic has influenced our lives, it can also be an opportunity to enhance our locality (Placemaking for a Post-Pandemic World, 2021). People care more about the social and economic aspects when creating a place, but the arts and culture should not be neglected. The arts and culture can be a valuable tool to stimulate the relationship between people and space. Increased creative placemaking projects in George Town show a positive sign of progress, and locals are becoming more aware of the significance of their own culture and history. However, how much the community knows about arts and culture in creative placemaking needs to be clarified. The process of creating a great public space should involve the participation of different stakeholders. It is essential to engage artists or creative practitioners in the placemaking process to generate innovative ideas or approaches and enable the community to visualise the potential future of their space (ArtsWork Collaborative, 2018). To attain greater sustainability, a clearer picture of how arts and culture affect the community must be explored.

Especially in George Town, arts and culture play a significant role. Like many other Asian cities, George Town uses arts and culture to accelerate the economy's growth. The beauty of arts and culture was vital to recognise George Town as a UNESCO World Heritage Site in 2008. This inscription is undeniably a revolutionary force that has changed George Town (Khoo, 2016). It is critical to understand and comprehend the significance of arts and culture to the local community today. The key to success mainly depends on the local community, which can utilise the rich and abundant resources readily accessible in the city. Still, these advantages are usually neglected by the community. To keep arts and culture alive, the community is encouraged to reflect on the significance of arts and culture and incorporate them into the design of a place. This research helps promote the arts and culture and understand the impacts of creative placemaking projects on the community. The stakeholders will know if the project is making a difference to the community and will learn about and enhance future project implementation.

LITERATURE REVIEW

Arts and Culture

Arts and culture are widely defined to incorporate multiple forms of creative expression, including formal and informal arts and cultural practices: performances, architectural design, media production, traditional arts, visual arts and culinary arts. These artistic approaches are now reflected in the growing field

of creative placemaking. Place-based arts and cultural initiatives promoting various cultural experiences, irrespective of background, will bring people together for shared experiences (Arroyo et al., 2020). Culture is described as a "specific way of life, whether of an individual, an era, a community, or civilisation as a whole." It also applies to the social interactions in the community, which can impact how innovation and creativity occur in a society. Examples of tangible cultural assets are murals, artefacts, historic buildings, and structures. Intangible cultural assets include practices, knowledge, traditions, and languages. Each community has its own cultural identity, identified by its shared history, beliefs, and assets. It is intrinsically tied to a person's sense of belonging, recognition, and engagement towards their place. Cultural exchange allows a group of people to maintain and preserve their social status and structure, thus aiding in the sustainability of a community (Sung, 2015). The interaction of people with arts and culture comes in a variety of contexts and delivery methods. Cultural interaction at home with television, radio, and various digital and online activities is familiar and is proliferating today. However, its growth affects people's perception of cultural meaning (Crossick & Kaszynska, 2016). The rise in digital interaction profoundly impacts cultural engagement and meaning, allowing people to engage with cultural institutions and commercial culture in new ways. The emergence of co-creation and user-generated content altered the production and consumption of arts and culture.

Arts participation can be categorised into three intertwined forms: arts involvement, individual art production and performance, and digital media involvement (Stallings & Mauldin, 2016). People may have fun and participate in the arts through various forms, such as public art, murals, galleries and festivals. Individuals can benefit from arts and cultural experiences to strengthen their skills and abilities and boost their physical and mental health. It enables people to escape their hectic daily lives and satisfy their desires and goals through arts experiences. As a result, their overall quality of life will be enhanced. Many studies have claimed that the arts will help to improve one's health and well-being. People who engage in the arts will feel happier or healthier, which correlates strongly with satisfaction. They can also boost self-esteem, social skills and interactions. Participation of older adults in arts and culture helps to strengthen their sense of self-worth and widen their social circle. More importantly, it could help the local community cultivate a sense of pride in their culture and become more aware of their local identity. People can express themselves and connect through different art. Increasing people's trust in society also makes them feel more secure in the face of crime.

Installing public art will decrease crime and violence, whereas massive investment in the cultural sector can increase local appearance (Sung, 2015). The importance of arts and culture should be highlighted in terms of placemaking. Arts and culture are community assets, and we should integrate them through

creative placemaking (Redaelli, 2014). Markusen (2014) claims that artists should participate and play a role in urban transformation, and places should "enable interaction among art-makers, permit socialising, and encourage conversation about the cultural experience". It reveals that the arts can bind people in a community with creative ways, put diverse people together, and discover the hidden talents of the community.

Regarding urban planning, most people, especially in developing countries, exclude the arts and culture. Arts and culture can solve fundamental issues such as the economy, healthcare, and education, but they are always considered secondary or tertiary. Since people have different feelings and perceptions towards public art, so their appreciation of art is often crucial in shaping its function. A few studies have investigated the importance of art in public spaces and claim that there are numerous perspectives on how people view public art and the form of art in which people take part, resulting in overall impacts (Jagannath, 2015). Public art connects to a city in various profound ways, bringing sense, memory, and social development and pushing towards creativity in a community.

Creative Placemaking

The term "creative placemaking" was introduced in the 1960s by urban planners like Jane Jacobs, who called for a community-driven strategy for creating places for people. In Malaysia, the idea of 'placemaking' is familiar but is acquiring momentum. Malaysia has been generating interest in placemaking and public spaces projects since 2014, beginning with Think City's cooperation and partnership with a Project for Public Spaces. The Project for Public Places (PPS) is a New York-based non-profit group dedicated to designing and preserving public spaces and promoting community development via placemaking. They are to assist Think City in disseminating the Placemaking concept in Malaysia by establishing a platform for placemakers and advocating with various government agencies to create high-quality public spaces around the country (Project for Public Spaces, 2014). In 2021, Placemaking Malaysia was launched by the Malaysian Institute of Planners (MIP), a network of individuals and organisations concerned about public space and hoping to make it more diverse, creative, and thriving. In partnership with the Penang City Council, Think City has generated significant waves of placemaking in Penang since 2019. From Sia Boey to Hin Bus Depot, they have embarked on various creative placemaking projects that support arts and culture to revitalise public spaces and bind the locals. George Town's thriving arts and cultural scene provides the framework for development in many other sectors, especially festivals and celebrations. The success of the creative placemaking project benefits the arts community as well. Rather than funding artists to produce artworks in silence, creative placemaking promotes creative installations in public spaces. Creative placemaking contributes to three

main goals: liveability, diversity and economic development. These goals are made to fulfil the public safety issues of local communities and their expressive and aesthetic needs. They are fostering environmental change by enhancing public facilities and landscape architecture. Creative placemaking also encourages more local expenditure, which may contribute to local economies (Markusen & Gadwa, 2010). Retail businesses supporting locals and visitors produce more employment opportunities and income. Arts and cultural industries that flourish will transform George Town into a creative hub, which is crucial for the survival and growth of the creative economy and the creative city.

In the present study, creative placemaking uses creative and participatory approaches to create more appealing and vivid public spaces. These artistic practices are in the physical setting, including public art, sculptures and murals (Cohen et al., 2018). Creative placemaking can also include art-related industries, galleries, places, and event-based practices in which seasonal shows, festivals, and other activities occur in public spaces (Lew, 2017). The word "creative" in "placemaking" can be addressed as a feature of a place where people come in and create places, embrace the cultural heritage and establish common goals for the community (Redaelli, 2018). Communities can contribute their creativity and imagination to collaborative art-making projects, too. This will lead to greater social cohesion and creative improvements in new spaces representing the community's cultural values. Indirectly, it will diversify the area's functions and offer another added advantage to the public (Isa, 2020). Economic growth programmes focusing on creative industries and cultural capital- residents' creativity- are another form of creative placemaking. In other terms, creative placemaking encompasses community and cultural building priorities, such as growing community pride, bridging gaps among the groups and creating opportunities for them to put thoughts into words. It lifts the community's well-being by creating local job opportunities and improving the environment for local businesses. Unlike traditional approaches, the economic growth that results from creative placemaking is asset- and place-based. It emphasises individuals' creative abilities and physical and psychological relations among people and their surroundings. Participation in creative placemaking initiatives and the arts more frequently is often shown to have positive mental effects. Till, K. E., & McArdle, R. (2015) explain the consequences of interaction in creative spaces that bring meaningful memories and experiences, helping to ease, accentuate, and gain trust in navigating the built environment. Arts participation could also ease the symptoms of depression and anxiety and reduce loneliness by fostering social ties (Erickson, 2016). The outdoor recreational activities involve direct contact with recreational resources and serve as a site for face-to-face social interaction (Isa et al., 2022). Placemaking activities will help to build new social networks, too.

METHOD

This study employs a quantitative method to achieve the research objectives. It comprises well-structured questionnaires to gather primary data from the local community and visitors. This study uses a descriptive research design to understand community participation and awareness in arts and culture and the impacts of the creative placemaking project. This research design is inexpensive and can gather data from a wide range of respondents in a limited time. This study used online questionnaires in which one can send out a survey to a particular target population, and they can respond to the survey whenever possible. In contrast to other data collection methods, online surveys are much faster and less expensive in getting feedback from the respondents. The study's population was comprised of Penang residents and visitors, who were all part of various demographic groups. The online questionnaire aims to reach 200 sample size with a margin of error of 6.93% of individuals of different age groups and social positions through other platforms, such as email and social media. However, only 125 answer forms can be used after screening. Hin Bus Depot, a vibrant creative hub, was selected as the case study. It is an example of creative placemaking in which a vacant bus depot is transformed into a gathering spot for artists, artworks, events, and creative works. A variety of arts and cultural activities are happening in this place. The online questionnaire is divided into three sections and generated using Google Forms. Google Forms is used as it offers an easy way to construct a survey online, with data gathered on an online spreadsheet. People may also use their smartphones to respond to the questions. The three parts of the online questionnaire are:

Part A: Demographic

The demographic survey asks about gender, age, ethnic background, where the respondents live, education level, household income, employment and marital status. This is an ideal method for understanding the respondents' backgrounds better.

Part B: Engagement with Arts and Culture

The questionnaire examined the kinds of arts and cultural events the respondents have engaged in, their motivations for participating, and the locations of the events. The results are essential for stakeholders who want to expand community engagement in arts and culture. Identifying which groups of people are most likely to participate in arts and cultural events is beneficial.

Part C: Awareness in Arts and Culture

This section reflects on the respondents' access to and awareness of arts and cultural events. It helps evaluate the availability of arts and culture in Penang and

understands what the community thinks about the existing arts and cultural opportunities.

Study Area

Hin Bus Depot was chosen as the case study for a creative placemaking project in George Town. It was a well-known bus depot on Penang island in the years after World War II, owned by Hin Company Ltd. It was believed to be the trendiest bus depot because of its unique architectural design. The bus depot eventually ceased operations in 1999. Then, it was left vacant until Ernest Zacharevic's 2014 art exhibition began the first ground-breaking moves in becoming the thriving creative hub today. The existing structures of the place have been maintained, with only minor changes and improvements made. The Hin Bus Depot is an essential venue for promoting and showcasing community artworks and cultural performances. There are a variety of exhibitions, music festivals, cultural activities, live performances and literary events. This place comprises 60,000 sq ft, with eight shop-houses on Jalan Gurdwara and three shop-houses facing Jalan Kampung Jawa Lama. Local small businesses and artists mainly occupy the shophouses. The location of Hin Bus Depot, which is in the centre of George Town, near the Komtar Tower, is easily accessible to both visitors and locals. The arrangement and orientation of the spaces are shown in

Figure 1.

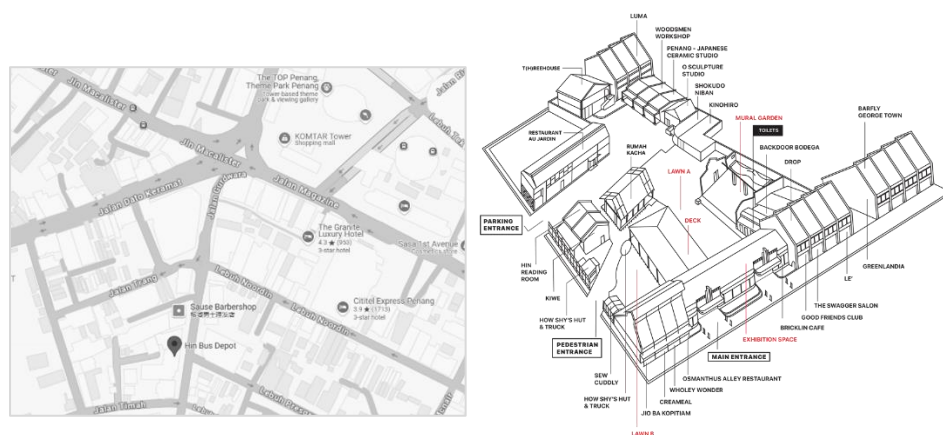


Figure 1: Hin Bus Depot Location and Layout Plan.

Source: Google Maps & <https://hinbusdepot.com/>

The exhibition space, deck, mural garden and lawn shown in **Figure 2** are public rental spaces. They come with standard event equipment such as power points, projectors, projector screens, and a basic PA system. When no private events are scheduled in the rental spaces, Hin Bus Depot will host a range of arts and cultural activities that are free and accessible to the public.



Figure 2: Rental Spaces.

Source: <https://hinbusdepot.com/space-rental>

RESULT AND DISCUSSION

Part A: Demographics of the Respondents

This section describes the demographic information provided by the respondents. The frequency distribution of the questions in this survey was analysed using descriptive statistical analysis by SPSS. There was all the information. **Table 1** provides a summary of the demographic of the respondents.

Table 1: Demographic of the respondents.

Variable	Category	Frequency, N	Percentage
Gender	Male	40	32.0%
	Female	85	68.0%
	Total	125	100%
Age	18-24 years old	77	61.6%
	25-34 years old	31	24.8%
	35-44 years old	5	4.0%
	Above 45 years old	12	9.6%
	Total	125	100%

Variable	Category	Frequency, N	Percentage
Ethnic	Malay	14	11.2%
	Chinese	100	80.0%
	Indian	5	4.0%
	Other	6	4.8%
	Total	125	100%
Current place of living	Penang	89	71.2%
	Other	36	28.8%
	Total	125	100%
Education Level	Secondary school	7	5.6%
	Pre-University	16	12.8%
	University or College	102	81.6%
	Total	125	100%
Characteristics	Teens or Young adults	88	70.4%
	Middle-aged adults	15	12.0%
	Child-free couples	8	6.4%
	Parents	10	8.0%
	Senior citizens	4	3.2%
	Total	125	100%
Employment status	Student	60	48.0%
	Employed	56	44.8%
	Unemployed	4	3.2%
	Retired	5	4.0%
	Total	125	100%
Income group	Less than RM2,500	54	43.2%
	RM2,500-RM5,000	39	31.2%
	RM5,000-RM10,000	19	15.2%
	More than RM10,000	13	10.4%
	Total	125	100%

Source: Authors

Part B: Engagement with Arts and Culture

This section examines community participation in arts and cultural events. The respondents can select multiple answers for each of the questions. All responses should be collected as respondents may participate in or wish to participate in different arts and cultural events and have multiple reasons for attending or not going. Multiple response analysis is used to analyse multiple response questions in SPSS accurately. It can construct frequency tables for every multiple response set. **Table 2** represents the overall community participation in arts and cultural activities.

Table 2: Engagement with arts and culture.

Variable	Category	Frequency, N	Percentage
Arts and cultural activities participated	Performing arts	74	26.9%
	Visual arts	52	18.9%
	Literary arts	20	7.3%
	Community arts and cultural festivals	80	29.1%
	Online artwork, performances or literary events	32	11.6%
	None of the above	17	6.2%
Total		275	100%
Reason for attending arts and cultural activities	Learn about art form.	38	9.7%
	Join in a religious ceremony.	21	5.4%
	Celebrate heritage.	45	11.5%
	Learn about another culture.	44	11.3%
	Support organisations or events.	59	15.1%
	Support friends or family.	45	11.5%
	Socialise with friends or family.	54	13.8%
	Leisure and recreation.	70	17.9%
None of the above	14	3.6%	
Total		390	100%
Places of arts and cultural activities participated	Public building	67	19.4%
	Museum or gallery	45	13.0%
	Place of worship	30	8.7%
	Cinema or concert hall	51	14.7%
	School or college	63	18.2%
	Open-air	48	13.9%
	Online	30	8.7%
	None of the above	12	3.5%
Total		346	100%
Arts and cultural activities wish to join	Performing arts	48	21.0%
	Visual arts	46	20.1%
	Literary arts	36	15.7%
	Community arts and cultural festivals	48	21.0%
	Online artwork, performances or literary events	29	12.7%
	None of the above	22	9.6%
Total		229	100%
Reason for not attending arts and cultural activities	Too expensive	24	11.9%
	Not enough time	47	23.4%
	No one to go with	38	18.9%
	Too difficult to get to	18	9.0%
	Not in my area	55	27.4%
	Not interested	19	9.5%
Total		201	100%

Source: Authors

Part C: Awareness in Arts and Culture

The respondents were asked about their awareness of arts and culture. A Likert scale indicates if they focus on or have various opportunities in arts and cultural activities. The availability and importance of arts and culture in George Town are also evaluated based on respondents' perceptions. This type of question enables respondents to express their agreement level with a particular statement. The results are summarised in **Table 3**.

Table 3: Awareness of arts and culture.

	1	2	3	4	5	Total
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
I pay much attention to the arts and cultural activities.	1 (0.8%)	8 (6.4%)	41 (32.8%)	55 (44.0%)	20 (16.0%)	125 (100%)
I have various opportunities to be involved in the arts and cultural activities.	6 (4.8%)	26 (20.8%)	45 (36.0%)	33 (26.4%)	15 (12.0%)	125 (100%)
I would like to see more arts and cultural opportunities.	-	2 (1.6%)	12 (9.6%)	58 (46.4%)	53 (42.4%)	125 (100%)
	1	2	3	4	5	Total
	Very Poor	Poor	Neutral	Good	Very Good	
How would you rate the availability of arts and culture in George Town, Penang?	2 (1.6%)	7 (5.6%)	12 (9.6%)	66 (52.8%)	38 (30.4%)	125 (100%)
	1	2	3	4	5	Total
	Not at all Important	Poor	Neutral	Important	Very Important	
How important is having arts and cultural offerings in George Town, Penang?	-	-	5 (4.0%)	24 (19.2%)	96 (76.8%)	125 (100%)

Source: Authors

Community Participation

Community engagement fosters relationship development via various activities to build a dynamic environment in a place. People involved in the arts and culture are more likely to form community ties in their area. Some may actively participate in community groups that are meaningful to them or come to places they frequently visit. The findings of community engagement are valuable to stakeholders who wish to encourage participation in arts and culture. The study asked about the types of arts and cultural activities people participated in, the reason for their participation, and the events' locations. The respondents are primarily teens and young adults in the city. They involve people in arts and culture when they are young, which can lead to a long relationship with the arts. Their most popular activities are performing arts such as music, dance, movies, and community arts and culture festivals, fairs, and celebrations. George Town hosts various arts and cultural festivals and events throughout the year. The George Town Festivals are the most expected annual cultural event, creatively showcasing the local arts and culture scene, including visual and performing art. Both performing arts and community festivals are abundant in George Town, a major tourist attraction that draws various visitors to celebrate together. Enhancing the overall tourist experience directly impacts post-visit intentions and indirectly shapes them by fostering a strong sense of place attachment (Bai et al., 2024).

Teens and young adults participate in arts and cultural activities for leisure and recreation. Weekend art and cultural workshops, exhibitions or performances could help them forget their busyness. The public building is where most people participate in arts and culture. Hin Bus Depot is another place that has held several public and private events. Since most respondents are students, they are also active in arts and cultural projects at their school. Students actively engaging in arts and cultural events are more inclined to volunteer their time as adults. Some people are not involved in any of the arts and cultural activities. They are primarily child-free couples and those who are employed. Males are also more prone than females to be uninterested in arts and culture. Participation is sometimes affected by an individual's interest, surroundings, and people's influence. Many people wish to receive information through electronic devices, especially in today's digital environment. However, it is a two-sided coin; when arts and cultural venues gradually transform into "smart places," the traditions and beauty of arts might be forgotten. Most respondents have a positive relationship with the city's arts and culture. They are interested in the activities and would like more possibilities. It is a positive sign since arts and cultural activities may benefit the community in various ways. George Town is a well-known creative hub, with arts and culture supporting the economy and its UNESCO World Heritage Site inscription. The city needs numerous people

focusing on the arts and cultural sector to strengthen the local creative industries and maintain their cultural heritage's distinctiveness.

Local Impacts

Creative placemaking projects' social and economic impacts on the community are assessed. More than half of the respondents, most teenagers and young adults, had visited or heard of this place. Many young local business owners, artisans, and performers display their products and skills. It also attracted international visitors to this spot, immersing themselves in the relaxing atmosphere. Hin Bus Depot is where everything fits well, with various exhibitions, events, stores, markets, and cafes. This makes it family-friendly and suitable for weekend gatherings. It is essential to bring a group of passionate people about the arts and culture sector to support the local arts scene to preserve this community hub. It fosters community relationships and provides unique experiences for people from all backgrounds. To continuously attract people to revisit Hin Bus Depot, the community needs to have a sense of attachment, feelings, and memories. The relationship between arts and happiness is natural and may serve as a determinant of mental health.

The existence of Hin Bus Depot has further increased the number of visitors, although it is at a less touristed location. A huge crowd can be seen, especially on weekends, as various arts and cultural activities occur. It has successfully drawn many international visitors who have fallen in love with this cosy environment. Even the locals love this spot, giving them a different vibe from the open street art. Not only are the activities engaging, but the building itself is also appealing, as it is a rarer kind of architectural design that appears in George Town. Besides, most respondents think that the Hin Bus Depot has encouraged community participation in arts and cultural events. It allows people in the community who are passionate about the arts to express themselves while sustaining and supporting the city's creative industry. In a nutshell, Hin Bus Depot has made significant contributions to the community's economy and social circumstances. As it is a community-driven platform, the community must contribute to its upkeep. This should be maintained, which gives Hin Bus Depot its uniqueness and attractiveness, with loving people willing to sacrifice and grow together. Funding from the state government is also necessary for this place to be supported. It will be exciting to see how well the Hin Bus Depot can flourish and fill gaps in the George Town art scene.

CONCLUSION

The data from this research shows a variety of practical implementations deserving of future work. It would be beneficial to understand the participation and awareness of the community in arts and culture and to measure the impacts of creative placemaking projects on the locals. The arts and culture must serve as

a tool to enhance the placemaking process and should also have a seat at the table in public space projects. This survey was significant in understanding the local community's perspectives on the creative placemaking project so that stakeholders could determine whether this approach is appropriate for George Town, Penang. Public opinion matters because placemaking is all about community-based participation. Those who live, work and play here are the only people who know their needs and expectations for the community. Arts and culture also significantly contribute to a city's social and economic well-being. Creative placemaking promotes civic participation, enhances public and mental health, strengthens place attachment, and reduces crime. Arts and cultural activities allow memories, cultural heritage and social interactions to build a sense of belonging to a place. The presence of arts and culture production reduces people's fear of crime as they feel safer walking down alleys with mural paintings on the walls. When a city invests in creative placemaking, it also expands the local business and employment opportunities. The availability of jobs and skilled labour force is often concentrated in high-quality places. A new destination that attracts visitors, locals, and workers will lead to a rise in property values and further infrastructure investment. Penang has a pretty active art community, supporting the effort to implement creative placemaking in this culture-rich city.

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EVALUATING THE URBAN ARCHITECTURAL COLOUR STATUS OF JINAN, CHINA FROM THE PERSPECTIVE OF COLOUR GEOGRAPHY

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Abstract

This paper provides a comprehensive evaluation of the current status of architectural colour in Jinan through the theory of colour geography. Founded by Jean-Philippe Lenclos, colour geography studies the influence of geography and social culture on architectural urban colour. This study used tools to generate the data on site, including Chinese architectural colour charts, drones, and cameras. The city of Jinan, China, was chosen because of its rich history and culture, unique geographical environment, and multi-ethnic composition, all of which have contributed to its diverse urban colour. The colour characteristics of Jinan are divided into three areas: the old city, the new city, and the industrial area. This study provides an in-depth analysis of the current status of urban colour in Jinan, which provides a scientific basis for future urban planning and design to support sustainable development and cultural heritage protection. The results revealed that warm earth tones and traditional styles dominate the old city area, while cooler modern tones dominate the new city area. The industrial area is dominated by grey and yellowish brown. The study found that Jinan's urban colour scheme lacks uniformity, especially in the new development areas where highly saturated colours are widely used. In contrast, the colour scheme in the old city is more consistent and reflects traditional aesthetics. The study highlights the need for coordinated colour schemes to preserve cultural heritage and improve the consistency of urban aesthetics. We hope this study not only enriches the theory of colour geography, but also provides an important reference for existing and future urban colour planning in Jinan.

Keywords: Architectural, Cultural, Geography, Urban Colour, Urban planning

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INTRODUCTION

This study delved into the importance of urban architectural colour in urban planning and design due to its far-reaching impact on urban aesthetics and cultural identity. Based on the theory of colour geography, this paper focused on the city of Jinan, which has a rich historical and cultural background. Colour geography, proposed by Jean-Philippe Lenclos, examines how geographic and socio-cultural factors influence architectural colour to create a unique regional identity.

Located in the centre of China's Shandong Province, Jinan is known for its historical value and diverse cultural heritage. The city's unique geographical features, such as the Yellow River, Mount Tai, and several iconic landscapes, contribute to its distinctive urban colour. At the same time, Jinan's multi-ethnic composition further adds to the complexity of the architectural colour scheme. This study adopted a comprehensive approach, combining a literature review and empirical research. Through the use of tools such as Chinese architectural colour charts, unmanned aerial vehicles (UAVs), and cameras, colour data from different urban areas in Jinan was systematically collected and analysed. The study covered the old city, new city, and industrial area, aiming to comprehensively analyse the urban colour landscape of Jinan.

This study is important because it provides a scientific basis for urban colour planning and design, to promote sustainable development, and to protect cultural heritage. Through an in-depth analysis of the current state of architectural colour in Jinan, the study aimed to provide practical insights and a scientific basis for future urban planning. The findings highlighted the need for coordinated colour planning to enhance aesthetic coherence and maintain the city's cultural identity during rapid urbanisation.

LITERATURE REVIEW

Urban colour has a broad and multifaceted connotation. According to Tosca (2018), the concept of urban colour planning defines the study within the context of the visible elements of the urban entity, specifically the urban landscape defined by colour. Colour is a visual perception that arises from the response of the visual cells in the human eye to light stimuli, and the physical environment serves as an essential medium that transmits colour (Chen & Liu, 2019). This material carrier or bearer of colour perception refers to the physical environment.

Urban Colour

Urban colour is a complex and multifaceted system that encompasses both natural and socio-human factors (Ma & Misni, 2024; Cui, 2020). Therefore, its definition should consider different levels and dimensions. China divides the definition of urban colour into a broad sense and a narrow sense (Wang et al., 2023). According to Song et al. (2019), urban colour broadly refers to studying the

interrelated qualities of colour representations as an integral part of the city and architectural space, encompassing all perceptible colour phenomena. On the other hand, urban colour, in its narrow sense, focuses on the recognisability and legibility of the overall urban image of the city, which is composed of urban architecture and spatial form (Wang et al., 2019).

Colour Geography

In 1960, the renowned French colourist Jean-Philippe Lenclos, along with Dominique Lenclos, pioneered the innovative field of colour Geography (La Géographe de La Couleur). This theory posits that geographical variations lead to architectural colour differences within cities, influenced by regional and socio-cultural factors. The principle of colour Geography confines colour to specific regions, surveys the colour expressions of residential buildings, and analyses the underlying mechanisms influencing colour aesthetic psychology in different geographical environments (Ma & Misni, 2024). This approach explores regional colour uniqueness and establishes a dialogue between traditional and modern architectural colours. "The main purpose of colour geography research is the selection, zoning, investigation, colour sampling, summarisation, and compilation of colour characteristics of buildings in different human geography zones. By summarising tones and analysing them, the colour aesthetic psychology characteristics of residents in the region can be deduced" (Song, 2010).

Jean-Philippe Lenclos's colour Geography methodology, involving the extraction of colour landscapes and the induction of visual colour samples, provides a significant framework for urban colour practice (Huang, 2012). It has gained recognition in the academic community, influencing urban colour studies, socio-cultural studies, urban planning, and international colour trends (Ma & Misni, 2024). According to Bian Wenjuan (2015), colour Geography minimally impacts architectural structures while reproducing historical styles using modern technology, thereby aiding the preservation of traditional buildings and urban redevelopment. This methodology offers an essential approach for understanding and applying regional colour characteristics in contemporary urban settings.

Current Status of Urban Colour Model

Urban colour planning research abroad closely synchronises with urban development. According to Cui (2006), the earliest colour practice emerged through the application of colour geography, pioneered by Professor Jean-Philippe Lenclos, known as the "Lenclos research method," which has been successfully employed in urban colour design. This method involves abstracting the colour of surrounding landscapes, recording them through data processing and photography, and then using computer-aided software to extract the main

colour data, resulting in a quantified spectral analysis chart that refines into a spectrum guiding urban colour planning factors (Linton, 1999).

a. Western Model

Lin (2021) posited that the urban environmental colour of European cities often shapes people's impressions of these cities. For example, the ochre tones of Paris, France, the coffee tones of Amsterdam, the romantic hues of St. Petersburg, Russia, the vibrant tones of Florence, Italy, and the white tones of Santorini, Greece, serve as distinctive identifiers for these cities, deeply etched into the memories of visitors. Surveys indicated that a majority of respondents feel proud and pleased with the colour of their own cities, indicating that successful urban colour development can enhance citizens' sense of identity and belonging (Fang & Qin, 2014).

b. Asian Model

In the Asian model, Cui (2006) suggested that colour analysis is particularly prominent in Japan and South Korea. The notable performance of colour research in Japan can be attributed to two main factors. Firstly, Jean-Philippe Lenclos, after studying at the Kyoto Institute of Technology in Japan, established the research method of colour geography, which was adopted by the colour Planning Centre in Tokyo, Japan. Secondly, the compulsory intervention and strong support from the Japanese and South Korean governments have led to significant attention to colour planning research. Wilson (2011) pointed out that the Japanese and South Korean governments have incorporated colour design into administrative planning, providing strong support for colour planning research.

RESEARCH METHODOLOGY

Study Area

Jinan City is located in the central part of Shandong Province, China (Figure 1). It is a historically renowned cultural city with a superior geographical location. Situated south of the Yellow River, north of Mount Tai, east of the Qilu Plain, and west of Mount Cangshan, Jinan boasts beautiful natural surroundings. There are several reasons for selecting Jinan as the study area. Firstly, Jinan possesses a rich historical and cultural heritage and is one of China's most significant historical and cultural cities. Its ancient history and abundant cultural heritage have profoundly influenced the urban colour palette. Secondly, Jinan has a unique geographical environment with many iconic landscapes, such as Qianfo Mountain and Daming Lake, providing abundant natural backgrounds for urban

colour. The geographical environment plays a crucial role in the formation and evolution of urban colour.

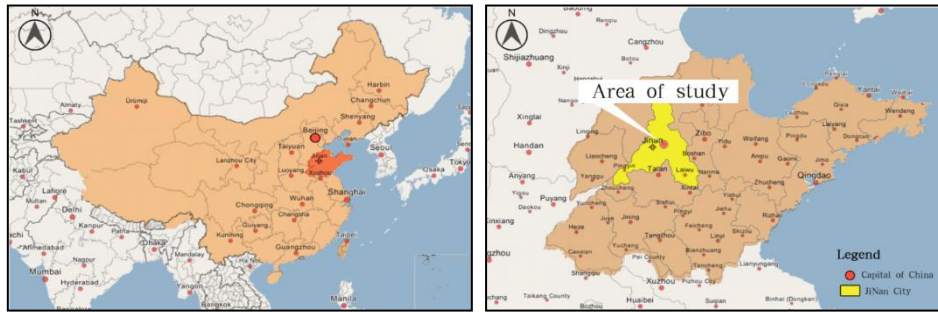


Figure 1: Key plan (left) and location plan (right) of study area of Jinan, China

Source: Authors (2024)

Furthermore, Jinan is a city inhabited by multiple ethnic groups with diverse cultural characteristics and religious beliefs. The cultural and religious diversity of various ethnic groups has different influences on urban colour (Teriman et al., 2009). Studying urban colour in Jinan can reveal the impact mechanism of multiculturalism on urban colour. Lastly, with the advancement of urbanisation, Jinan's urban development has been rapid, and there is an urgent need for scientific colour guidance in urban planning and construction. By studying urban colour in Jinan, a scientific basis can be provided for urban planning and design, promoting the city's sustainable development. The study area is divided into three parts: old urban city areas, new city areas, and the industrial area as shown in Figure 2.

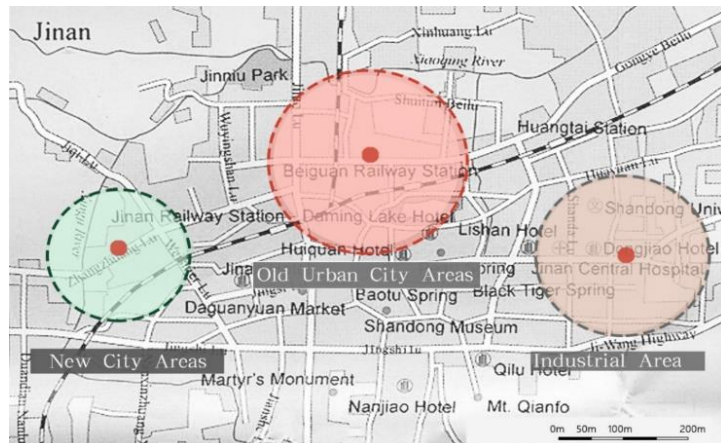


Figure 2: Specific site plan of new, and old city, and industrial areas in Jinan city

Source: Authors (2024)

Research Method 1: Literature Review

This study employed a literature review method aimed at comprehensively understanding issues related to the conservation and planning of geographical colour and providing a theoretical basis for the current status of urban colour in Jinan. Firstly, relevant literature, including academic journals, conference papers, theses, and government reports, was collected and screened based on the research topic. Subsequently, the literature was comprehensively reviewed and summarised, with a focus on theoretical frameworks, methodologies, and case analyses, as well as the progress and trends of research both domestically and internationally. During the organisation process, sorting and categorisation based on keywords, publication years, or countries were conducted to facilitate comparison and analysis of different research characteristics and development trends. Through a comprehensive literature review, an in-depth understanding of issues related to geographical colour preservation and planning was obtained, providing a theoretical foundation for the current state of urban colour in Jinan.

Research Method 2: Colour Geography Research Method

Utilising the colour geography research method in conjunction with the Chinese Architectural Colour Chart, unmanned aerial vehicles (UAVs), and cameras, the tangible geographical colour landscape and abstract cultural colour genes were abstracted and refined. This approach aimed to explore the essence of colour and grasp the evolving patterns of urban colour. Through on-site observations, high-altitude aerial photography using UAVs, and recording with cameras, colour data of buildings, public spaces, and landscapes were collected. This empirical evidence supported the planning and preservation of urban colour in Jinan.

Technological Means:

In the actual investigation of urban spatial environmental colour, different information collection tools were selected based on the different research objects. In this research, a CBCC Chinese Building Colour Card, a Spectrophotometer CS410 portable colour brightness metre, and an SG906MAX1 unmanned aerial vehicle were employed. Table 1 provides a summary of the equipment, objectives, and methodologies employed in the study of urban colour in Jinan. The Chinese Architectural Colour Card is utilised for obtaining information on building colour, the portable colourimeter (Spectrophotometer CS410) was employed to measure colour brightness and spectral data; and the SG906MAX1 drone was utilised for panoramic research, capturing high-altitude perspectives of urban colour.

Table 1: Equipment used and its purpose and method

No.	Equipment	Purpose	Methodology
1	CBCC Chinese Architectural Colour Card	Obtain Colour information of buildings	Select appropriate Colour card samples, compare with the colour of buildings, and record Colour codes and descriptions.
2	Spectrophotometer CS410 Portable Colourimeter	Measure brightness and spectral data of colour	Use the portable Colourimeter to measure the colour of buildings or environments, obtaining brightness and spectral data.
3	SG906MAX1 Drone	Conduct urban spatial panoramic research, obtain high-altitude perspective of colour	Capture urban landscape photos using the drone, with a specific focus on the overall colour of buildings and environments, obtaining panoramic Colour information.

Source: Authors (2024)

Research Steps

Based on the research methods of colour geography, the specific research steps for the urban colour investigation in Jinan were designed as follows:

- i. Site Selection: Choose regions with typical, distinctive, and significantly variable urban colour, identify the survey area, specify to specific streets and individual buildings, etc.
- ii. Investigation: Focus on the colour image and cultural atmosphere of specific areas; take photos of building materials and surrounding natural environmental colour. Develop a specific investigation plan for building names, block history, etc.
- iii. Measurement: Primarily use CBCC Chinese Building Colour Card National Standard Samples (GBT18922--2008) for comparison, supplemented by a Spectrophotometer CS410 portable colour brightness metre, and an SG906MAX1 unmanned aerial vehicle. Record the data.
- iv. Induction: Transform the colour with urban regional features measured into specific colour data. Adopt a unified colour format, Munsell values, and RGB values. Next, systematically summarise large-scale colour schemes and discard chaotic and interfering colour outside the series.

ANALYSIS AND DISCUSSION

Analysis of Jinan's Architectural Colour Context

The development of architectural colour in Jinan shares similarities with the evolution of northern cities, embodying distinct characteristics of "Spring City." Transitioning from the traditional grey tones of Ming Prefecture City to the red brick and brown tile in the commercial area and further to the modern new city with elegant, bright, and stable colour tones reflects Jinan's unique orientation within its geographical and temporal environment.

Jinan's architectural colour has long transcended traditional boundaries, presenting the face of a modern urban environment. The development of the commercial area has led to a mixture of Chinese and Western architectural styles, creating an experimental ground for the fusion of these influences and showcasing the diversity of Jinan's urban colour palette (Table 2).

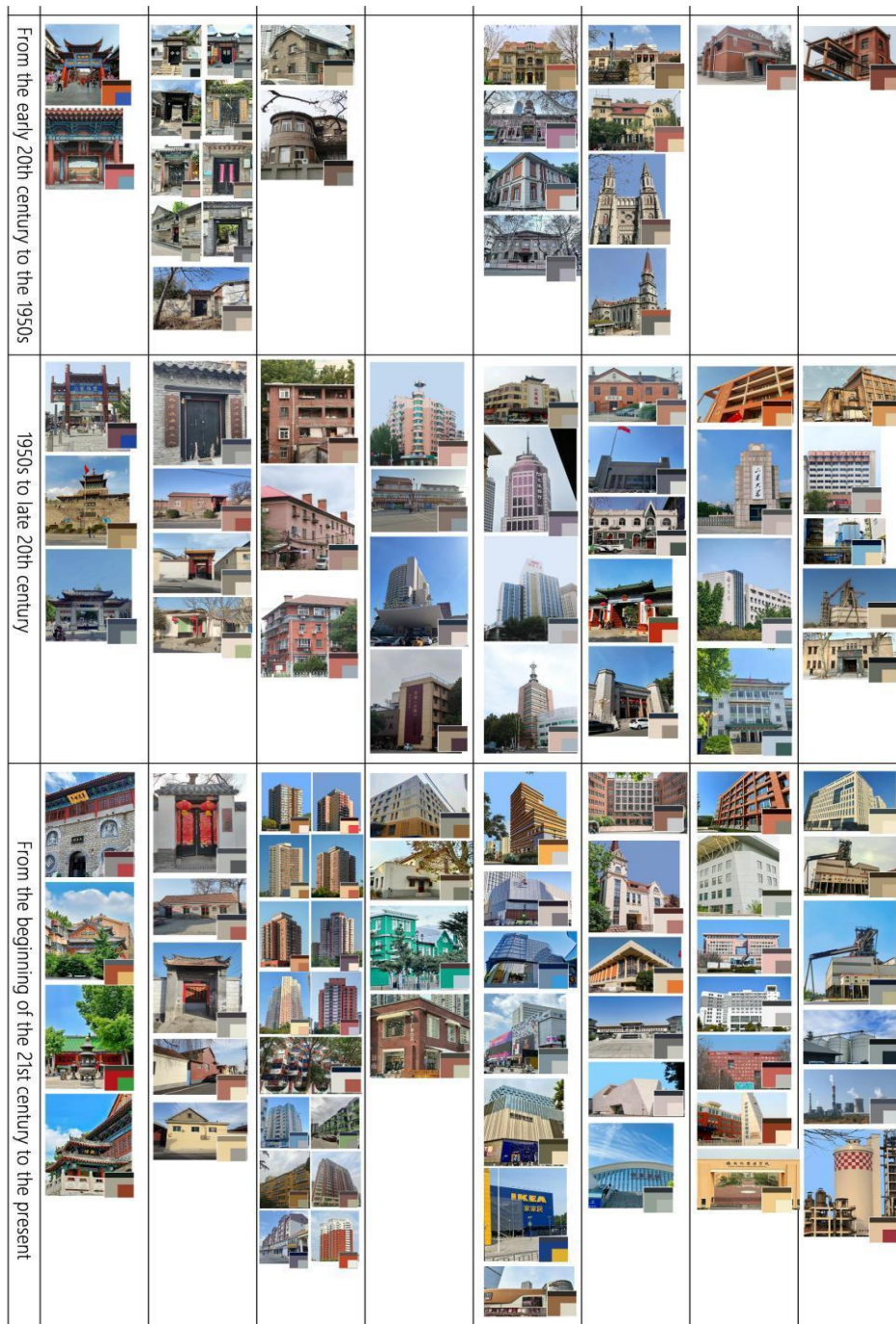
Architectural colour Spatial Composition in Jinan

Historical buildings in Jinan are widely distributed, primarily concentrated in the old city area, including the ancient city and the commercial area. These buildings encompass a rich variety of types, such as residential, religious, consulates, transportation and telecommunication structures, banking and financial buildings, schools, hospitals, commercial establishments, and other service-related structures. Architectural forms vary, covering Gothic, Roman, classical, and modern styles while also featuring traditional architecture such as German, Japanese, English, and a fusion of Chinese and Western styles. The architectural structures predominantly use brick and stone, preserving the original colour of blue bricks, red bricks, or cement mortar.

There is a substantial number of newly constructed buildings, mainly distributed in the western and eastern new city areas. The application of modern construction techniques and high-tech building materials has led to a diminishing distinctiveness in the colour palette of new areas. Residential buildings extensively use warm colour tones, but there is an issue of independent colour schemes in each community, lacking coordinated connections. The colour design of commercial buildings appears disorderly, with prominent misuse of large outdoor billboards and high-saturation colour.

Table 2. Chronological Table of Colour Sorting for Some Buildings in Jinan

Chronology of Colour Sorting for Some Buildings in Jinan								
Architectural type	Monument	live (Traditional Architecture)	live (Modern Architecture)	Commercial residential	Commercial building	Public building	School building	Industry building
19th century - early 20th century								



Source: Authors (2024)

Administrative buildings have a large volume, and the lack of variation in street-facing facades makes them appear somewhat monotonous. In terms of industrial facilities, there is a lack of consideration for industrial characteristics, resulting in a homogeneous colour presentation. It is recommended to design colours based on different industries and forms, emphasising the coordination between individual industrial buildings along the street.

Analysis of the Current Situation of Architectural Colour in Jinan

In the qualitative study of urban colour in Jinan, various observation methods were employed, including literature review, photographing, colour card comparisons, and physical sampling, to comprehensively understand the current status of architectural colour in Jinan. Special attention was given to the overall colour in the old city area and the new city area, analysing the colour of typical buildings to gain an in-depth understanding of regional colour profiles under different terrain and location conditions. This comprehensive research approaches allows us to analyse, at a macro-level zoning, the colour characteristics and colour layout of Jinan city more profoundly (Figure 3).

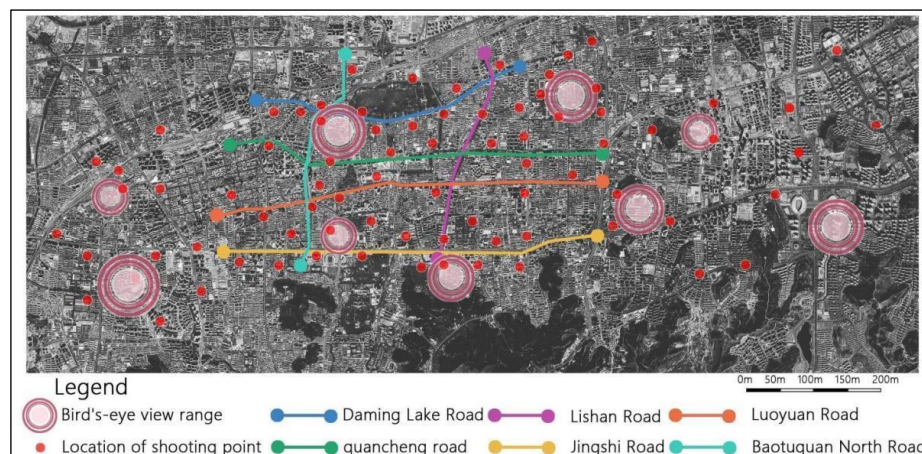


Figure 3: Schematic diagram of survey distribution points
Source: Authors (2024)

For a more precise and detailed investigation into Jinan's urban colour palette, we delineated the primary areas into the old city district, the eastern new city, and the western new city.

i. Analysis of Architectural colour in the Old City Area

Architectures in the old city area predominantly utilise warm yellow and warm red colours with medium to low brightness, complemented by warm and cool grey colours with medium to low brightness and saturation, creating a warm,

simple, and steady urban atmosphere. In late autumn, the vegetation presents an interweaving of yellow, green, and red, primarily characterised by warm and moderately saturated shades of green with medium to low brightness (Figure 4).

By employing the method of colour restoration through typical architectural colour, a detailed analysis was conducted on the colour tendencies of buildings with different functions (Figure 5). This unveiled the characteristics of architectural colour in different Jinan urban areas. Such research aids in comprehending the unique traits of urban colour and serves as a reference for future colour positioning.

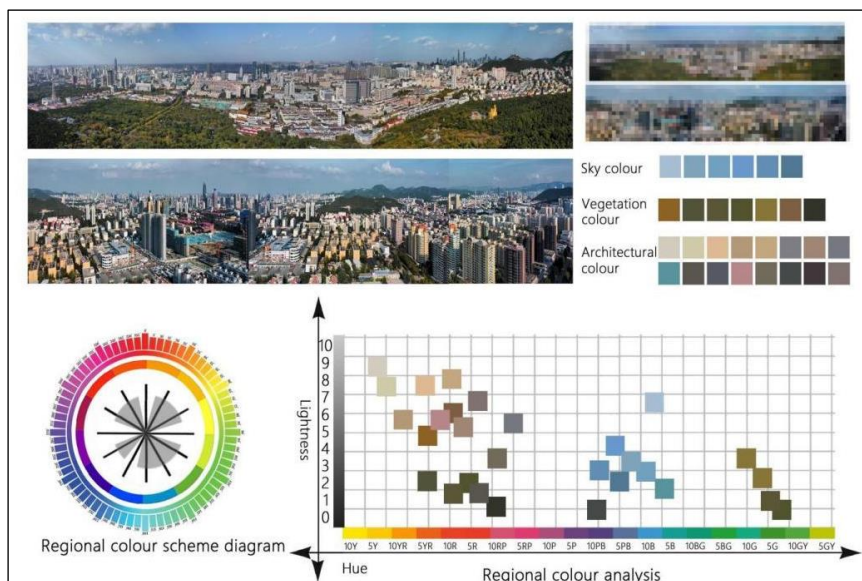


Figure 4: Schematic diagram of the current colour situation in the old urban area
Source: Authors (2024)

ii. Analysis of Architectural colour in the New Urban Area

The new urban area of Jinan presents a cool colour tone with medium to high brightness and low saturation, demonstrating medium to long tonal colour contrasts (Figure 6). This area includes large public buildings, high-tech industrial parks, and newly constructed residential communities. Large public buildings primarily feature medium to high brightness in the grey colour range, while the colour palette in newly built residential areas is more vibrant. The predominant tone comprises medium-to-high brightness and low-saturation warm colours, which are complemented by elements of medium-to-high saturation.

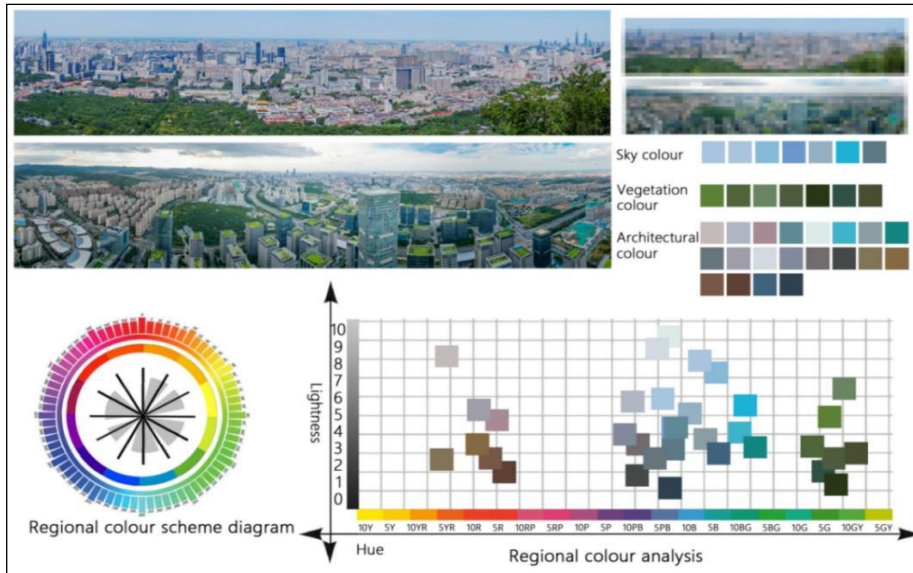


Figure 5: Current status of typical architectural colour in old urban areas
Source: Authors (2024)

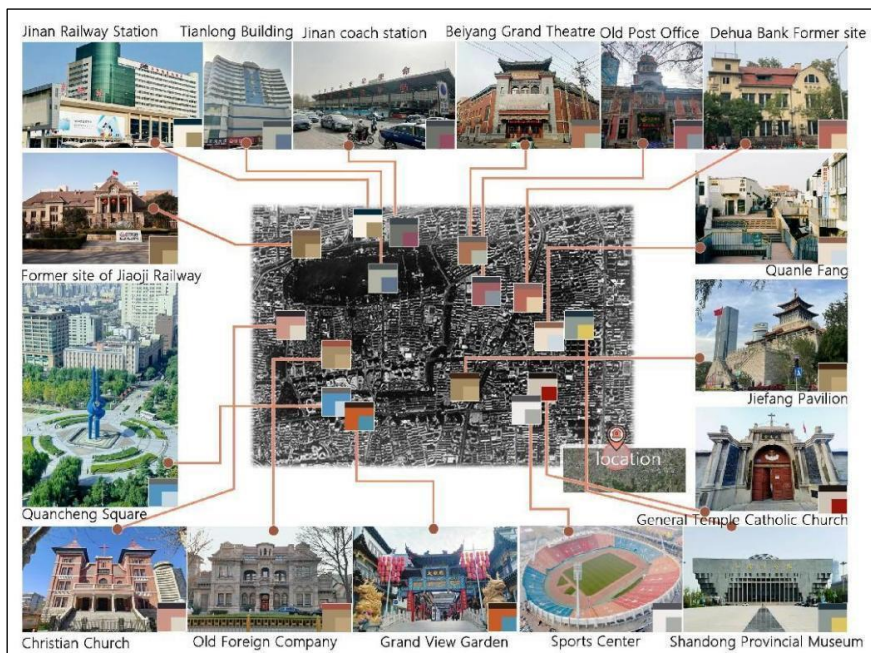


Figure 6: Schematic diagram of the current colour situation in the new urban area
Source: Authors (2024)

iii. Analysis of Architectural Colour in the Industrial Zone

Industry is one of Jihan’s economic pillars, and the industrial zone’s colour palette occupies a significant position within the urban colour scheme. An analysis of the current colour situation reveals that the industrial zone is characterised by a concentration of medium to high brightness in the grey colour range and medium to high brightness, low saturation yellow-brown hues (Figure 7).

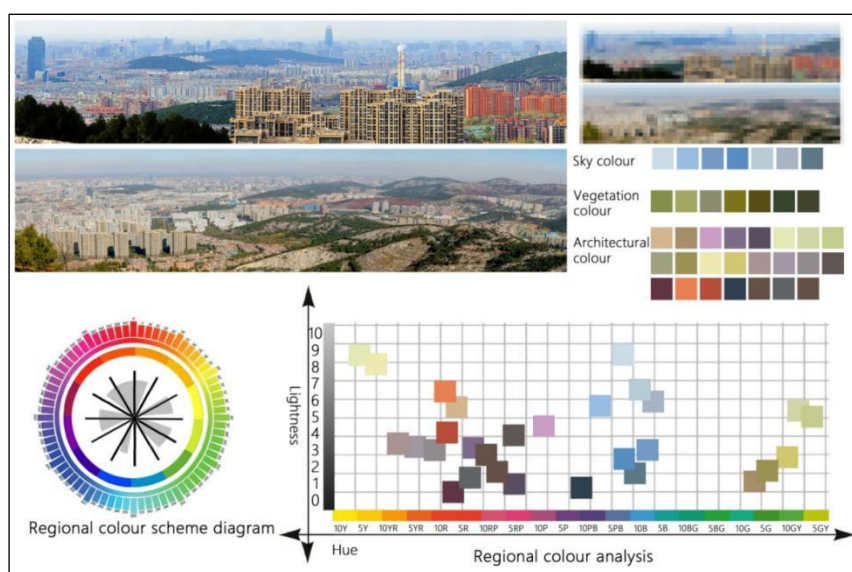


Figure 7: Schematic diagram of the current colour situation in industrial areas
 Source: Authors (2024)

iv. Analysis of the Current Architectural Colour in Different Functional Buildings

The analysis of architectural colour in Jinan shows that red-brown and yellow-brown hues heavily influence building colour schemes. Industrial and public buildings have the lowest colour saturation, followed by educational buildings, while residential and commercial structures exhibit higher saturation. The ancient city and commercial areas boast the most vibrant architectural colour. Overall, Jinan's urban colour palette appears diverse but somewhat disorderly, with a warm grey base and issues arising from the arbitrary use of highly saturated colour. The new city's colour scheme lacks coherence and distinctiveness, whereas the old city's hues are more pronounced, mainly in medium-to-low brightness yellow-grey and red-grey ranges.

Landscape Greening colour

Landscape greening is a significant component of urban colour, primarily manifested through colour artistry, showcasing a variety of colourful and diverse plant forms (Adam et al., 2022; Ali et al., 2018). The study of landscape greening colour in Jinan focused primarily on park greening and road greening. Jinan's major parks include Wulongtan Park, Quancheng Park, Zhongshan Park, Baihua Park, Jinan Botanical Garden, etc., and the plants in each park exhibit diverse colours.

CONCLUSION

Various factors influence the architectural colour of Jinan, displaying significant differences between the old and new urban areas. The buildings in the old city predominantly use warm yellows and reds, complemented by medium-to-low brightness warm and cool greys, creating a warm, simple, and stable urban atmosphere. These colours, combined with traditional grey bricks and black tiles, reflect Jinan's rich historical and cultural heritage.

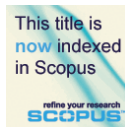
In contrast, the new urban areas are dominated by cool colours with high brightness and low saturation, presenting a modern and bright urban image. Public buildings mainly use grey with medium to high luminance, while the new residential areas show more vibrant colour with warm tones of high luminance and low saturation. Overall, Jinan's architectural colours are varied, but there is some confusion. The colour scheme of the new city lacks coherence and uniqueness, while the old city is more uniform and distinctive. Future urban planning and development should focus on the coordinated design of building colour to maintain overall harmony and unity, while preserving Jinan's unique historical and cultural hues.

In order to preserve and pass on Jinan's rich architectural colour, future urban development should focus on the following key aspects: Firstly, attention should be paid to the protection of historical buildings and cultural heritage to ensure that their original colours are preserved, thus maintaining the city's historical atmosphere and cultural identity. Secondly, reasonable urban colour planning should be incorporated into urban construction, and relevant policies and standards should be formulated to guide the colour coordination and design of buildings and public facilities, so as to ensure the overall harmony and unity of urban colour. In addition, special attention should be paid to the protection of religious buildings in order to preserve their unique religious colour and historical values. The dissemination and understanding of Jinan's history and culture by residents and tourists can be enhanced through the promotion of cultural education and tourism development. Finally, community participation and public opinion surveys are encouraged to actively collect residents' opinions and suggestions on urban colour protection and development, so as to form a consensus and promote the implementation and enforcement of relevant policies.

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ECONOMIC EMPOWERMENT OF INDIGENOUS COMMUNITIES THROUGH THE GAZETTEMENT OF LAND OWNERSHIP

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Abstract

Most of Malaysia's indigeneous (Orang Asli) population continues to live according to traditional customs, especially when it comes to business. The subsistence farming practices and natural resources are the main sources of income for the Orang Asli community in Malaysia. However, certain tribes have also engaged in various commercial economic endeavours, like the production of durian, rubber, cacao, and palm oil. The Orang Asli community generally views these economic activities as a new opportunity to improve their standard of living and income stream. Unfortunately, many of them are incapable of transforming their tanah saka (customary land) to more productive and organized agriculture that could potentially be commercial due to many limitations, particularly those associated with property ownership not being officially recognized in Malaysia. Accordingly, this study aims to develop economic empowerment plans that can be effectively executed through the gazetting of the Orang Asli's tanah saka. This study uses a qualitative method by applying an ethnographic approach through fieldwork at 14 Posts of the Temiar community in Gua Musang, Kelantan. The results of this study show that there are several potential economic empowerment plans that can be implemented if the land gazetting proposal is approved. Among the economic empowerment opportunities are the development of organised settlements, economic development of subsistence agriculture, commercial economic development, entrepreneurship development, rural tourism, guidance and training. In order to safeguard the well-being of the Orang Asli in Malaysia, especially the Temiar tribe, gazetting tanah saka (customary land) is crucial to the implementation of the RMK12 plan.

Keywords: Empowerment, Economy, Orang Asli, Tanah Saka Gazetteer

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INTRODUCTION

Orang Asli plays an important role in Malaysia's cultural diversity and heritage. The majority of the *Orang Asli* people live in forest areas and practice a traditional way of life that is strongly influenced by the environment (Carey, 1976). This includes life skills such as hunting, gathering, and farming for their livelihood. Malaysian law gives recognition to the position of *Orang Asli* in the Constitution. The definition of *Orang Asli* enshrined in Article 160(2) and the *Orang Asli* Act 1954 explains who is considered as an *Orang Asli* (Ramle, A, Hafis, S, Asmawi, I, Sahar, S, H., & Hairulnizam, M.K., 2020). JAKOA (2022) divides the *Orang Asli* into three main groups, namely Negrito, Senoi, and Proto Malay (Indigenous Malay). In the three main groups, there are six tribes categorised in each race; the Negritos represented by Kensiu, Kintak, Lanoh, Jahai, Mendriq and Bateq, the Senoi represented by Temiar, Semai, Semoq Beri, Jahut, Mahmeri and Che Wong, and the last race, the proto-Malays represented by Orang Kuala, Orang Kanaq, Orang Seletar, Jakun, Semelai and Temuan. This division was made based on their physical characteristics, language, and customs (Hafis, Ramle, Asmawi, Sahar, & Abdullah, 2020). According to JAKOA (2022), the total number of *Orang Asli* communities in Peninsular Malaysia until 2022 amounts to 209,575. The composition of the population according to race is, the Negrito race totalling 6,322 people (3.02%), the Senoi race group totalling 115,712 people (55.21%), and the Proto Malay race group totalling 87,541 people (41.77%). They live in 852 *Orang Asli* villages across the states in Peninsular Malaysia, except Penang and Perlis (JAKOA, 2022). The statistics in 2022 show that the population has increased from the previous year. The *Orang Asli* races and population in Malaysia are shown in Table 1.

Table 1: Race and Indigenous Population in Malaysia

Races			Total Number
Negritos	Senoi	Proto Malay	209,575
6,322	115,712	87,541	

Source: JAKOA (2022)

This study focuses on the Temiar tribe. The Temiar tribe is made up of *Orang Asli* population from the Senoi tribe. The Temiar tribe is an *Orang Asli* tribe that mostly lives in the interior and highlands of the states of Kelantan and Perak (Ramle, Hafis, Asmawi, Hairulnizam, & Faizol, 2019). The Temiar tribe is the largest tribe, as compared to the other *Orang Asli* communities in Kelantan. Traditionally, the Temiar tribe carries out economic activities of subsistence agriculture (e.g. cassava, paddy huma, fruit orchards), collecting forest produce, and hunting (Ramle et al, 2020). However, due to the current economic

development, their economic activities have also changed from traditional agriculture such as hill paddy to modern agriculture such as rubber (Hafis et al, 2020). The population of the Temiar tribe in Kelantan has reached 16,168 (JAKOA, 2022). The detailed population of the Temiar tribe in Kelantan is as follows:

Table 2: Total Population of the Temiar Tribe in Gua Musang, Kelantan

Settlement	Heads of Household (KIR)	Household Members (AIR)	Total
Pos Broke, Pos Hendrop, Pos Hau, Pos Bihai, Pos Balar, Pos Simpor, Pos Belatim, Pos Pasik, Pos Blau, Pos Tohoi, Pos Gob, RPS Kuala Betis and Kampung Kuala Wook	4135	12033	16168

Source: JAKOA (2022)

According to Ramle et al. (2020), the Temiar tribe frequently faces difficulties such as poverty, socioeconomic problems, encroachment on customary territory, and environmental impacts resulted from development. Therefore, understanding and supporting their rights and interests, as well as empowering the potential socio-economic opportunities of the Temiar tribe are important in ensuring their well-being in the future. In light of this, the researcher has conducted research to determine the socioeconomic prospect of them receiving gazetted clearance for their *tanah saka* (customary land) in Gua Musang, Kelantan.

PROBLEM STATEMENT AND RESEARCH OBJECTIVES

The *Orang Asli* community is one of the vulnerable groups that consistently garners attention from the government. Since Malaysia’s independence, the government has drawn up various comprehensive socioeconomic development plans to improve the living standards of the *Orang Asli* community. The plan covers aspects of increasing income, education and well-being up to the basic infrastructures for them. However, the efforts implemented have only reached some *Orang Asli* tribes. There are still many people in the *Orang Asli* tribes who are facing severe poverty. The majority of *Orang Asli* households are B40 with a high poverty rate, which is 33.6 percent in 2019 (Hairulnizam, Hafis, Asmawi & Abdullah, 2023).

According to Md Rami, A. A., Ibrahim, A., Ismail, I. A., Nazuri, N. S., & Ahmed Olaitan, A. (2023), *Orang Asli* community is a major component of the Malaysian people, whom we must encourage to grow along with the nation under

the 12th Malaysia Plan. In order to accelerate the socioeconomic growth of the affected population, the government is working to guarantee that the *Orang Asli* community receives high-quality education. There will be more opportunities for *Orang Asli* pupils to complete their education up until Form Five. There will be an addition and a partial upgrade to Comprehensive Special Model School 9 (K9) to Comprehensive Special Model School 11 (K11). Aspects of education are enhanced, encompassing the calibre of educators and school infrastructure.

Nonetheless, it is also evident that attention needs to be paid to government's initiatives to support the socioeconomic growth of the *Orang Asli* community through development, educational empowerment, and recognition of land ownership rights. Among the primary causes for their inability to raise their socioeconomic standing are exactly these. These limitations prevent their potential from being realised. This study is conducted with the aim to determine the possibilities for economic empowerment that can be implemented through the gazetting of the *tanah saka* of these indigenous people.

THEORETICAL FRAMEWORK

In this study, the cultural ecology theoretical approach is used to show the Temiar tribe's very close relationship to nature, especially the land. This relationship explains the formation of their beliefs, traditional economic activities and cultures, which all rooted from the influence of environment. The entire Temiar tribal group, from the earliest generation to today, engages in the process of application and self-adjustment as established in these beliefs, traditional economic activities, and cultures. The influence of environment in the life of the Temiar tribe can be seen from various elements including their traditional knowledge, beliefs, economic activities, arts, daily activities and taboos. Therefore, environment and beliefs are important in the traditional land management process for them.

Basically, this traditional land management exists in tandem with the dependence on the environment and the economic activities traditionally carried out by the Temiar tribe, which is subsistence farming. The process of land selection and land use is also seen to be influenced by the adaptation to the environment by the ancestors of the Temiar tribe in the past such as traditional knowledge, beliefs, customs and taboos. Following that, the new generation directly adapts to the local environment along with the culture inherited from the previous generation. Since its introduction, the theoretical approach has been widely used by researchers to explain the role of the environment in human life, especially the *Orang Asli*. Among the researchers are William (1983), Gomes (1986), Hasan, (1991), Ramle (2001:2014), Faizol (2019), Iqbal (2020) and Nik Nidzam (2020).

According to William (1983), the *Orang Asli* tribes cultivate the land inherited from their ancestors to carry out agricultural activities, such as rubber production, and growing fruit orchards and *huma* rice. This opinion is also seen to be in line with Hasan (1996) who explains that ever since immemorial time, the *Orang Asli* community has participated in various agriculture activities. This, according to Ramle (2014), can be seen through a series of successes of some *Orang Asli* communities engaging in subsistence as well as commercial agriculture. Additionally, Gomes (1986) and Hasan (1991) explain that the Semai tribal community only did *berhuma* work, which was the traditional activity that they had inherited from generation to generation and was their main source of income, but now only some of them stay with this upland rice economic activity while others have changed to more modern agriculture. This shows that the *Orang Asli* tribes rely on land use for their economic activities and subsistence.

Recent researchers such as Ramle (2001), Faizol (2019), Iqbal (2020) and Nik Nidzam (2020) explain the type of land used for the traditional Semaq Beri crops, of which are divided into two types of crops, short-term crops and long-term crops. Short-term crops cover a wide variety of crops. Among of them that are often given attention are bananas, corn, cassava, sugarcane, chilies and vegetables. Long-term crops involve commercial crops implemented in collaboration with JAKOA, RISDA and FELCRA to generate income for the *Orang Asli*. Based on the theory of cultural ecology, the researcher is of the view that the influence of the environment, traditional economic activities and culture had by the Temiar tribe has the potential to be developed in order to help them to get a more prosperous and secure life.

METHODOLOGY

This study uses a qualitative method in obtaining data. The use of the qualitative method is appropriate here as it helps the researcher to obtain data comprehensively, clearly and more accurately, and allows the researcher to make descriptive relation to the aspects studied (Ramle, 2001). An ethnographic approach that requires fieldwork over a relatively long period of time is needed to understand and explore the real situation in order to get a clear picture of the phenomenon being studied (Asmawi, Ramle, Wan, Wan, & Ahmed, 2023). The researcher took a period of 12 months to complete the fieldwork process. This ethnographic approach is found very helpful in providing a real picture of the available opportunities to be offered to the Temiar tribe for economic empowerment. The researcher has spent time in the field to carry out interacting and interviewing activities, observing this community's activities and documenting in detail to get accurate information and insight. Throughout the fieldwork process, the ethnographic approach was used as a process to collect data from a number of villagers consisting of penghulu, JPKKOA chairman,

JPKKOA members, JAKOA officers, PENERAK teachers, Indigenous Religious Teachers (GAOA), and some local residents. A total of 37 informants were responsible in providing information for this study. Throughout the study, data was successfully collected through interview technique and participant observation. The interview technique is the main data collection technique in this study. The researcher obtains research information directly from the informants through the interview process (W. Ariffin, W. J., Shahfiq, S., Ibrahim, A., Mohd Pauzi, H., & Md Rami, A. A., 2023). Through this technique, the researcher conducted a series of interviews with the local community, particularly the local leaders, Penghulu, Chairman of JPKKOA, local (elderly) residents and implementing agencies. Through this technique, the researcher obtained detailed information related to the potential of economic empowerment in the Temiar tribe. The researcher also collected data using the participant observation technique. During the study, the researcher observed and participated in activities, including economic activities and daily activities of the local community, in order to obtain detailed and accurate data. Data collection through the document analysis technique was also used to help the researcher in obtaining an overview and initial understanding of the issues being studied. All information collected through the three techniques are analysed to obtain a complete picture of the phenomenon studied. The data was analysed using QSR NViVO 12 software through several processes, namely transcription, data organization, conditioning, themes, coding, triangulation and reports.

FINDINGS

i. Potentials of the Organized Settlement Development

The Organized Settlement Program consists of several programs such as Regrouping Plan “Rancangan Pengumpulan Semula” (RPS), Village Reorganization “Penyusunan Semula Kampung” (PSK), Natural Disasters, New Village Plan “Rancangan Kampung Baru” (RKB) and Land Development. The development of these organized settlements can help to place the *Orang Asli* community who are scattered across various locations in one area that is developed in an integrated manner, which would involve the development of land, facilities, infrastructure and public facilities as well as residential areas. Accordingly, based on the results of the study, the Temiar community is very interested in developing their *tanah saka* (customary land) to be recognized as an organized settlement. By establishing this, they would find it easier to manage life activities, especially those related to infrastructure development and economic activities. This is explicitly stated by some of the informants:

"If our *saka* land can be gazetted, we can live in better conditions than we do now because we have seen other villages that have been gazetted and they are all good and organized. House facilities, electricity and water are easy for us to get when the land is gazetted."

Informant 1

"We really want our *tanah saka* (customary land) to be recognized so that we can turn it into a village. When it is recognized, it will be easy for our village to get help and facilities from the government."

Informant 3

In addition, the gazettelement of *tanah saka* (customary land) to be used as an organized settlement can also facilitate the government's planning of assistance and basic needs for the Temiar tribe. This is because an organized settlement would have a better leadership and organization system. Planning to develop the education system by building schools for the new generation would also be easier to execute. The following informants have clearly pointed this out:

"When we have a gazetted village, we will be able to establish a better leadership system in line with the wishes of the villagers who want development, assistance and so on. So this penghulu who will be appointed will represent us to convey our wishes to the government."

Informant 2

"With the recognition of organized settlement, we can apply for a school for our children. Right now, our children go to school far away from home and have to live in a boarding school despite of them being very young. We have no choice but sending them off to the boarding school as we believe that education is one of the ways for the new generation to live better in the future."

Informant 18

In addition, the reorganization of *Orang Asli* villages without moving the residents can also be implemented if the gazetted process is through. We will be able to plan developments for the community in the villages, which are concentrated on the outskirts of the city and rural areas. Various public and basic facilities in the existing Temiar tribal settlements can be implemented without any issue.

"The importance of the publication or granting of this title to us is that we can enjoy various basic facilities in our settlement such as electricity and water. Right now, we are depending on solar energy and generators for electricity and clean water. When our settlement is gazetted, it will be easy for us to get these basic facilities."

Informant 3

ii. Economic Development Potentials of Subsistence and Commercial Agricultures

Ever since Malaysia's independence, the government has been making efforts to promote rural economic development, especially for the *Orang Asli*. Various plans have been drawn up and made, and the results have been very good. Many rural communities have been helped and supported economically by the government. However, the *Orang Asli* communities, especially the Temiar tribe, there have been several issues obstructing the government's plan including the issue of land recognition. Due to the unresolved gazetting issue, the economic development of the *Orang Asli*, especially the Temiar, is stunted, as explained by one of the informants:

"Now the land we sit and work on is still not gazetted. We don't even know why this is still not resolved. Now we want to expand our plantation and we are worried that later when we get the produce, it will be taken by other people or the government. We will not be entitled to compensation, so we lose."

Informant 16

For the Temiar tribe, they are very interested and competent in farming activities. They are skilled in short-term cash farming activities, such as cassava, sweet potato, lemongrass, pineapple, banana, corn and vegetables. This works for them as they are also very dependent on the produce for their own food supply. The results of the study show that with the traditional skills that this Temiar tribe has, it would have a great potential to be developed into an income-generating activity if the *tanah saka* (customary land) gazetting could be realised. Related statements were made by some informants as follow:

"We have been doing this planting work for generations. We used to grow a lot of cassava and bananas. But now we already know how to grow vegetables, pineapple, corn, pepper and more. We only grow these vegetables in small gardens by our houses for us to use for daily meals."

Informant 18

"Traditionally, we find food by farming. We learned this from our parents. We grow cassava, bananas, and other fruits. We also learn from the Malays and Chinese who come to our village. Right now, there are many vegetables that we can grow, but we can only use them for our own meals."

Informant 2

In addition to that, the Temiar tribe is also very interested in carrying out commercial agricultural activities on their *tanah saka*. Before this, they have been carrying out commercial rubber farming activities on a small scale, but in an unorganized and unsystematic way. They have also shown interest in other commercial agriculture such as the cultivation of palm and durian. However, due to several factors including the land recognition issue, financial problems and lack of skills, the interest stops there. This was as stated by some of the informants:

"We are aware that our village is far inland, so we really hope that our *tanah saka* (customary land) will be gazetted or given ownership so that we can develop our land for better economic activities with the guidance and assistance from the government and JAKOA."

Informant 17

"This gazetted process cannot be executed quickly because there are many problems involved, from the problem of financial allocation to that of payment for land survey and site planning."

Informant 31

"Actually, we are really interested in getting involved in the cultivation of palm, rubber and *musang king* (durian), but because we do not have an ownership right to the land, it is difficult for us to pursue it as the capital is also large. If we do it now, we will have to face the difficulty when an outside party suddenly comes and takes our land. "

Informant 16

iii. Potentials of Entrepreneurial Development

The results of the study also show that there are many Temiar people who are interested in business. However, there are constraints in their efforts to enter the field. For them, capital, equipment, guidance and facilities are seen as constraints that cause them to be afraid and unable to carry out business activities. They are aware that the demand for agricultural resources and selected forest products is very high but due to these constraints, they are afraid to venture into business. Their statements suggested this:

"I do sell herbs and tree roots. There are requests from outside but I can't afford to leave the village every day. Usually when there is a demand for wood roots, I will ask the buyer to come to my house to take it himself."

Informant 28

"In terms of business, there are actually a lot of villagers who are interested, but they know they will not be able to last long in the business because of insufficient capital, lack of facilities, and lack of knowledge. I have seen so many people trying to do business here but were unable to last long."

Informant 2

"We have tried to do business, but could not survive because of the small capital that we had and very high operating costs. Can you imagine how it is for us to live in the forest? To get goods, you have to go out to the city and buy goods in large quantities, so you would need a large amount of capital. Plus, the transport costs are high. That's why we cannot survive in business."

Informant 17

iv. Potentials of Rural Tourism

The approval for the gazettement of the Temiar tribe's *tanah saka* (customary land) is very important in order to increase their income. Through the recognition of *tanah saka*, the Temiar tribe will be able to plan various activities to generate income. The results of the study show that among the aspects that have the potential to be developed as a source of income is rural tourism. The Temiar tribe will be able to provide a potentially interesting holiday and recreation destination in their locality. This activity can help increasing their economic income. They can give cultural performances, sell forest products, be tourist guides and the like. For the Temiar community itself, they are very interested in making their settlement a tourist hotspot and there are already a number of villages such as Pos Tuel and Kampung Dakoh in Pos Balar that have started to get involved in rural tourism activities by offering homestays and holiday services near the waterfall area. This is seen as having great potentials to be further developed, especially if their *tanah saka* (customary land) is gazetted. One informant states this clearly:

"Actually, in this Orang Asli village, there are many places that we can develop to be tourist hotspots such as waterfalls, caves, forest tracks and others. For example, at Pos Tuel and Kampung Dakoh at Pos Balar, they have built traditional Temiar houses by the clean and clear river and built some facilities with allocations from the people's representatives here to help us generate income. The reception has been good. On weekends, there are usually many foreigners coming to stay and picnic there."

Informant 16

v. Willingness to Receive Guidance and Training

From the results of the study, it is obvious that the majority of Temiar people want to better their lives financially. Majority of them are very interested in venturing into new fields of agriculture to increase their income. They are ready to be guided and trained to gain new knowledge on how to carry out more profitable modern economic activities. This was expressed by the following informant:

"I am very interested in venturing into new fields of agriculture or programs if given the opportunity guidance. I am aware that life is becoming more challenging day by day. If we do not change, we will be left behind."

Informant 20

Programs that give exposure and increase the knowledge of farmers and breeders on modern and commercial techniques or technologies can potentially help the Temiar community to develop their *tanah saka* (customary land) for them to generate higher income.

CONCLUSION

This study shows the importance of gazetting *tanah saka* (customary land) in an effort to advance the economic development of the *Orang Asli*, especially the Temiar tribe. Based on the results of this study, it is clear that the issue of land recognition should be resolved either through gazette or the granting of ownership rights. Once this land recognition issue is resolved, potential economic development projects for the *Orang Asli* can be planned and implemented successfully and their income will also be increased. It is therefore hoped that this study can be used as a reference and guide for the interested parties to get involved and resolve this issue so that the welfare and well-being of the *Orang Asli* will be improved.

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CARVING SUCCESSFUL PUBLIC SPACES ALONG HISTORIC URBAN RIVERSCAPES

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Abstract

Recreational activities along urban waterways has gained popularity since the 1970s and efforts are underway to enhance public access to waterfront locations. Consequently, this resurgence has spurred the development of diverse public open spaces along riverbanks, offering various means of engagement with the river ecosystem. In the case of Kuala Lumpur, Malaysia, the historical significance of the confluence of Sungai Klang and Sungai Gombak dated back to the 1850s. This paper examines on how these historic urban rivers of Kuala Lumpur portrayed as a successful public space based on four qualities highlighted by the Project for Public Spaces: Sociability, Uses and Activities, Access and Linkages, as well as Comfort and Images. To study the applicability of these qualities, a comprehensive site observation was conducted using a checklist provided by the Project for Public Spaces. The findings from this case study confirmed the relevance of these criteria and underscore the significance of an integrated approach to foster successful public spaces, particularly in accentuating the unique attributes of historic urban rivers.

Keywords: Urban River, Historic Urban River, Public Space, Kuala Lumpur

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INTRODUCTION

Urban river corridors are considered as crucial components of green infrastructure, offering scenic views and open spaces for recreational activities (Vian, Izquierdo & Martínez, 2021; Prominski et al., 2023). They often become popular spots for parks, promenades, and cultural events, enhancing the quality of life for urban residents. However, the historical evolution of urban development has significantly influenced the structure of riverside areas and their integration into urban landscapes (Yassin, Bond & Mc Donagh, 2015). Globally, natural riverbanks have undergone extensive transformations due to historical neglect in urban planning (den Boer, 2020). River-oriented recreational developments typically adopt a "ribbon" layout in most cities, featuring activities like walking, cycling, sightseeing, boating, and nature excursions distributed along the river corridor (Vian, Izquierdo & Martínez, 2021).

Referring to Kuala Lumpur, the inception of Kuala Lumpur's settlement in 1850 were located on the confluence of two rivers; Sungai Klang and Sungai Gombak. The rivers had become the catalyst of the mining, agricultural and cultural activities of Kuala Lumpur. Since then, urban fabric of Kuala Lumpur has changed gradually and became one of most well-planned cities in Malaya. Hence, the history and identity of Kuala Lumpur not only limited to the historical buildings located along the rivers, but the entire area including the spaces and the rivers. These rivers served as crucial catalysts for the development of culture and civilization (Wang & He, 2022). Their role goes beyond mere geography, profoundly shaping economic, social, and cultural aspects throughout the course of human history.

To ensure the historical value of the urban river of Kuala Lumpur are well conserved, a successful public space need to be integrated alongside the river. The examination of on-site conditions of the Sungai Klang and Sungai Gombak will involve the integration of a checklist provided by the *Project for Public Spaces*, focusing on the four key qualities of successful public spaces: i) Access and Linkages, ii) Comfort and Image, iii) Uses and Activities, and iv) Sociability. As highlighted by *Charter of Public Space* (2013), public space “are an integral and meaningful part of the urban architecture and landscape, with a determinant role in the overall image of the city” (National Institute of Urban Planning (INU), 2013). Their impacts extend beyond mere geographical significance, permeating various aspects of human life, from economic activities and settlement patterns to cultural practices and spiritual beliefs.

LITERATURE REVIEW

Historic Urban River

Urban historic rivers foster a strong connection to a city's history and an appreciation for the natural environment. They served as focal points for social and recreational activities, providing opportunities for leisure, relaxation, and

community gatherings. Additionally, urban historic rivers contribute to the overall sustainability of cities (Feio et al., 2022).

The *Recommendation on the Historic Urban Landscape* (HUL) by UNESCO defines the historic urban landscape as the result of a historic layering of cultural and natural values, extending beyond the notion of a "historic centre" to include the broader urban context and its geographical setting (UNESCO, 2011). Even without explicitly mentioning "historic urban rivers," the Recommendation on HUL includes elements such as topography, geomorphology, hydrology, natural features, built environment, infrastructures, open spaces, gardens, land use patterns, spatial organization, perceptions, visual relationships, and all other elements of the urban structure (UNESCO, 2011). Within these definitions, UNESCO indirectly acknowledges historic urban rivers as part of urban heritage.

Now, historic rivers actively fulfil their newfound roles, seamlessly integrating water as a fundamental element within the city's public spaces. The embankments have evolved into focal points of social life. In Malaysia, urban design teams still face challenges creating designs that are appropriate and sustainable for the city's river corridor due to insufficient development policies and guidelines related to the river corridor (Abidin, Flanders, & Gillian, 2020).

Public Space

Recreational activities in public spaces commonly take place in expansive areas such as parks, streets, plazas, sports facilities, private yards, balconies, and other similar spaces. These urban public spaces served as realms of freedom, enabling citizens to express their urbanity in diverse ways, be it through contemplation, social interaction, or physical exercise (Gouvea & Mont'Alvao, 2021). The inclusion of open space should be regarded not as an afterthought but as an integral component of urban planning that required careful consideration (Suratman, Raid, Nadzri, Samsudin, & Mohammad, 2020).

Based on *Charter of Public Space* (2013), public spaces should be regarded as a "public good" where "all places are publicly owned or of public use, accessible and enjoyable by all for free and without a profit motive [and] has its own spatial, historic, environmental, social and economic features" (National Institute of Urban Planning (INU), 2013). Hence, the potential for diverse manifestations in urban public spaces is immense, contributing to the overall well-being of a city if urban public spaces maintain a vibrant population.

Based on the *Project for Public Spaces* (2023), successful public spaces are indicated by four (4) qualities; i) Access and Linkages, ii) Comfort and Image, iii) Uses and Activities, and iv) Sociability. Each of these qualities act as a tool to help in accessing any public place, as a good or bad space (Refer Figure 1: The Place Diagram). A thorough understanding of these attributes are essential for the

effective development of public spaces, particularly those situated in proximity to historic urban rivers.

Referring to the historical urban rivers, the incorporation of these four essential qualities is imperative for the successful reintegration of the watercourse into the urban landscapes. This endeavour, in turn, will indirectly address the aesthetic and functional requirements of the city and its inhabitants, augment the vibrancy of public spaces, and contribute significantly to the overall prosperity of the community (Hradilová, 2013).



Figure 1: The Place Diagram
Source: *Project for Public Spaces, 2023*

i. Access and Linkages

The accessibility of a location is determined by connections to the surrounding environment, encompassing both visual and physical aspects. Thriving public spaces are characterized by easy entry and navigation, being noticeable from afar as well as in proximity (*Project for Public Spaces, 2023*). In the context of historical urban rivers, access and linkages are important, shaping the connectivity and utilization of these watercourses within the urban fabric. A

comprehensive understanding of these factors is essential for sustainable urban development (Miradyanti, Srinaga & Dewi, 2021).

As urban settlements expand, well-designed public spaces with good access and linkages become increasingly vital. They are essential for the success of urban areas, promoting inclusivity and catering to diverse resident needs (Miradyanti, Srinaga & Dewi, 2021). These elements, functioning as components of plazas or streets (Byrne & Sipe, 2010), often adopt broader dimensions in densely populated urban environments, creating a promenade-like character and hosting recreational, cultural, and commercial attractions (Vian, Izquierdo & Martínez, 2021). An effective planning ensures a harmonious integration of historical urban rivers into contemporary landscapes, fostering cultural and environmental enrichment.

ii. Comfort and Image

Comfort, addressing physical and psychological aspects, are essential for user's satisfaction (Gehl, 2010), while image, shaped by aesthetics and design, influenced social interactions and the overall appeal of public spaces (Whyte, 1980; Nasar, 1998). Both elements enhanced the quality of urban environments, contributing to positive experiences for residents and visitors, ultimately influencing the sustainable development of urban areas. Understanding these factors are essential for effective urban planning and design (Gehl, 2010; Whyte, 1980; Nasar, 1998). Considerations of safety, cleanliness, and seating area accessibility are encompassed within the aspects of comfort and image (*Project for Public Spaces*, 2023).

For historic urban rivers, comfort and image are pivotal for fostering community well-being and sustainable development. Comfort, addressing physical and psychological elements, is crucial for user satisfaction within the river environment (Gehl, 2010). Simultaneously, image, influenced by historical preservation and aesthetic design, plays a crucial role in shaping social interactions and the overall appeal of the river area (Whyte, 1980; Nasar, 1998). Prioritizing these factors are imperative for effective planning and preservation strategies, contributing to more positive experiences for residents and visitors and influencing the long-term sustainability of historic urban riverscapes (Gehl, 2010; Miradyanti, Srinaga & Dewi, 2021; *Project for Public Spaces*, 2023).

iii. Uses and Activities

The significance of uses and activities in urban public spaces are fundamental for fostering vibrant communities and sustainable development. Diverse, well-planned activities contribute to social interaction, cultural enrichment, and community engagement, enhancing the overall vitality (Carr et al., 1992; Loukaitou-Sideris, 2018). A cherished public space seamlessly incorporates diverse planned and spontaneous activities, serving and engaging the local

community. However, maximizing these benefits require strategic planning and continuous management, involving program development, organization, triangulation, and effective conflict resolution, such as those arising between commercial interests and complex historical considerations (*Project for Public Spaces*, 2023).

Varied activities, including cultural events, recreational pursuits, and communal gatherings, also contribute to the river's vitality (Whyte, 1980; Carmona et al., 2003). Strategic planning and management of these activities are essential for the preservation and adaptive reuse of historical riverfronts, ensuring their relevance and contribution to the socio-cultural fabric of urban areas (Loukaitou-Sideris, 2018; Carr et al., 1992).

iv. Sociability

Achieving sociability is challenging but becomes a distinctive hallmark once accomplished. Encounters with friends, engagement with neighbours, and ease in interacting with strangers create a heightened sense of place and attachment to the community (*Project for Public Spaces*, 2023). Social interactions, facilitated through diverse activities and gatherings, contribute to a sense of belonging and shared identity (Allen et al., 2021). Sociability's functions extend beyond spatial design, influencing the overall liveability and vibrancy of public spaces (Carmona et al., 2003; Loukaitou-Sideris, 2018). In terms of understanding and prioritizing sociability are considered crucial for effective urban planning, ensuring that public spaces are dynamic, inclusive, and conducive to positive social experiences, ultimately enhancing the quality of urban life (Whyte, 1980; Gehl, 2010).

In public spaces along historic urban rivers, interactions and communal activities foster a shared connection to the historical and cultural identity of the river environment. This sociability not only enhances the overall quality of the public spaces but also strengthens the community's attachment to the historical narrative of the urban river (Francis, Giles-Corti, Wood, & Knuiman, 2012).

METHODOLOGY

This research employed a qualitative research approach with a qualitative descriptive analysis method. Qualitative descriptive analysis is utilized to demonstrate a phenomenon occurring in a specific location and described the reasons behind such occurrences, rather than to prove or refute a theoretical hypothesis (Taguchi, 2018). This study adopted a case study method, signifying that an event in one location cannot be generalized to events in other places even if they share similar components (Ebneyamini & Moghadam, 2018). A case study is a thorough empirical investigation examining a current phenomenon within its authentic context, particularly when the distinctions between the phenomenon and its context are unclear, and the researcher has limited control over the events.

(Yin & Campbell, 1989; Yin 1994, 2009). Data collection method in this study includes site observations. The study employed observational method where the researcher visited the research site to directly observe and experience the events taking place (Morgan et al., 2017). The research was conducted along the historic urban river of Kuala Lumpur, Sungai Klang and Sungai Gombak.

FINDINGS

Study Site: The Confluence of Sungai Klang and Sungai Gombak in Kuala Lumpur, Malaysia

A prosperous public space, complemented by diverse activities along the banks of Sungai Klang and Sungai Gombak, play a pivotal role in accentuating the historical significance of these rivers (Figure 02). By integrating checklist provided by *Project for Public Spaces*, the four qualities of successful public spaces; i) Access and Linkages, ii) Comfort and Image, iii) Uses and Activities, and iv) Sociability will be examined on site. The determination of whether public spaces situated along these rivers can be deemed as successful hinges on the presence of these four qualities.

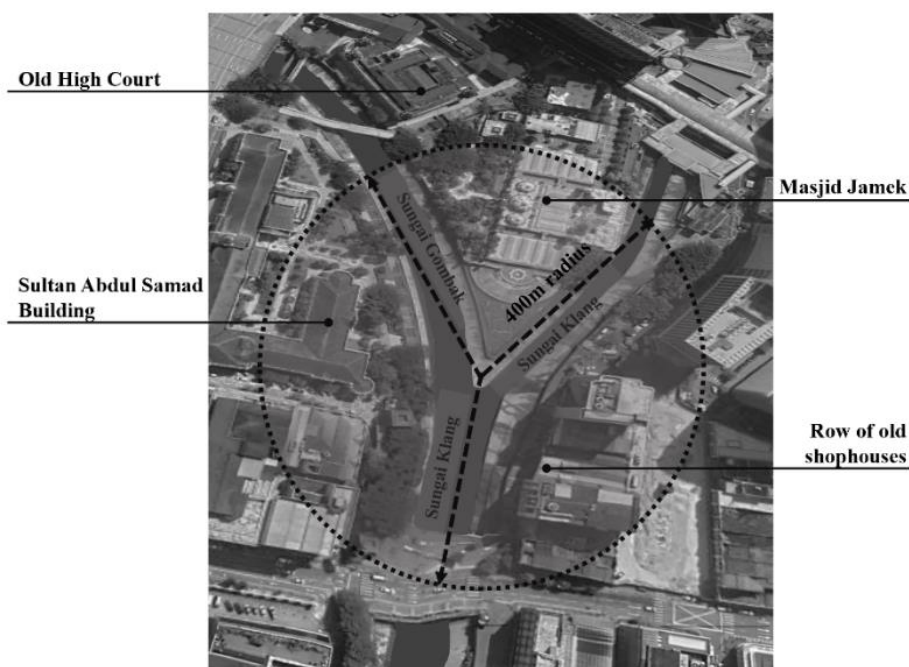


Figure 2: The Klang River and Gombak River, enveloped by historic edifices.
Source: Adapted from Google Earth, 2023

The site observation encompassed a spatial radius of 400 meters from the confluence of the Sungai Klang and Sungai Gombak. This methodology

aligned with established urban planning principles that recommend a proximate analysis of a site to capture the immediate contextual influences (Cullen, 2010). Such radius ensures a comprehensive examination of the surrounding built environment and facilitates a nuanced understanding of the historical, cultural, and architectural dynamics at play in the vicinity of the rivers (Gehl, 2011; Lynch, 1960). This approach is consistent with best practices in urban research and design, enabling a thorough exploration of the spatial relationships and contextual factors shaping the studied area.

Access and Linkages

Accessibility analysis from the site observations shown that the access and linkages to the north of Sungai Kelang and Sungai Gombak, and to the south of Sungai Klang are well maintained and accessible in a diversity of ways — walking, cycling and micro-mobility (Figure 3). However, there is an unwelcoming area underneath the city’s elevated Pasar Seni Light Rail Transit (LRT) Station that had created a barrier between the Pasar Seni and Jalan Benteng. But with shade from the sun, this site can be an ideal place to potentially be revived (Figure 4).



Figure 3: Access and linkages located along Sungai Klang and Sungai Gombak that can easily access in a diversity of ways.
Source: Author, 2023



Figure 4: Potential spaces located underneath of Pasar Seni LRT Station.
Source: Author, 2023

The proximity of the rivers to transit hubs significantly influences the utilization of linkages along their banks. This site is close to the Pasar Seni LRT Station, Masjid Jamek LRT Station, and several bus stops. The moments preceding a train arrival, the anticipation for a bus, and the brisk walk to a connection collectively transform the area into an active space.

Comfort and Image

The streetscape along a river serves as a pivotal factor in establishing comfortable spaces. Referring to the qualities of comfort, the public spaces located along these rivers are well equipped with streetscapes such as seating, landscaping, and pedestrian pathways (Figure 5). The seats for example are conveniently located in the sun or shade that contributed to the creation of inviting environment and conducive to the users. In addition, these public spaces also provide visually unblocked pathways (Figure 3). Therefore, it created a sense of safety by providing clear sightlines, minimizing hidden corners, and enhancing overall visibility. This transparency foster a perception of openness, reducing potential hiding spots and promoting a secure environment through increased awareness of surroundings.



Figure 5: Strategically positioned streetscapes within the study area offer users comfort-enhancing qualities.

Source: Author, 2023

This location holds considerable potential for enhancing its image. Surrounded by noteworthy heritage buildings, these public spaces contributed to the augmentation of the site's historical value (Figure 6). Positive perceptions of these public spaces, coupled with opportunities for photography, enhancing user engagement and contribute to the overall success of the area. The combination of aesthetic appeal and photo-worthy features will attract users, fostering an increase in activity and vibrancy in these public spaces.



Figure 6: Heritage buildings located along the river created a photo-worthy experience to the users.

Source: Author, 2023

Uses and Activities

Major nodes that become the main meeting point can be seen on the south part of the rivers, facing the Masjid Jamek and the Sultan Abdul Samad building. The water features situated at the confluence, along with the bridge spanning along Sungai Gombak, have attracted a greater number of users, including tourists, to visit this area (Figure 7). However, moving to the south of the area, most of the users used the space as main linkages to the transportation hubs.



Figure 7: Most activities are centred around the convergence of the river near Masjid Jamek and the Sultan Abdul Samad Building.

Source: Author, 2023

The individuals utilizing the access points along the rivers are predominantly comprised of staff working near this area. Hence these public spaces are more active during daytime. It is challenging to observe a diverse range of individuals, such as retirees and those with young children, utilizing these spaces during the daytime when others are typically at work.

Sociability

As highlighted earlier in the literature review, when individuals meet up with friends, and find ease in connecting with strangers, they often experience a heightened sense of connection or attachment to both their community and the environment that encourages these social activities. For this study area, there is a mix of ages and ethnic groups especially at the café located next to the rivers and photo-spot. Even in the absence of conversation, some users exchange smiles and make eye contact as they cross paths.

For spaces located near Pasar Seni or Central Market, the temporary night market set-up underneath the Pasar Seni LRT Station has become a popular social gathering spot for users (Figure 8). Featuring stalls offering a diverse range of local foods and artwork, this location has inadvertently evolved into a renowned hub for users.



Figure 8: Rows of stalls offering a diverse range of local foods and artwork.

Source: Author, 2023

CONCLUSION & RECOMMENDATIONS

Among the four qualities assessed on-site, the most notable attributes of the public spaces along these heritage rivers are i) Access and Linkages, and ii) Comfort and Image. These spaces demonstrated excellent connectivity between the buildings situated near the rivers and transportation hubs. Concerning the qualities of iii) Users and Activities, as well as iv) Sociality, although their attainment poses a moderate challenge, once realized, they constitute distinctive and unmistakable features. These qualities are crucial for the placemaking movement and help to establish vibrant community spaces for all. Accordingly, it is logical to view activity as both the inception and culmination of the process—serving as the perspective through which public spaces are conceived and a significant metric of their efficacy in the elements.

The geographical juncture of the rivers should be highlighted as the main city's historical genesis. The confluence not only symbolizes Kuala Lumpur's foundational origins but also highlights its historical and cultural significance. Therefore, this area holds significant potential to provide users with diverse experiential opportunities. Recognizing and promoting sociability is crucial for sustaining the cultural legacy of historic urban riverside public spaces. This fosters a heightened awareness of the rivers' historical value, transforming them into vibrant conduits of cultural heritage. The symbiotic relationship between public spaces and activities revitalizes the urban landscape and nurtures collective consciousness about the historical narrative embedded in Sungai Klang and Sungai Gombak. Establishing an authentic local destination requires understanding of the genuine preferences of the local populace. Development of policies and guidelines related to the river corridor should emerge from community engagement, ideally leveraging local resources, expertise, and materials. Such creative involvement cultivates an inclusive milieu where community members witness their ideas that shaped the place.

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FEAR OF COVID-19, LANDSCAPE SPATIAL CONFIGURATION AND ENVIRONMENTAL SATISFACTION IN URBAN PARKS

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Abstract

The COVID-19 pandemic has changed the mobility, accessibility dynamics and user behaviours in urban parks. A prevalent concern among park users is the heightened fear associated with the potential transmission of COVID-19, leading to apprehensions about personal health and perceived infection risks. However, at present, there is limited understanding of how park users perceive this public health crisis, along with the safety and satisfaction in urban parks after the spread of the pandemic. This study investigates the mediating role of fear of COVID-19 on the relationship between landscape spatial configuration and environmental satisfaction in urban parks. The study, which was conducted in Lanzhou, China, involved 450 urban park users (231 females, 219 males) aged between 18 and 75 years. Analytical findings reveal that urban park landscape spatial configuration affects fear of COVID-19 and environmental satisfaction. Furthermore, such fear negatively predicts environmental satisfaction. Importantly, the study establishes the mediating role of fear of COVID-19 in shaping the link between urban park landscape spatial configuration and environmental satisfaction. The implications of the results are discussed in conjunction with the relevant literature, thereby providing valuable insights for urban park planners and policymakers. Based on the study findings, an adaptive design of urban parks in the event of pandemics or health crises can be conceptualised to avoid the loss of users and contribute to resilience planning in urban design and public health.

Keywords: Urban Park, Landscape Spatial Configuration, Fear of COVID-19, Environmental Satisfaction

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INTRODUCTION

With the global outbreak of the COVID-19 pandemic in December 2019, the disease spread out to different countries within a short period. According to relevant data, 219 countries were affected by COVID-19, infecting hundreds of millions and causing millions of lives (Parra & Tan, 2021). In response to the spread of the diseases, the World Health Organization, with the cooperation of various countries, introduced severe restrictions, such as lockdowns, school and business closures, cancellations of public gatherings, travel restrictions and limitations on import and export trade transactions (Huang et al., 2023).

The rapid spread of COVID-19 and the sharp rise in deaths from infections sparked panic and anxiety. Ahorsu et al. (2022) refer to an individual's anxiety and fear of COVID-19 infection as 'fear of COVID-19'. Meanwhile, environmental cognitive theory (ECT) emphasises that positive spatial layout and organisation can positively affect people's satisfaction and comfort with the environment (Yan, 2023). However, most existing studies have focused on the aesthetics and functionality of urban parks while ignoring the impact of landscape spatial configuration, specifically the layout and organisation of spaces in parks, on environmental satisfaction. At present, there remains a lack of specific guidance and case studies on alleviating public fear and anxiety through reasonable landscape spatial configuration in response to public health emergencies. As a result, urban parks have failed to realise their potential mental health benefits during pandemics. In such events, there is an urgent need to utilise parks to reduce the psychological and physical ailments caused by fear or anxiety. This is because certain outdoor activities could be used to enhance individuals' mental well-being and combat loneliness in the COVID-19 era.

This study explores how urban parks' landscape spatial configuration affects users' environmental satisfaction, along with the mediating role of fear of COVID-19 in this relationship. By revealing this mechanism, we aim to provide theoretical and practical guidance for future urban park designs, help urban planners better respond to similar public health challenges and improve the mental health of the public during the pandemic.

LITERATURE REVIEW

Environmental Cognitive Theory (ECT)

ECT is a human behaviour theory that posits the interaction between personal attributes, behaviours and environments in shaping human behaviours. Kurt Lewin (2013) believes that the environment significantly impacts people's psychological activities, which in turn affect people's behaviours. In this theory, behaviour is represented by 'B', personal attributes by 'P' and the environment by 'E'. Hence, environmental stimuli (E) necessitate personal psychological perception (P) to maintain individual behavioural preferences (B). Particularly during the COVID-19 pandemic, when disease-ridden environments impacted

personal perceptions of COVID-19, urban parks provided a place to rest, escape, or relieve anxiety. Thus, research should seek to understand these emotional responses, which can help urban planners design use environments that promote well-being and increase safety in public parks (Swapan et al., 2024).

Urban Park Landscape Spatial Configuration

When designing urban park landscapes, several factors must be considered. First, it is necessary to create an excellent natural environment ('E' in ECT), including planting various trees, shrubs, flowers and other plants. Second, it is necessary to ensure the siting of urban parks, meet the accessibility of urban parks (including buses, trams or subways) and provide convenient services for residents who depend on urban public transportation (Grzyb, 2024). Connectivity within the urban park landscape spatial configuration is another critical aspect to consider. This involves designing the layout to facilitate seamless connections between parks and their surroundings, including adjacent urban areas and infrastructure, thereby enhancing accessibility, usability and overall functionality (Al-Kodmany, 2024).

Additionally, effective connectivity enhances the accessibility, usability and overall functionality of urban parks. The proximity of urban parks encourages their integration with commercial and cultural districts, and the creation of more parks near mixed-use areas surrounded by shops, restaurants and service facilities can lead to highly attractive and useful urban parks (Qin et al., 2024). Finally, the present study points out that the spatial configuration of urban park landscapes can affect the risk of COVID-19 transmission and the well-being of urban residents. Crowded urban parks may exacerbate users' fear of COVID-19. Therefore, well-maintained urban parks with a good-quality landscape spatial configuration can calm users and reduce pandemic-related anxiety (Padeiro et al., 2022).

Fear of COVID-19

Urban parks are one of the essential places for outdoor activities for city dwellers. However, during the COVID-19 pandemic, the public's ('P' in ECT) use of urban parks and their fear of COVID-19 became contradictory, and such contradiction and fear may persist. People were cautious about using public places, such as urban parks, due to the fear of contracting the virus. Fear of COVID-19 has influenced users' behavioural patterns in using urban parks. People avoided crowded parks and rush hour to reduce their risk of infection. While research has shown that urban parks are essential in improving people's mental health, fear of COVID-19 negatively impacted personal mental health during the pandemic (Zull Kepili et al., 2023). This fear exacerbated anxiety, stress and depression, especially among those who felt lonely or were diagnosed with a mental illness (Mayorga et al., 2022). Currently, COVID-19-related lockdowns have been

lifted. As a result, fear of COVID-19 among urban park users may have diminished, but this continued to have lasting effects on people's perceptions of public health, social distancing and physical and mental health. As such, urban park management departments and local authorities should continue to monitor the changing COVID-19 situation, along with shifting public attitudes, as a way to build resilience against future outbreaks and pandemics.

Environmental Satisfaction

Environmental satisfaction refers to the level of satisfaction an individual develops when interacting with and experiencing a particular landscape. This concept refers to users' subjective assessment of a landscape to meet their aesthetic, functional and emotional needs or their behavioural preferences ('B' in ECT) (Song et al., 2023). The spatial configuration of urban park landscapes is widely believed to have a positive impact on environmental satisfaction. However, recent research suggests that individual fear, particularly fear of COVID-19, negatively influences satisfaction levels (Davis et al., 2021). The fear associated with the pandemic has not only altered perceptions of urban park landscape spatial configuration but also significantly impacted environmental satisfaction in various ways.

The Current Study

Recently, people worldwide have experienced various problems caused by COVID-19 and have had to overcome the negative situations arising from the pandemic (Rosni & Zainol, 2022). Indeed, the pandemic has negatively impacted economies, human health and psychology worldwide. Related to this, urban parks have emerged as vital spaces where residents can seek solace and recreation amidst these trying circumstances. However, the pandemic and associated policy responses have led to significant psychological distress among urban dwellers, necessitating a closer examination of factors influencing the public's fear and well-being.

Therefore, this study focuses on urban park users as a sample group, given the increasing research interest in understanding fear of COVID-19 and the factors mitigating this fear since 2020. Zhang & Li (2023) investigated how urban park landscape spatial configuration can alleviate user stress and anxiety during the pandemic, while Xie et al. (2020) investigated the relationship between urban park satisfaction and fear of COVID-19. Despite these valuable contributions, existing research has not comprehensively addressed the relationships between urban park landscape spatial configuration, fear of COVID-19 and environmental satisfaction.

We believe that the results obtained in this study will guide urban planners and urban park managers to design and manage urban parks that can help increase resilience against pandemics. In turn, this can increase the need for

outdoor exercise among dwellers during pandemics, serving as an effective intervention to prevent mental health problems faced by users who cannot go outside to relieve stress and anxiety during such trying times.

To clearly explain the variables in this study, we provide the operational definitions of all variables: urban park landscape spatial configuration refers to the spatial distribution and layout of the environmental quality of urban parks, the accessibility of roads within parks, the connectivity of roads bordering parks and the proximity to services around parks. Fear of COVID-19 refers to health and safety concerns and anxieties due to the COVID-19 pandemic. Environmental satisfaction refers to an individual's satisfaction with the overall atmosphere of an urban park environment. The relationship between variables can be better understood and studied by clarifying these operational definitions. In this context, the main objective of the current study is to explore the mediating role of fear of COVID-19 in the relationship between landscape spatial configuration and environmental satisfaction in urban parks (Figure 1). To achieve this, the following hypotheses are proposed:

- H1.** Landscape spatial configuration negatively affects fear of COVID-19.
- H2.** Landscape spatial configuration positively affects environmental satisfaction.
- H3.** Fear of COVID-19 positively affects environmental satisfaction.
- H4.** Fear of COVID-19 mediates the relationship between urban park landscape spatial configuration and environmental satisfaction.

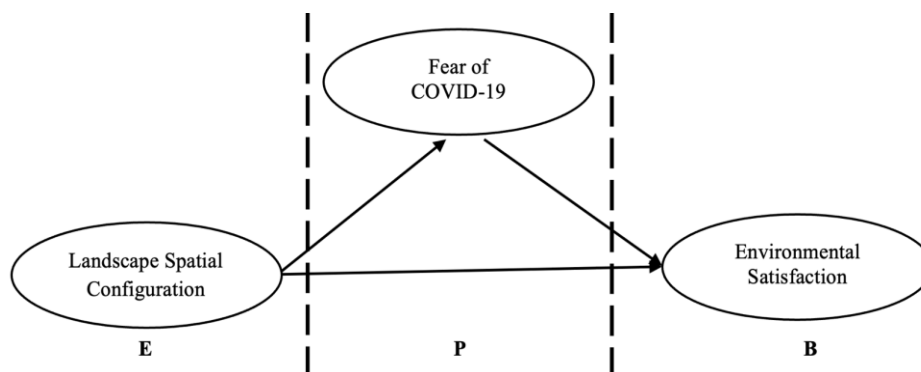


Figure 1: Conceptual model of the study
Source: Authors

RESEARCH METHOD

Study Site and Selection of Sample Park

The study site, Lanzhou City, is the capital of Gansu Province and home to the majority of regional administration headquarters in the province (Xu et al., 2007). Xigu District is an important part of Lanzhou City and has unique socioeconomic

characteristics. We selected Xigu District because it represents the typical characteristics of medium- and large-scale urban areas in Lanzhou, making the research results more universal and applicable. As such, participants from Xigu Park, Lanzhou City, China, were recruited for this study. Xigu Park mainly serves urban residents, has good accessibility and has sound service facilities. Thus, it can provide valuable data on the role and effectiveness of medium- and large-scale urban parks during the pandemic.

Based on the sample size reported by G Power, we chose the F-tests method, selected [ANOVA: Fixed effects, omnibus, one-way] and set the parameter effect size $f=0.25$, $\alpha=0.05$, $\beta=0.8$. We calculated that the sample size for this study should be at least 128.

In this study, we used a simple random sampling method to conduct a questionnaire survey. Individuals aged 18–75 who actively used Xigu Park were included, while users outside this age group were excluded. Data were collected from July to October 2023 via 500 questionnaires that were distributed on-site. A total of 450 valid questionnaires were collected, with a response rate of 90%.

Questionnaire Design

In this study, data were collected and analysed using questionnaires that were divided into two parts. The first part solicited demographic data, including the respondents' age and gender. The second part comprised the main questionnaire of the study, including three variables (landscape spatial configuration, fear of COVID-19 and environmental satisfaction). The scale used in this study was the same as that used in many studies, although some items were modified to accommodate our study. First, we used the landscape spatial configuration questionnaire, which was developed by Zheng (2021) to create urban parks' landscape spatial configuration scale. To make it suitable for this study, we selected 17 items with four dimensions (environmental quality, accessibility, connectivity and proximity), which were more helpful in refining the landscape spatial configuration dimensions of urban parks and improving the accuracy, depth and representativeness of the data. Second, we used the Fear of COVID-19 Scale developed by Ahorsu et al. (2022). To accommodate the measurements of COVID-19 fear among urban park users in this study, we modified this tool by removing two items and adjusting the remaining items. Finally, environmental satisfaction was measured based on the study of Cheng et al. (2022). In particular, we selected five items applicable to this study. **Table 1** shows all the items used in this study, which we assessed using a 5-point Likert scale.

Table 1: Study variables with their respective indicators

Construct	Item	Description
Landscape Spatial Configuration (1=strongly disagree, 5=strongly agree)		
Environment Quality	EQ1	This park has a good-quality activity space.
	EQ2	This park is built in a good location.
	EQ3	This park has good activity facilities.
	EQ4	This park has good landscape design.
	EQ5	There is a wide variety of plants in this park.
	EQ6	This park has an excellent physical environment (e.g. air, trees and natural vegetation).
Accessibility	AC1	There are many ways to get to this park (e.g. walking, driving and taking the bus).
	AC2	This park is close to where I live.
	AC3	The cost of transportation to reach this park is cheap.
	AC4	I spent less time on the way to this park.
	AC5	Traffic is smooth ton the way to this park.
Connectivity	CN1	There are many crossroads on the way to this park.
	CN2	An excellent road system connects this park.
	CN3	There are many road types to reach this park (e.g. walking trails, cycle lanes and driving roads).
Proximity	PX1	There are service sectors surrounding this park (e.g. restaurants).
	PX2	There are many types of service sectors surrounding this park (e.g. restaurants, cafes, supermarkets and malls).
	PX3	I can easily access the service sectors surrounding this park.
Fear of COVID-19 (1=strongly disagree, 5=strongly agree)		
	FC1	I am most afraid of getting COVID-19 in the park.
	FC2	It makes me uncomfortable to think about possibly getting COVID-19 in the park.
	FC3	My hands become clammy when I think about possibly getting COVID-19 in the park.
	FC4	I am afraid of losing my life because of COVID-19 while playing in the park.
	FC5	When watching news and stories about COVID-19 on social media I become nervous or anxious.
Environmental Satisfaction (1=strongly disagree, 5=strongly agree)		
	ES1	Satisfaction with park greenery.
	ES2	Satisfaction with road paving design.
	ES3	Satisfaction with environmental visual aesthetics.
	ES4	Satisfaction with the water environment comfort.
	ES5	Satisfaction with air quality.

Source: (Zheng, 2021; Ahorsu et al., 2022; Cheng et al., 2022)

RESULTS

Descriptive Statistics

Out of the 450 valid questionnaires obtained, 48.67% (n=219) were completed by males, while 51.33% (n=231) were completed by females. The respondents' ages ranged from 19 and 71 years old. The primary types of users surveyed included residents and individuals who were working, studying and living in Lanzhou City, Xigu district. When the absolute value of data skewness is less than 3, and the absolute value of kurtosis is less than 7, the sample data generally conform to the normal distribution (Blanca et al., 2013). The sample data in this study meet the requirements of normal distribution and are thus suitable for further analysis.

Reliability and Validity Analysis

In this study, PLS-SEM was employed to test the research hypotheses. Various criteria were considered to assess the validity and reliability of the measurement. The evaluation of the measurement model involved examining the outer loadings, convergent validity, composite reliability and discriminant validity. Outer loadings exceeding 0.6 indicate satisfactory validity. Reliability assessment included the consideration of Cronbach's alphas and composite reliability, with a threshold of 0.7 indicating acceptable reliability. **Table 2** indicates that all constructs surpass this threshold, demonstrating strong reliability. Convergent validity was evaluated using average variance extraction (AVE), in which a threshold exceeding 0.5 indicates satisfactory convergent validity (J. F. Hair et al., 2013).

In addition, the results of the Fornell-Larcker reveal that all square roots of AVE exceed the off-diagonal elements in the corresponding rows and columns. The cross-load method is performed by checking the cross loadings of the indicator. The difference between the outer loadings of the indicator within the related construct and all its loadings should at least be 0.1. The Heterotrait-Monotrait (HTMT) ratio should be less than 0.85 (J. F. Hair et al., 2013). The results indicate that the model has both convergence and discriminant validity.

Table 2: Measurement model results for the latent constructs

Construct	Items	Loadings	Cronbach's Alpha	CR	AVE
Landscape Spatial Configuration			0.946	0.952	0.543
Environment Quality	LSC_EQ1	0.855	0.928	0.943	0.734
	LSC_EQ2	0.851			
	LSC_EQ3	0.863			
	LSC_EQ4	0.860			
	LSC_EQ5	0.865			
	LSC_EQ6	0.848			
Accessibility	LSC_AC1	0.846	0.920	0.940	0.757
	LSC_AC2	0.869			
	LSC_AC3	0.889			
	LSC_AC4	0.887			
	LSC_AC5	0.857			
Connectivity	LSC_CN1	0.898	0.877	0.924	0.803
	LSC_CN2	0.892			
	LSC_CN3	0.898			
Proximity	LSC_PX1	0.876	0.869	0.920	0.793
	LSC_PX2	0.894			
	LSC_PX3	0.900			
Fear of COVID-19	FC1	0.815	0.898	0.925	0.710
	FC2	0.856			
	FC3	0.851			
	FC4	0.861			
	FC5	0.829			
Environmental Satisfaction	ES1	0.851	0.903	0.928	0.721
	ES2	0.840			
	ES3	0.851			
	ES4	0.852			
	ES5	0.850			

Source: Author's Calculation

Structural Model Analysis

Table 3 and **Figure 2** show the pathway analysis results from testing the hypothesised direct effects among the main variables. As can be seen, the landscape spatial configuration is a negative and significant predictor of fear of COVID-19 ($\beta = -.427$; $p < .001$), thus supporting H1. The study also found that landscape spatial configuration positively and significantly predicts environmental satisfaction ($\beta = .33$; $p < .001$), thus supporting H2. We also found that fear of COVID-19 is a negative and significant predictor of environmental satisfaction ($\beta = -.252$; $p < .001$), thus lending support to H3. The R^2 value for satisfaction is 24.3%.

Table 3: Path coefficient and hypothesis testing (direct effects)

Hs	Relationship	β	t value	Decision	f^2	VIF
H1	LSC →FC	-0.427	10.992	Supported	0.223 (Medium)	1.000
H2	LSC →ES	0.330	7.448	Supported	0.118 (Small)	1.223
H3	FC →ES	-0.252	5.555	Supported	0.069 (Small)	1.223

Notes: LSC=Landscape Spatial Configuration; FC= Fear of COVID-19; ES=Environmental Satisfaction. β =regression weight. The t values are computed through bootstrapping with 450 cases and 5,000 samples. *** $p < 0.01$. VIF: variance inflation factor.

Source: Author's Calculation

Table 4 shows the mediating relationship within the study model. Initially, we estimated the direct effect between the independent and dependent variables without a mediator. The path coefficient between landscape spatial configuration and environmental satisfaction was $\beta=0.330$, indicating a significant relationship. This was confirmed by bootstrapping with 5000 resamples (t value=5.029), thus supporting H4. Mediation strength, assessed through variance accounted for (VAF), quantifies the indirect effect's size relative to the total effect. VAF values under 20% indicate no mediation, values of 20%–80% suggest partial mediation and values over 80% signify complete mediation (J. Hair et al., 2017). In this study, we calculated VAF by dividing the indirect effect by the total effect. The VAF values showed that about 24.7% of the indirect impact of landscape spatial configuration on environmental satisfaction can be explained by the partial mediating effect of fear of COVID-19.

Table 4: Strength of mediation effect

Hs	Relationship	Indirect effect	Direct effect	Total effect	t value	p	VAF
H4	LSC→FC→ES	0.108	0.330	0.438	5.029	0.000	24.7%

Notes: LSC=Landscape Spatial Configuration; FC= Fear of COVID-19; ES=Environmental Satisfaction

Source: Author's Calculation

Effect size (f^2) indicates the strength of a phenomenon, estimating the relationship between each endogenous variable in the statistical total (Anderson et al., 2017). Values of 0.02, 0.15 and 0.35 indicate small, medium and large effects. In the current study, landscape spatial configuration ($f^2=0.118$) and fear of COVID-19 ($f^2=0.069$) had little effect on environmental satisfaction. However, the results revealed that landscape spatial configuration had a medium effect on fear of COVID-19 ($f^2=0.223$).

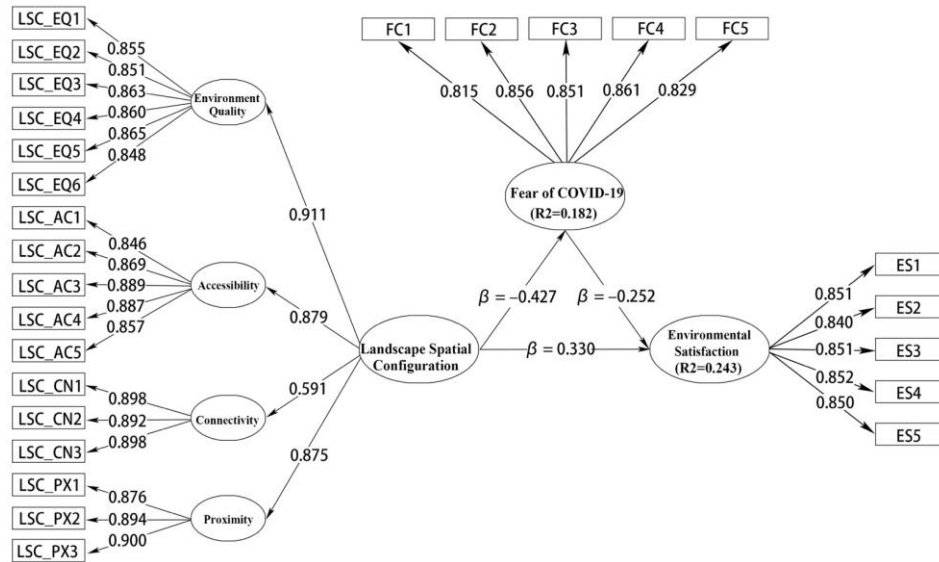


Figure 2: Conceptual model of the study

Source: Authors

DISCUSSION

The global outbreak of COVID-19 led to significant socioeconomic and health challenges, along with severe psychological impacts on individuals. As a result, the concept of ‘fear of COVID-19’ has garnered considerable attention among researchers. Drawing from ECT, this study investigates the mediating role of fear of COVID-19 in the relationship between landscape spatial configuration and environmental satisfaction in urban parks.

H1 explores the predictive power of landscape spatial configuration on fear of COVID-19 in urban parks. Our results indicate a negative correlation between urban park landscape spatial configuration and fear of COVID-19, suggesting that a more rational spatial configuration of urban parks is associated with lower levels of fear among users. Interestingly, this finding contrasts with a study by Pan et al. (2021), which demonstrated that higher accessibility and connectivity of spatial configurations in public green spaces in London were linked to increased risk of COVID-19 transmission and greater user fear. In comparison, the results of our study offer a different perspective.

H2 examines whether the spatial configuration of urban park landscapes predicts environmental satisfaction. Our results support this hypothesis, indicating a positive relationship between spatial configuration and environmental satisfaction. Thus, higher satisfaction levels are associated with a more favourable landscape spatial configuration in urban parks. These findings are consistent with the literature (Mohammadzadeh et al., 2023).

H3 investigates whether fear of COVID-19 significantly predicts environmental satisfaction, and our results indicate a negative impact of fear of COVID-19 on environmental satisfaction, thus supporting this hypothesis. This finding is also consistent with previous studies in the literature (Maury-Mora et al., 2022).

H4 explores whether fear of COVID-19 mediates the relationship between urban park landscape spatial configuration and environmental satisfaction. After confirming the first three hypotheses, the fourth hypothesis was tested, and the analysis revealed that fear of COVID-19 partially mediated the relationship between urban park landscape spatial configuration and environmental satisfaction, with a VAF of 24.7%. Hence, H4 is supported, suggesting that urban park landscape spatial configuration influences fear of COVID-19, subsequently affecting environmental satisfaction. While direct studies corroborating this specific result are limited, existing research provides related insights. For instance, Reid et al. (2022) reported that the abundance and quality of green spaces during the COVID-19 pandemic can enhance residents' mental health. Furthermore, Mayen Huerta & Cafagna (2021) found that users' perceptions of safety in green spaces during the pandemic can impact their subjective well-being, with some users opting to avoid green spaces due to safety concerns.

Implications of the Study

The findings of this study have significant implications for theory, practice, management and policy. They offer theoretical insights from ECT on how landscape spatial configuration affects users' personal experiences, such as satisfaction. The results suggest that optimising landscape configuration can reduce fear of COVID-19 among urban park users, thus supporting this theory empirically. Applying ECT is crucial for identifying environmental characteristics that influence fear and satisfaction. These insights can inform urban planning and policy decisions, which in turn can help optimise park design, management and funding to enhance visitor satisfaction and promote public health benefits, thus contributing to long-term environmental sustainability goals (González et al., 2023).

CONCLUSION

This exploratory study examines how landscape spatial configuration in urban parks can enhance users' environmental satisfaction and mitigate COVID-19 fears. In a novel approach that uses PLS-SEM, we link landscape configuration, COVID-19 fear and environmental satisfaction. Our findings show that while landscape configuration boosts satisfaction, COVID-19 fear reduces its perceived effectiveness, thus lowering satisfaction. Optimising urban park design is crucial

in counteracting COVID-19-induced psychological effects, thus highlighting its role in future health event prevention.

Limitations and Future Avenues for Research

This study has its limitations. In particular, it did not consider the impact of socioeconomic status on park use and satisfaction and relied solely on questionnaires. Thus, future research should include socioeconomic status and use mixed methods to better understand urban park users' perceptions as well as enhance design and management strategies.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s).

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THE IMPACT OF BIOPHILIC DESIGN ON COGNITIVE ABILITIES IN UNIVERSITY LIBRARY SETTINGS AND URBAN EDUCATIONAL ENVIRONMENTS

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Abstract

This study explores the potential of biophilic design to enhance student learning within university libraries, an often-neglected aspect of urban design. While offices and hospitals have been extensively studied for their impact on well-being and performance, post-secondary education settings have received limited attention. A mixed-methods approach was conducted in this study, including interviews, VR simulation experiments, and a questionnaire survey. The results revealed a significant reduction in participants' blood pressure and heart rate following the implementation of the biophilic design. There were also unanimous reports of improved learning experiences; statistical analysis confirmed these positive effects, highlighting the calming influence of biophilic indoor environments on students. The study emphasised the benefits of creating conducive learning spaces and fostering pro-environmental behaviours. This research underscores the importance of integrating sustainable and biophilic design principles into urban educational environments, ultimately enhancing student well-being and academic performance in a student-centric urban design theme.

Keywords: Biophilic design, Student well-being, Learning ability, Urban design, VR simulations

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INTRODUCTION

In high-expectation university settings, student stress is common. To address this challenge, integrating biophilic design into learning spaces is crucial, reducing stress and fostering innovation (Peters & D'Penna, 2020). Academic libraries, the "heart of the university," have evolved to enhance student experiences but encounter challenges like limited space (Kim, 2017; Sufar et al., 2012). Many library design initiatives neglect student-centric environments (Abdelaal, 2018). To address this, academic libraries should prioritise user-centred services and spaces based on user needs. Research shows that nature immersion enhances creativity and productivity (Abdelaal & Soebarto, 2018), and learning spaces impact academic performance (Ryan & Browning, 2018). Coordinated by "Terrapin Bright Green LLC biophilic patterns," this research fills gaps in understanding the impact of biophilic design in university libraries, offering evidence-based design recommendations (Peters & D'Penna, 2020) to enhance student learning.

Insights from psychology, physiology, sociology, and anthropology inform architects, interior designers, and urban planners that nature exposure improves cognitive performance and reduces stress in educational settings (Benfield et al., 2015; Li, D., & Sullivan, W.C., 2016). Yet, research on architectural features promoting cooperation and creativity is limited (Yin et al., 2019). Biophilic design in universities creates healthier environments, reducing stress and enhancing focus (Berman et al., 2012; Kaplan, 1996). However, studies connecting biophilic design to imagination in higher education are lacking. Thus, this research assesses student learning within university library interiors based on Terrapin Bright Green LLC biophilic patterns (Ryan & Browning, 2018), which comprise 14 natural patterns that evoke positive biological responses. It employs a questionnaire and physiological measurements (blood pressure and heart rate) to evaluate learning abilities before and after implementing biophilic design. Unlike prior biophilic design studies in workplaces, elementary schools, and healthcare settings, this research fills a critical gap by examining the impact of biophilic design in university libraries. It offers valuable insights for enhancing student learning in academic settings.

LITERATURE REVIEW

Biophilic design, as defined by Wilson and Kellert (1993), involves consciously incorporating humanity's innate affinity for natural systems and processes into the physical structure of environments, particularly in healing settings, thereby utilising natural elements to enhance built spaces. This approach has been associated with numerous health benefits (Kellert, 2008) and is supported by various studies that highlight its positive effects on physical well-being, productivity (Marzukhi et al., 2020; Shibata & Suzuki, 2004), and emotional

well-being (Gillis & Gatersleben, 2015). It promotes relaxation and mood enhancement (Wijesooriya & Brambilla, 2020) and fosters survival instincts, leading to increased engagement, curiosity, and compatibility (Hartig et al., 2003). In addition to its mental health benefits, biophilic design has been found to enhance creativity, efficiency, and learning environments (Browning, 2018). Furthermore, contact with natural environments in learning spaces, as emphasised by Saleh, Latip, & Rahim (2018), offers advantages such as language development, improved academic achievement, higher scores, increased learning opportunities, and enhanced educational performance, while also providing a peaceful and motivating environment that stimulates knowledge seeking, curiosity, and attentiveness.

Biophilic design should be integrated early in the concept's development, necessitating collaboration among designers, contractors, and experts from various fields such as sociologists, geologists, botanists, and historians (Ryan & Browning, 2018). This approach is based on the "14 patterns of biophilic design," which encompass three experiences and 14 design patterns, enhancing the nature-health connections within built learning spaces. These experiences and patterns are detailed in Table 1 and fall into three categories:

- i) Nature in the Space,
- ii) Natural Analogues,
- iii) Nature of the Space.

Table 1: 14 Biophilic Design Patterns

Categories	Biophilic design pattern
Nature in the Space	[P1]. Visual Connection with Nature [P2]. Non-Visual Connection with Nature [P3]. Non-Rhythmic Sensory Stimuli [P4]. Thermal and Airflow Variability [P5]. Presence of Water [P6]. Dynamic and Diffuse Light [P7]. Connection with Natural system
Natural Analogues	[P8]. Biomorphic Forms and Patterns [P9]. Material Connection with Nature [P10]. Complexity and Order
Nature of the Space	[P11]. Prospect [P12]. Refuge [P13]. Mystery [P14]. Risk/Peril

Source: Ryan and Browning, (2018).

Learning is the biological process of acquiring knowledge or skills, involving various mechanisms from molecules to the mind (Lafontaine et al., 2020). It results in improved knowledge, skills, and behaviours. Learning abilities progress from basic reactions to complex information encoding, enabling more accurate responses (Lafontaine et al., 2020). Customised learning environments enhance control over learning (Gerber et al., 2001). Effective brain function is crucial for attention and learning, and neurodevelopmental analysis can help in understanding maturity differences (Lafontaine et al., 2020).

These skills are crucial for learning and can be assessed through various methods, including performance curves, recall, recognition, response time, and neuropsychological tests. Learning measures often involve multiple cognitive processes, making them comprehensive. Biophilic design, influenced by Ryan and Browning (2018), is evident in various library projects worldwide and fosters cultural hubs that offer diverse sensory experiences and promote cultural development. Notable examples include Oodi Central Library (Finland), Maranello Library (Italy), Musashino Art University Library (Japan), Dalarna Media Library (Sweden), Vac-Library (Vietnam), and IRC UTP (Malaysia), each of which showcases unique biophilic elements. This design underscores the importance of architects and interior designers embracing biophilic principles for creating environmentally friendly, functional, and enriching spaces in libraries (Nursalam, 2016). From Table 1, ten key biophilic design patterns are identified as relevant to library contexts, emphasising the integration of nature into architectural concepts (P1-P10). However, no pertinent sources are found for four patterns: Prospect, Refuge, Mystery, and Risk/Peril (P11-P14).

The ability to learn is closely linked to an individual's capacity for adapting knowledge and behaviours (Othman et al., 2016). Multidisciplinary studies have consistently shown that exposure to nature improves academic and cognitive performance (Benfield et al., 2015). Biophilic design, as highlighted by multiple researchers, enhances student productivity, creativity, cognition, and physical activity (Li & Sullivan, 2016). Additionally, biophilic design fosters a deeper connection to nature, nurturing curiosity and facilitating innovation (Abdelaal & Soebarto, 2018). Nature views provide students with valuable mental breaks, supporting attention and learning (Li & Sullivan, 2016). Factors like spatial proportions, natural ventilation, indoor plants, and daylight within educational spaces promote innovative thinking and well-being (Shi et al., 2020). Emotions significantly impact human abilities, including learning, making a view of nature crucial for student learning (Tyng et al., 2017).

Numerous studies support the benefits of “Visual Connection with Nature” and “Natural Analogues” in university libraries, including views through windows, nature posters, images, murals, indoor plants, and green colour schemes (Roetzel et al., 2019). Recent research suggests that images of nature

can aid students in emotional recovery (Kaur, 2017). Other studies focus on the impact of lighting systems, showing they can enhance student behaviour and the appeal of learning spaces (Shi et al., 2020). Natural light access positively affects student performance, and varying light levels increase visual interest (Yin et al., 2020). Additionally, indoor air quality is also crucial for student comfort and performance, with findings suggesting that locating learning activities near windows and study areas can improve air quality (Walimbe & Chitgopkar, 2018). Natural ventilation helps reduce CO2 levels (Atchley et al., 2012), and vegetation contributes to microclimate regulation and noise reduction (Li & Sullivan, 2016).

Nature influences overall attitudes in university library environments, impacting place attachment and student satisfaction (Dewi et al., 2020). Students with a strong connection to nature exhibit more inventive and holistic thinking (Ayuso Sanchez et al., 2018). University students prefer "refuge" spaces with "prospect" views for privacy, security, and excitement (Roetzel et al., 2019). However, there is limited research on "Non-Rhythmic Sensory Input" in academic settings (Browning, 2018). This category includes unpredictable encounters with nature, like rustling leaves and rippling water. Additionally, no studies were found on "Complexity and Order," "Mystery," and "Risk/Peril" biophilic patterns within "Nature of the Space" in university library contexts.

METHODOLOGY

This study utilised a mixed-methods approach, including qualitative interviews and quantitative VR simulation experiments. The aim was to assess how biophilic library design impacts students' learning abilities. Qualitative data were collected through interviews, and the data were then analysed using thematic content analysis. VR simulations measured students' learning abilities before and after exposure to biophilic library settings. This included an emotional reaction test. This was further examined through a questionnaire assessing the difference in emotions before and after exposure to biophilic library settings. The university selection process for this study was based on Malaysia's QS World University Rankings by Subject, which assesses universities across 51 fields. Other criteria taken into consideration was that a university must offer both undergraduate and postgraduate programmes and engage in research in at least two of the five fields. For this research, only three universities from the 2021 Asia QS rankings that met these criteria were interviewed: i) University Sains Malaysia (USM), ii) University Technology Malaysia (UTM), and iii) University Technology MARA (UITM). The research employed open-ended interviews using a checklist, which were conducted through tele-conversation using Google Meet video communication with the librarians of the selected universities' libraries.

Data collection for the experiment was conducted on Level 1, which serves as the central open space designated for student use, as illustrated in Figure 1. This particular space is predominantly frequented by students who engage in book searches, establishing it as the library's primary area for both students and staff. The primary focus of this experiment was on the open spaces available on Level 1. These spaces encompass e-resource terminals, open reading areas, meeting rooms, and presentation rooms, all of which are widely utilised by students. Indeed, the focus of the experiment is on the students. For a visual representation of the experiment layout, see Figure 2. Additionally, it is worth noting that the chosen location for the experiment setup was deliberately positioned at the centre of the open space to facilitate participant interaction with the existing design.

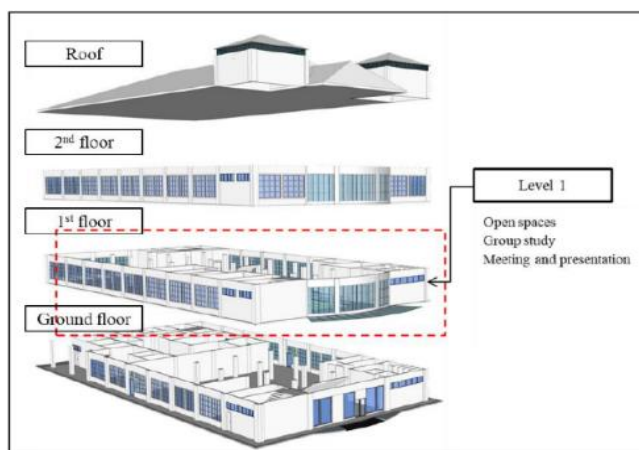


Figure 1: The 3D Illustration of level 1
Source: Author

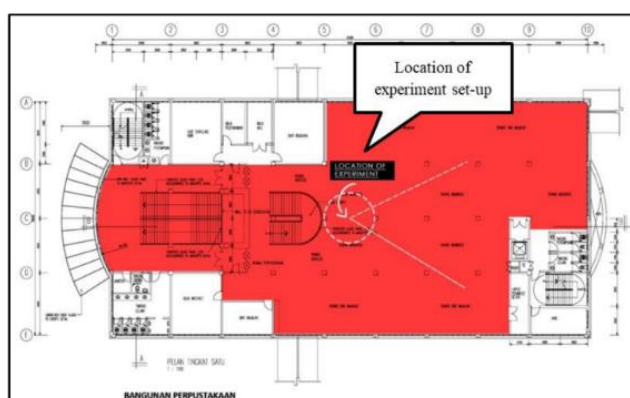


Figure 2: The Experiment Layout of Level 1
Source: Author

The experiment involved 50 students, each representing different faculties. The number of participants was chosen based on previous research that looked at how biophilic design affects learning ability both before and after exposure. The participants in this type of study are typically between 30 and 100 students. According to past research, a sample size of 50 participants is deemed sufficient to yield reliable and accurate results, as supported by Yin et al. (2020).

To conduct the simulation experiment, participants were required to abstain from engaging in strenuous activities the day before the experiment and were instructed to rest for a period of 20 minutes to achieve emotional and physical balance. During the simulation experiments, participants were asked to complete a survey questionnaire, which employed a Likert scale consisting of five levels. The Likert scale is a crucial psychometric tool extensively employed in educational and social sciences research. The use of this scale often sparks debates and controversies regarding how the scale points are analysed and aggregated (Joshi & Pal, 2015). For this study, the participants consisted of 50 healthy students, both male and female, selected from various faculties at UiTM Seri Iskandar. Their ages ranged from 18 and above. All participants were required to adhere to the proper attire guidelines stipulated by UiTM's library regulations. Additionally, participants followed the standard operating procedure (SOP) prior to commencing the experiment.

FINDING AND DISCUSSION

Based on the interviews with the librarians of selected universities' libraries, it is evident that Malaysian universities have incorporated biophilic design into their library spaces. Universiti Sains Malaysia (USM) currently integrates 13 out of 14 biophilic design patterns, achieving a score of 92.8%. In addition, Universiti Teknologi Malaysia (UTM) also incorporates 13 biophilic design patterns, attaining a matching score of 92.8%. Next, Universiti Teknologi MARA (UiTM) implements 9 out of the 14 biophilic design patterns, resulting in a score of 64.3%. Despite the variations, all three universities exhibit elements of biophilic design within and around their library spaces.

The pattern of biophilic design that was adopted in three universities' libraries found eight patterns were the most adopted, which are: (P1) Visual connection with nature; (P6) Dynamic and diffuse light; (P7) Connection with natural systems; (P8) Biomorphic forms and patterns; (P9) Material connection with nature; (P11) Prospect; (P12) Refuge; and (P14) Risk/Peril as shown in Table 2.

Table 2: Pattern That Being Adopted in Three Universities' Library

No	Biophilic Patterns	Biophilic	Categories
1	P1	Visual connection with nature	Nature in the Space
2	P6	Dynamic and diffuse light	
3	P7	Connection with natural systems	
4	P8	Biomorphic forms and patterns	Natural Analogues
5	P9	Material connection with nature	
6	P11	Prospect	Nature of the Space
7	P12	Refuge	
8	P14	Risk/Peril	

Source: Author

The data provided in Table 2 were employed in the VR simulation experiment. Within the context of a 3D design, all the patterns were subjected to testing using a series of questions aimed at assessing the effects of biophilic design before and after its implementation, as perceived by respondents. There were 171 items designed in the questionnaire in order to determine student learning ability. There were 41 items under the dimension of biophilic design, which were based on the selected biophilic pattern, and 130 items under the dimensions of learning ability. All scores for every dimension observed are considered reliable and valid if they are greater than 0.70.

To assess the impact of biophilic design on learning ability, a paired-sample t-test was performed to compare the participants' heart rate readings before exposure to non-biophilic design conditions and after exposure to biophilic design conditions. The increase in heart rate readings observed during biophilic exposure indicated a noticeable influence on participants' learning abilities. The statistical analysis revealed a significant difference between the pre-test heart rate ($M = 81$, $SD = 16$) and post-test heart rate ($M = 88$, $SD = 12$) conditions; $t(49) = 3.157$, $p = 0.003$, which was less than the significance level of 0.05 (refer to Table 3). These findings suggest that the biophilic design intervention had an effective impact on enhancing participants' learning abilities in the library. Furthermore, the results indicate that the degree of improvement in learning ability depended on the participants' experiences within the indoor environment designed with biophilic patterns.

Table 3: Mean and standard deviation of heart rate (HR) before and after

	Paired Differences				t	df	Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower				Upper
Pair 1 Before Heart rate - After Heart rate	7.24	16.21	2.29	-11.84	-2.63	3.15	49	.003

In addition to monitoring the heart rate (HR) readings of the participants, the blood pressure (BP) readings were also monitored. The paired t-test was used to determine if participants' physiological responses after completing the tasks were significantly lower than their initial baseline measurements. This analysis was carried out using a one-sided alpha level of 0.05 to determine the statistical significance.

The paired-sample t-test was used to compare the participants' learning ability before and after the exposure to biophilic design in terms of blood pressure readings, including systolic (BPS) and diastolic (BPD) measurements. The results showed that BPS and BPD readings were lower after exposure to biophilic design, indicating a positive impact on learning ability. Specifically, there was a significant difference between post-test BPS ($M = 120$, $SD = 13$) and pre-test BPS ($M = 113$, $SD = 12$) conditions; $t(49) = 3.555$, $p = 0.001$. Additionally, there was a significant difference between post-test BPD ($M = 71$, $SD = 11$) and pre-test BPD ($M = 69$, $SD = 12$) conditions; $t(49) = 3.157$, $p = 0.003$. These findings suggest that biophilic design creates a calming effect on students, leading to lower blood pressure. The significant difference in blood pressure between biophilic and non-biophilic design settings indicates that biophilic design positively affects students' well-being and learning performance.

Furthermore, a paired-sample t-test was used to compare the participants' heart rate readings before and after the implementation of the biophilic design. There was a significant difference in the scores between the pre-test heart rate ($M = 46$, $SD = 4$) and the post-test heart rate conditions ($M = 47$, $SD = 4$); $t(49) = 2.674$, $p = 0.01$, which was less than the significance level of 0.05. These findings demonstrate that the application of biophilic design had a positive impact on improving students' learning abilities in the library, reaching a significance level of 0.05. The results highlight the enhancements in students' learning abilities following the implementation of biophilic design patterns in the library.

CONCLUSION AND RECOMMENDATION

The output of this study indicates that there is a statistically significant difference between the conditions before (non-biophilic design) and after (biophilic design) the implementation of biophilic design elements, emphasising the significance of biophilic design within the context of urban design. This means that the introduction of biophilic design patterns into the library has a measurable impact on various aspects, such as learning abilities and physiological responses (e.g., heart rate and blood pressure), highlighting the relevance of urban design principles in shaping educational environments. By comparing the two conditions, the research has demonstrated the potential benefits of incorporating biophilic design in the library environment, underscoring the importance of

integrating urban design considerations in educational spaces. This information can be valuable for decision-makers and stakeholders, including library administrators and designers, as it provides empirical evidence of the positive effects of biophilic design on students' learning experiences and well-being within library spaces. Consulting a biophilic design expert is a noteworthy step, as such experts can provide valuable insights into the application of biophilic principles, ensuring that the design aligns with best practices and enhances the overall quality of the library environment within the broader context of urban design. This collaboration with experts adds credibility and expertise to the decision-making process regarding the adoption of biophilic design in the library, promoting a holistic approach to urban design principles in educational settings.

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BIOPHILIC DESIGN ELEMENTS PREFERENCES AMONG GOVERNMENT OFFICERS IN PUTRAJAYA, MALAYSIA

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Abstract

The theory of human dependence on other living things and their processes is called the “biophilia hypothesis”, and has been discussed in various literature. The theory was then translated into design features, namely "biophilic design", to be assimilated with the built environment, including residential areas, the medical sector and commercial property such as office buildings. Through the implementation of biophilic design in office buildings, the building occupants can improve their physiological and psychological well-being as they spend a lot of time at work. The study examines the selected government office buildings in Putrajaya to identify the preferred biophilic design elements among government office workers that can be used to reduce their stress, and thus improve their productivity. Based on the questionnaire survey that was answered by 977 respondents from different types of work schemes, different working space environments, and different employment periods among the government office workers in Putrajaya, the findings have revealed that natural ventilation, external view to nature, and daylighting are the most preferred biophilic design elements that can help them feel less stressed in the office working spaces; these are followed by attraction and beauty, prospect and refuge.

Keywords: Biophilia, Biophilic Design Elements, Government Office Malaysia, Public Service Malaysia

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INTRODUCTION

The need to connect with nature has always been part of the human conscience. Humans are wired to be interconnected with nature or another form of life, and this ideology was noted by Roger Ulrich in 1973 and later expanded by Edward Osborn Wilson in 1984 through the concept of the Biophilia Hypothesis. The absence of contact with nature can have negative effects on the psychological and physiological aspects of human life. The transition into the modern world and urbanisation have severed the ties between humans and nature. In order to reduce the impact of urbanisation, the integration between nature and humans needs to be celebrated and encouraged. Most people spend most of their time indoors and at work. The ability of workers to perform their work depends on the design of the work environment (Hedge, 2017). Work is a necessity as a source of livelihood, which may impact the physical and mental health based on the environment of individuals at the workplace.

LITERATURE REVIEW

Biophilic Design

Aduwo and Akinwale (2020) summarised biophilic design as an approach in space designs where natural elements are incorporated into it to create a holistic connection between humans and nature. Biophilic design has been introduced into the built environment as one of the approaches to connect people with nature while reducing the impact of urbanisation. Notably, three most vastly referred biophilic design characterisations have been structured by Stephen Robert Kellert (2008) in his work "Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life", followed by Browning et al. (2014) with "15 Patterns of Biophilic Design: Improving Health and Well-being in the Built Environment", and Kellert and Calabrese in 2015 with "The Practice of Biophilic Design".

Kellert (2008) listed 72 biophilic design attributes that can be applied and implemented into design processes, which are categorised into six main elements, namely, (1) environmental features, or materials that are available all around, (2) natural shapes and forms, that may be related to the natural forms and characters, (3) natural patterns and processes, or description of spaces, (4) light and space which is related to lighting and space conditions, (5) place-based relationships, or the human connections and interaction to the place, and lastly (6) evolved human-natural relationships which can be described as the reaction and sensorial aspects of the place towards the occupants.

Table 1: Biophilic Design Elements cited from Kellert (2008)

Biophilic Design Elements	Biophilic Design Attributes
Environmental Features	Colour, Water, Air, Sunlight, Plants, Animals, Natural Materials, Views and Vistas, Facade Greening, Geology and Landscape, Habitats and Ecosystems, Fire
Natural Shapes and Forms	Botanical Motifs, Tree and Columnar Supports, Animal (mainly vertebrate) motifs, shells and spirals, egg, oval and tubular forms, arches, vaults, and domes, shapes resisting straight lines and right angle, simulation of natural features, biomorphy, geomorphology and biomimicry
Natural Patterns and Processes	Sensory variability, information richness, age, change and the patina of time, growth and efflorescence, central focal point, patterned wholes, bounded spaces, transitional spaces, lined series and chains, integration of parts to wholes, complementary contrasts, dynamic balance and tension, fractals, hierarchically organised ratios and scales.
Light and Space	Natural Light, Filtered and Diffused Light, Light and Shadow, Reflected Light, Light Pools, Warm Light, Light as Shape and Form, Spaciousness, Spatial Variability, Space as shape and form, Spatial Harmony, Inside-Outside Space.
Place-Based Relationships	Geographic Connection to Place, Historic Connection to Place, Cultural Connection to Place, Indigenous Materials, Landscape Orientation, Landscape Features that Define Building, Landscape Ecology, Integration of Culture and Ecology, Spirit of Place, Avoiding Placelessness
Evolved Human-Nature Relationships	Prospect and Refuge, Order and Complexity, Curiosity and Enticement, Change and Metamorphosis, Security and Protection, Mastery and Control, Affection and Attachment, Attraction and Beauty, Exploration and Discovery, Information and Cognition, Fear and Awe, Reverence and Spirituality.

The extension of the study in biophilic design was continued by William Browning, Catherine Ryan and Joseph Clancy in 2014 where the Patterns of Biophilic Design are elaborated into three categories which are the Nature in the Space Patterns, Natural Analogues Patterns and Nature of the Space. The patterns are mostly annotated as the condition of the space whether it can be tangible or intangible features.

Table 2: The Biophilic Design Pattern cited from Terrapin Bright Green (2014)

Pattern	Attributes
Nature in the Space	Visual Connection with Nature, Non-Visual Connection with Nature, Non-Rhythmic Sensory Stimuli, Thermal and Airflow Variability, Presence of Water, Dynamic and Diffuse Light, Connection with Natural System
Natural Analogues	Biomorphic Forms and Patterns. Complexity and Order
Nature of the Space	Prospect, Refuge, Mystery, Peril

Integrating the natural environment and its processes is not definite and is still evolving from time to time, as humans are highly dependent on natural elements and vice versa for survival. In providing a sustainable and long-term engagement with nature through its implementation in the built environment, another framework of biophilic design was developed by Kellert and Calabrese in 2015. The principles have been divided into three categories, namely, the Direct Experience of Nature, Indirect Experience of Nature, and Experience of Space and Place, ensuring a more concise understanding towards the elements and effective practice.

Table 3: Biophilic Design Categories cited from Kellert et al. (2015) **

Categories	Attributes
Direct Experience of Nature	Light, Air, Water, Plants, Animals, Weather, Natural Landscapes and Ecosystem, Fire
Indirect Experience of Nature	Images of Nature, Natural Materials, Natural Colors, Simulating natural light and air, Naturalistic shapes and forms, Evoking Nature, Information Richness, Age, Change and the Patina of Time, Natural Geometries, Biomimicry
Experience Space and Place	Prospect and refuge, Organised Complexity, Integration of Parts to Wholes, Transitional Spaces, Mobility and Wayfinding, Cultural and Ecological Attachment to Place

The comprehensive biophilic design subjects that are presented in the above studies show the importance of integrating nature into normal activities and lifestyles. The wide range of studies, using a variety of methods, have attempted to produce a conducive environment for people, or in the study's context, for the working class. Nabilah et al. (2023) proposed a conceptual framework for Indoor Biophilic Design Elements for the Working Environment; analysed from the three most referred biophilic design literature, the elements are divided into six categories: Natural Elements, Natural System, Nature Experience, Natural Connectedness, Sensorial and Comfort, and Nature Infrastructure. These categories are essential and comprehensive in ensuring a

conducive working environment for office occupants to reduce their stress and improve productivity. Although some of the elements can be deemed quantified, the preferences of each element can be assessed through the preference survey, including the visual aspects, comfort, perceptions and how they perceive each element. The characterisations of biophilic designs depend on the approach and the occupants' experiences of the space.

Working Environment and Biophilic Design

The global urban population has placed new demands for sustainability, resilience and quality of life as most people spend most of their time working and being indoors. One of the approaches to reducing the impact of urbanisation is through the implementation of natural settings and their related aspects into the lifestyle and the current urban norms. The workspace and the level of stress in the office depend on the office environment. Physical office plays an important factor in motivating workers to perform well at work (Hamidi et al., 2020; Suwati & Gagah, 2016; Hogan et al., 2013; Samson et al., 2015; Kamarulzaman et al., 2011). As biophilic design can be perceived as a method or an approach to reduce the gap between humans and nature, and by extension, mitigating the alarming mental health and physical well-being of office occupants, it is vital to consider the perceptions and the preferences of the users in order to improve their working environment. The preferences of biophilic design elements can be interpreted in an aesthetic manner, and their functionality is inclusive and holistic, encompassing comfort. Working long hours in the office can take its toll on the occupants, resulting in poor performance and a lack of motivation as an outcome of a stressful working environment.

RESEARCH METHODOLOGY

The site is mainly comprised of office buildings in Putrajaya. The selection is made due to its administrative importance to the nation, which could act as a benchmark for future studies in relation to office design. The site stretches from Presint 1 to Presint 7, spanning over 2.75 million square meters, accommodating 51400 workers. In parallel with the agenda to strive for Garden City to Green City in 2025, Putrajaya's emphasis on the 'co-existence with nature', 'green', sustainable and environmental-friendly city, which correlate to the objective of biophilic design theories to strengthen the interrelationships between man and nature. The government sectors in Putrajaya comprise a multitude of professions and occupations, ranging from support groups to the top management and professional groups, which fit the needs to identify and allocate the type and characteristics of office workers in order to determine and utilise the significant biophilic design elements in the workspace.

The study attempts to identify the preferred biophilic design elements in the workforce of the administrative district in Putrajaya and, respectively, to

propose a way to reduce stress levels and improve productivity in the workplace. The study also aimed to identify the relationships between office types and the level of working schemes to formulate an optimal biophilic design framework for the working environment. To achieve these objectives, the questionnaire, which consists of biophilic design elements, has been outlined and distributed among office occupants in Putrajaya. The number of respondents who participated in this survey is 977, consisting of employees in different work schemes, which are the top management group, managerial and professional group and support group. The mean for each element is identified using the statistical analysis program SPSS Statistics 25 to obtain which biophilic design elements can help reduce stress and improve the productivity of the office occupants.

ANALYSIS AND DISCUSSION

977 office workers from various departments in Putrajaya participated in a questionnaire survey. All questionnaires were answered through the distribution of Google Forms, and later, the responses were tabulated in Microsoft Excel. A total of 4 sections of questions are presented, which comprise the Demographic Profile followed by Occupation Information, which is necessary to profile the type of respondents, their nature of work, and also their current working conditions in the office, whether it is stressful or not. The next section comprises the Biophilic Design Experience to identify the understanding and awareness of the office occupants, followed by the last section, the Biophilic Design Preferences, to determine the preferred Biophilic design elements focusing on reducing their stress and improving their productivity at work.

Current Workplace Environment

The following results were identified to assess the experience of stress in the workplace and to investigate whether improving office design and environment is necessary to enhance the office occupants' health, physical and mental well-being. This could contribute to reducing stress and improving work performance.

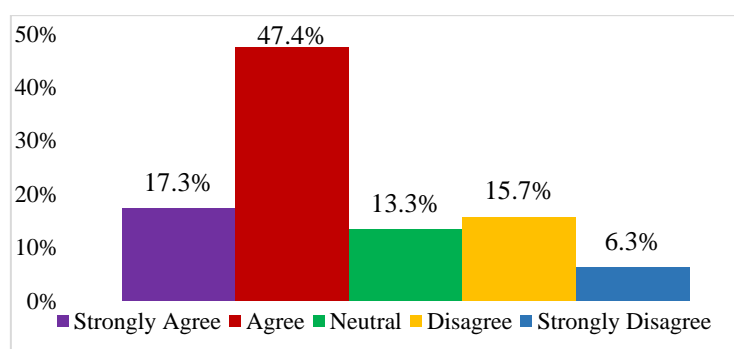


Figure 1: Experience of Stress in the Workplace

Based on the above results, 47.4% of the respondents (N: 463) experienced feeling stressed at their workplace, in which the absence or the lack of biophilic design elements in the working spaces might be a contributing factor. The factors of the long commute to work, service scheme, and line of work could be contributing factors to this result. Most of the respondents might have other types of stressors apart from work. However, the present or the current condition of their surroundings might not be effective and conducive to reducing the level of stress. The dull and non-stimulating office environment as well as limited visual and thermal comfort are some of the factors that need to be discarded in order to improve the mood and provide a sense of a spirit of place for the office occupants.

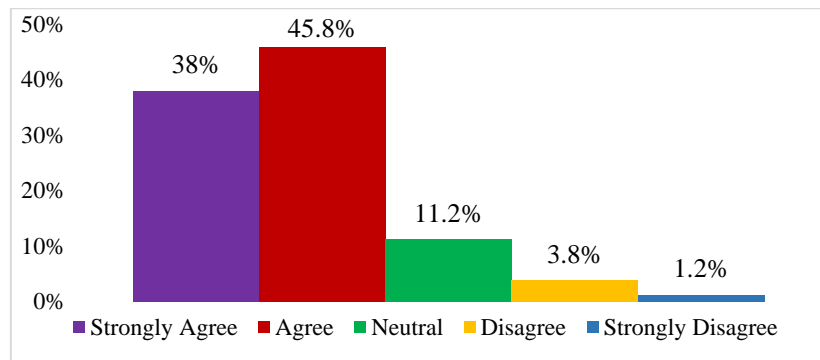


Figure 2: Improvement of Office Design

Figure 2 shows that 447 out of 977 respondents (45.8%) agree that the indoor office environment can be improved in order to reduce the stress at work thus improving the productivity of the office occupants. The higher-ups play a salient part in ensuring that the welfare of the workers is well taken care of by providing a conducive workspace through the implementation of biophilic design.

Preferences On Biophilic Design Elements in Indoor Work Settings

Table 4: Preferences on Biophilic Design Elements among Government Employees in Offices in Putrajaya

Elements	Mean	Std. Deviation
Natural Ventilation	8.35	1.750
External View of Nature	8.335	1.680
Daylighting	8.32	1.706
Attraction and Beauty	8.115	1.825
Chromotherapy	8.1	1.810
Prospect and Refuge	8.055	1.782
Water	8.045	1.930
Space Harmony	8	1.843
Curiosity and Enticement	7.915	1.822
Spaciousness	7.84	1.863
Utilising Vision (Sight) to Experience Nature	7.825	1.881
Indoor Plants	7.805	1.888
Outdoor Plants	7.805	1.927
Natural materials	7.775	1.924
Interplay of Natural Light	7.75	1.956
Spatial Variety	7.755	1.901
Geographical Connection to Place	7.625	1.863
Ecological and Cultural Connection to Place	7.615	1.884
Utilising Olfactory (Smell) to Experience Nature	7.59	1.915
Utilising Auditory (Hear) to Experience Nature	7.58	1.905
Form Harmony	7.545	1.990
Adaptation of Nature Color	7.53	1.970
Utilising Tactile (Touch) to Experience Nature	7.48	1.928
Area of Emphasis	7.395	2.149
Meteorology	7.325	2.125
Actual Nature Motifs and Patterns	7.26	2.011
Artificial Generated Natural Features (wind, lights)	7.22	2.048
Fractal Geometry	7.155	2.021
Imitations of Nature Motifs and Patterns	6.93	2.070
Organic and Fluid Forms	6.74	2.133
Integration of Parts to Whole	6.985	2.077
Organised Complexity	6.965	2.099
Transitional Space	6.965	2.107
Therapy Animals	5.34	2.787

The preferred biophilic design elements are scored based on a 10-point Likert Scale and compared using their means. Natural ventilation has been chosen by the respondents as the most important feature that can help reduce their stress, thus, improving their productivity in the workplace (8.35), this is followed by an external view to nature (8.335), daylighting (8.32), attraction and beauty (8.115), and chromotherapy (8.055), respectively. It can be deduced that natural ventilation is the most preferred element by the office occupants in order to work optimally in the office. Various literature has supported this result as it can enhance thermal comfort and improve concentration at work. Most of the respondents spend the majority of their time in the office. The lack of physical movement, combined with a constant ventilation rate impacted their performance at work.

The presence of daylight in the office has proven that it can boost moods and provide a comfortable ambience for the office occupants. The availability of a view towards nature also plays a part in reducing the stress of workers in a confined area. There is a myriad of literature that emphasises the needs of nature, such as plants, water and landscapes, to reduce strain while working. The presence of natural elements in indoor work settings is crucial to enhancing productivity. Apart from natural elements, the cognitive aspects have been chosen by the respondents as important, such as attraction and beauty, and chromotherapy, which is therapy using colours. These elements could be implemented in the employees' immediate working spaces, as they encourage the workers to be productive in their own workspaces, provide a sense of calmness, and reduce interference from other colleagues, hence, improving the employees' focus.

Based on Table 4, the least preferred elements for office employees in their working space are the Organic and Fluid Forms (6.74). This might be due to the unfamiliarity of the subject itself, as the employee prefers elements that are derived from natural materials compared to indirect natural applications, despite their availability to provide a sense of natural workspaces. Furthermore, consideration of office spaces in general is also not preferred, which are the Integration of Parts to Whole (6.985), Organised Complexity (6.965), and Transitional Space (6.965). These elements require less attention as compared to the immediate working area of the employees. Therapy animals, for example cats or birds, are the least preferred element in working spaces (5.34), probably due to the attention they require to manage them, which might hinder the employees from performing well at work.

CONCLUSION

It can be summarized that office employees prefer natural elements in their working environment compared to artificial elements that are derived from natural environments. Attraction and beauty of the working spaces may enhance

employees' productivity, including the use of colours to create a visually soothing environment. These elements can be implemented into their working spaces to improve their work productivity while reducing stress at work.

Biophilic designs can be annotated as a bridge to connect the built environment and the people. Biophilia is not limited to a specific condition or environment but can be applied to a variety of human aspects and livelihoods, such as physical interactions, the place or the habitat and even the perceptions of the individual. For the indoor working environment, biophilic design can serve as a means to reduce stress, bring comfort to the office occupants, and improve the physiological, mental and social manners that can contribute to a healthier and happier community.

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THE IMPACT OF FUNDAMENTAL PLANTING DESIGN ON WELL-BEING

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Abstract

The planting design plays a pivotal role in shaping the campus landscape, blending scientific planning with artistic expression. The fundamental aspects of planting design, such as plant density, configuration, and properties, have a substantial impact on the daily lives of students. However, unattractive landscape planting on campus can diminish students' connection to nature. This study aims to investigate the interaction between planting design and students' well-being, drawing from positive psychology principles. The objectives of the study involve identifying fundamental elements in planting scenes that impact students' perceptions and, subsequently, their well-being. Using a photo-based questionnaire, 319 students from diverse faculties rated 51 selected landscapes photographs. Data analysis revealed that arrangement emerged as the most crucial fundamental element influencing preferences of planting design. Interestingly, the naturalness of scenes uniquely correlated with engagement among respondents. These findings underscore the potential of visually appealing planting designs to boost students' happiness, satisfaction, and engagement in their educational environments. Future research should further explore how strategically planted greenery influences individuals' nature experiences and mental health, offering insights for nature-based interventions on campuses.

Keywords: Fundamental planting design, Well-being, Campus landscape

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INTRODUCTION

Studies on landscape and well-being have been common focus areas in research. However, these studies often provide a holistic view of landscapes deprived of delving into specific elements within them. This research aims to investigate the interaction between students and planting design, assessing it visually through students' perceptions to understand its impact on their well-being.

Recent research has revealed that looking at nature through windows is linked to various enhancements in mental well-being, encompassing heightened life satisfaction, improved attention restoration, and better stress recovery (Soga et al., 2020; Chang et al., 2020). Interestingly, it has been discovered that the impact of viewing a green scenery on individuals' mental health generally surpasses that of actively utilizing green spaces (Soga et al., 2020). This discovery carries significant implications as it suggests that smaller number of direct interactions with nature can yield comparable benefits for human health and well-being when compared to more immediate interactions. One plausible explanation for this outcome could be that these surveys were conducted during the pandemic, a period when people were advised to stay indoors in isolation. Consequently, experiences with nature that were less immediate, such as looking out of windows, might have been far more prevalent than immediate interactions with nature (Soga et al., 2020).

Instead, this study will explore students' preferences for planting design in the vicinity of their educational spaces through photographs. Furthermore, students will be asked to articulate their emotions and feelings regarding their most preferred planting scenes. The purpose of these inquiries is to anticipate the immediate impact of planting design principles on well-being.

STUDENTS' WELL-BEING

Positive psychology within an educational setting yields positive outcomes such as the improvement of well-being and decrease in levels of depression among students (Lai et al., 2018). Presently, numerous efforts have been undertaken to explore the connections between landscaping and well-being. One such study delves into the impact of planting design on visual landscape quality and its influence on overall well-being (Mt Akhir et al., 2021), plants impact on health and well-being of people (Parwiz et al., 2023) and the benefits of indoor and outdoor vertical greening system towards human health and well-being (Fonseca et al., 2023).

Well-being is a comprehensive concept frequently deliberated within the realm of psychology. In accordance with well-being theory, it can be divided into two primary categories: hedonic well-being and eudaimonic well-being (Deci & Ryan, 2008; Schueller & Seligman, 2010). In a more straightforward explanation, both forms of well-being involve the expression of emotions, with

hedonia being synonymous with experiencing positive emotions and eudaimonia entailing the aspect of functioning effectively.

Seligman (2011, 2018) has delineated well-being into five pillars: Positive emotion, Engagement, Relationships, Meaning, and Accomplishment, collectively referred to as PERMA. These dimensions can be associated with highly preferred planting design scenes to evaluate the quality of the planting design settings. This evaluation can provide valuable insights for enhancing students' happiness and satisfaction within their educational environment. Therefore, this study used these five pillars as measurement indicators to assess students' views towards planting design scenes and relate to their emotional perceptions.

FUNDAMENTAL OF PLANTING DESIGN ON CAMPUS

The assessment of how planting design scenes dimensionally impact students' well-being can be gauged by examining various properties of plants. Distinct physical characteristics of plants, such as colour, shape, texture, size, density, arrangement, natural appearance, and vividness, have been demonstrated as fundamentals to influencing people's preferences (Jiang et al., 2014; Polat & Akay, 2015; Yilmaz et al., 2018; Wang et al., 2019; Sanders, 2020; Ma et al., 2020). These fundamental elements of planting design can then be linked to dimensions of well-being.

Research by Jiang et al., (2014) found that trees' density positively predicted mental restoration and aesthetic satisfaction. Kaplan, Kaplan and Brown (1989) noted that people experience a sense of calmness around plants. Areas without trees experienced a notable increase in stress and low preferences (Jiang et al., 2014). However, excessively dense planting can hinder regeneration and increase feelings of uncertainty (Van den Berg, Jorgensen & Wilson, 2014). Generally, areas with a mixture of trees and shrubs are more preferable. Additionally, flowers, especially vibrantly coloured ones, receive higher preference ratings (Hoyle et al., 2017), with their presence contributing positively to psychological well-being.

On the other hand, changes in plant selections have subsequently changed the plant profiles and criteria of the landscape design in particular place (Mohd Hussain et. al, 2022). However, by considering the fundamentals of design such as principle of balance, order, sequence, rhythm and others, it allows various categories of plant selections to be able included in the fundamental design and setting of a landscape.

These examples of studies demonstrate that the fundamentals of planting design characteristics such as density, colours, and the form of planting composition have the ability to impact one's mental or psychological well-being. Hence, this study intent to explore the preferences of students on campus

regarding fundamental planting design and how these preferences influence their perceptions and emotions when observing these scenes.

METHODOLOGY

Landscape photographs are frequently employed in landscape perception research (Mirza, 2015; Sevenant & Antrop, 2011). Traditionally, Kaplan, Kaplan, & Brown (1989) used photographs as visual stimuli, considering them to be a suitable substitute for direct visual assessment in this field. These photographs serve as potent tools for studying how people perceive landscapes when presented in visual form (Dupont, Antrop, & Van Eetvelde, 2014). This study used photo-based questionnaire as a tool to measure students' well-being in preferred planting design sceneries.

A total of ninety-four (94) landscape planting scenes were photographed in the study area. However, only 51 photographs were selected with the aid of subject experts who are academicians from the landscape architecture field. The selection was executed based on whether the main planting design elements of each image accurately reflected the fundamentals of planting design scenes.

The research site was selected to represent the settings where students interact with the campus environment. Universiti Putra Malaysia's (UPM) campus in Serdang (Figure 1) was chosen for the study, covering a land area of 1245.056 hectares. This campus, comprising 15 faculties, accommodates approximately 25,000 students. The exploration areas included only green spaces with passable landscape planting scenes in each of the faculties, and can be physically and visually assessed by the students. This study involved 319 students from different faculties.



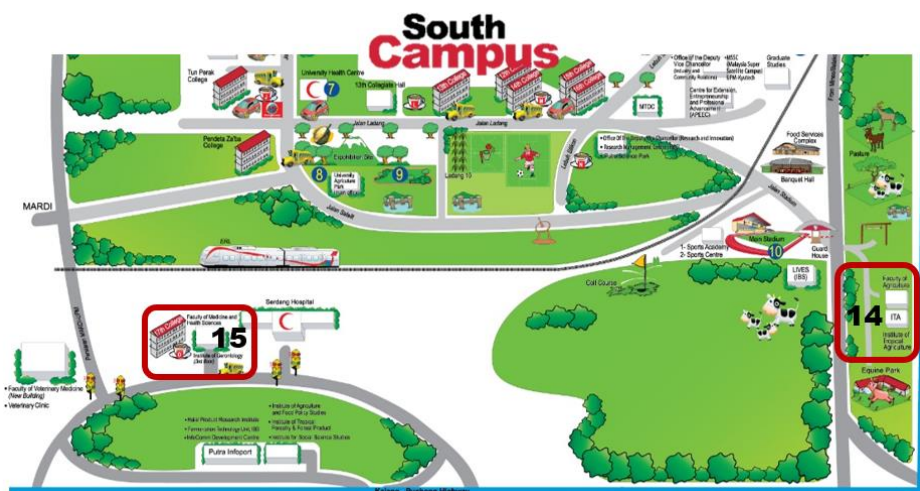


Figure 1: 15 Faculties at Universiti Putra Malaysia, Serdang
 Source: UPM web page (2024)

The first section of the photo-questionnaire comprised inquiries related to the demographic profile., followed by section two which was the evaluation of planting photographs, and section three consisted of a well-being survey. The items for sections two and three were formulated by drawing upon established, academically developed, and validated multi-item scales for assessing well-being in individuals or populations, such as PERMA. The questions were crafted using a multi-item scale approach, as suggested by Singh, Todd Donovan, Mishra, and Little (2008), who emphasized that employing multi-item scale measures for various constructs can help mitigate measurement errors. The items were assessed utilizing a five-point Likert scale, with response options spanning from 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree) to 5 (strongly agree).

Since the photo-questionnaire sought to evaluate the respondents' opinion immediately, their responses would depend on their emotion at that particular time. The collected data were analysed using SPSS software version 23.0. The average of the planting photograph scores and the dimension of planting properties were then calculated. Relative Importance Index (RII) were used to rank the most preferred planting scenes and well-being scores.

RESULT AND DISCUSSION

The result of study is shown in Table 1 which display the ranking of planting design dimensions or attributes in the evaluated planting sceneries, as rated by the respondents. Among the eight essential planting design dimensions, the arrangement attribute garnered the highest preference rating (Mean=4.339; RII=0.868). Following closely were density, naturalness, colour, shape, size, and

vividness of planting scenes, ranked in descending order. The plant texture element was the least prioritized factor as respondents assessed the landscape planting images (Mean=3.712; RII=0.742).

Table 1: Mean and RII score for landscape planting scene dimension

Planting design dimension	Mean value	Tendency level	RII	Rank	Importance level
C6_arrangement	4.339	High	0.868	1	High
C5_density	4.188	High	0.838	2	High
C8_naturalness	4.185	High	0.837	3	High
C2_colour	4.154	High	0.831	4	High
C4_shape	4.097	High	0.819	5	High
C1_size	4.022	High	0.804	6	High
C7_vividness	4.006	High	0.801	7	High
C3_texture	3.712	High	0.742	8	High-Medium

Figure 2 also illustrates the ranking of the most prominently regarded fundamental element in planting design, which is arrangement. This discovery emphasizes the importance of organizing planting elements in a coherent and orderly manner.

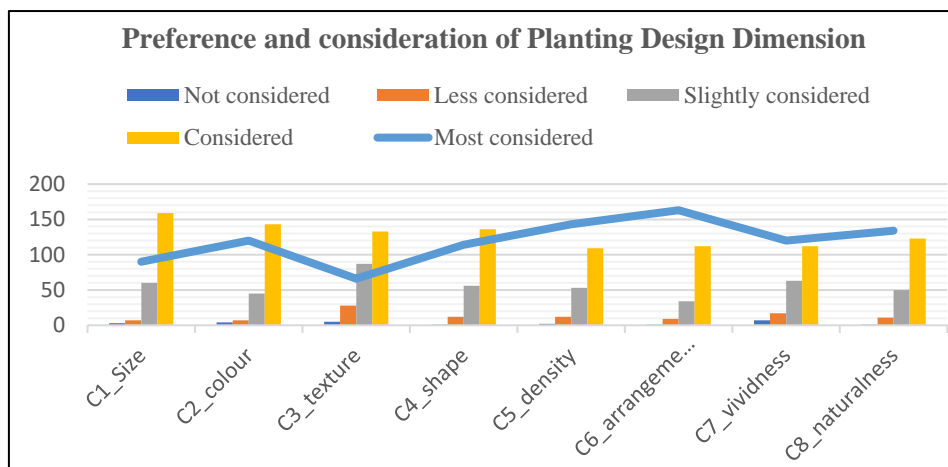


Figure 2: Ranking of planting design dimension preference and consideration

According to Sanders (2020) who studied planting design in urban vacant lots, participants consistently highlighted planting, arrangement, emotional responses, and environmental factors as key factors influencing their ratings of planting images. Similarly, in alignment with the current study, respondents assigned the highest mean value and importance index to planting

arrangement, underscoring the significance of prioritizing this variable as it forms the initial impression during review. This observation may be influenced by the high ratings given to photographs that were visibly well-organized and well-arranged, as depicted in Figure 3.



Figure 3: Images with highly rated by respondents

Texture emerged as the last dimension prioritized in the assessment of planting design scenes, likely because it is perceived as less visually striking compared to other elements (Ma et al., 2020). Serpa & Muhar (1996) note that texture significantly influences size and distance perception. In this context, respondents might not be as attentive to the spacing between planting scenes, resulting in lesser consideration. Ma et al. (2020) study found that the texture of foreground plant design did not significantly impact landscape visual quality, suggesting that while texture is an important dimension, its level of consideration is comparatively less significant. This outcome may also be influenced by the diverse background knowledge of respondents regarding planting design dimensions.

Moreover, the study compared considerations for planting design dimensions with students' well-being outcomes. Positive emotion, such as feeling at ease or maintaining a positive mindset, was closely associated with almost all factors related to well-being. Only the naturalness dimension showed a connection to high levels of engagement among those who independently decide on matters involving a natural setting. The correlation between planting dimension consideration criteria and strongly agreed-upon statements of well-being indicators is detailed in Table 2.

Table 2: The most considered planting design dimension relation to well-being

Mostly Considered Planting Dimension	Well-Being Items with Strongly Agree Statement	Total responses
C6_arrangement	Positive emotion_feel at ease	163 (51.1%)
C5_density	Positive emotion_feel positive	143 (44.8%)
C8_naturalness	Engagement_makeup my mind	134 (42%)
C2_colour	Positive emotion_feel positive	120 (37.6%)
C7_vividness	Positive emotion_feel at ease	120 (37.6%)
C4_shape	Positive emotion_feel positive	114 (35.7%)
C1_size	Positive emotion_feel at ease	90 (28.2%)
C3_texture	Positive emotion_feel positive	66 (20.6%)

With the exception of naturalness consideration, the findings indicate that nearly all factors strongly influence respondents' positive emotions. Naturalness is closely linked to the impact of engagement on well-being, attributed to natural features such as the diversity, variety, or richness of plants that connect with cultural values (Bulut & Yilmaz, 2008; Gungor & Polat, 2018) and the constructs of complexity (Abkar et al., 2011; Sanders, 2020). As classified by Kaplan, Kaplan & Brown (1989), the complexity construct falls under "involvement," requiring exploratory information. Consequently, factors related to naturalness contribute to well-being engagement, allowing respondents to feel empowered in decision-making when observing natural scenes. Additionally, numerous researchers hypothesize that engagement with natural scenes can enhance performance, alleviate stress, and improve overall well-being (Li & Sullivan, 2016; Scholl & Gulwadi, 2018).

Furthermore, the natural settings in this study contained the natural form of plant attributes rather than manicured plants. As a result, students are more likely to notice the uniqueness of plant forms that are freely planted in the courtyard spaces, exposing the natural scenery and generating engagement vibes when seeing this planting design. In fact, as Browning and Rigolon (2019) empirically tested and discovered that there was substantial evidence to suggest the relationship between natural green space views from classroom windows and increased classroom engagement. On that basis, the natural planting design is critical to ensuring improved student engagement with their campuses, particularly with their faculties.

Similarly, other factors under consideration, including arrangement, density, colour, shape, size, vividness, and texture, also exhibited positive influence on respondents' emotions, contributing to feelings of ease and positivity. This positive emotional response is closely associated with happiness and satisfaction. Consequently, images that are highly preferred may possess qualities that enhance respondents' happiness and satisfaction, considering these specific aspects. Furthermore, the positive emotion experienced also correlates

with feelings of security and excitement, aligning with previous research findings that suggest the density and arrangement of vegetation can positively or negatively influence people's preferences.

CONCLUSION

Individual preferences for the design of planted landscapes and their effects on people's well-being can vary. The view of planting design through windows is notably linked to experiences with nature, contributing to human health and overall well-being. This visual exploration of the fundamentals of planting design is strongly recommended for further exploration, particularly among university students facing challenges.

To cultivate a positive association with their learning environment and enhance their well-being, including positive emotions and engagement, it is advisable to incorporate visually pleasing planting design scenes into the areas of study. Students in this study expressed that a well-arranged placement of plants provides a sense of ease, while optimal level of plant density is crucial for fostering positivity, and finally the natural form of plants facilitates engagement with the surroundings, contributing to a composed state of mind. All these fundamental elements should be taken into account to reduce stress and improve the well-being of students on campus.

Moving forward, future research should focus on comprehending how the positioning of green spaces and trees influences individuals' experiences with nature, along with the associated benefits for mental health. This knowledge is essential for designing effective nature-based interventions aimed at improving the health and well-being of campus populations.

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THE INFLUENCE OF OUTDOOR SPACE SPATIAL ECOLOGICAL ENVIRONMENT FOR THE ELDERLY

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Abstract

Outdoor activities improve the physical and mental health of the elderly. Only an excellent outdoor environment can attract the elderly, increase the frequency of their activities, and improve their quality. However, there is a lack of research on urban outdoor environmental factors that influence the outdoor activities of elderly people in China. This study aims to explore outdoor environmental elements suitable for the elderly in China, explore the impact of the environment on the activities of the elderly, and better design outdoor environments for the elderly. The study selected Beishan Park in Qingdao, China, as the research location because of its outdoor environment. It explored three aspects: the physical environment, the psychological environment, and the ecological environment. A survey questionnaire was written for data collection. The data was analysed using PLS-SEM to analyse the relationship between outdoor environmental factors. The research findings indicate that the ecological environment, which fosters both the physical and psychological environments, significantly influences the outdoor activities of the elderly population. A good ecological environment can encourage the elderly to spend more time outdoors. This paper discusses the important outdoor environmental factors that affect the outdoor activities of the elderly, provides a basis for improving the outdoor environment and outdoor activities of the elderly in Chinese cities, and also provides a reference for designers and related personnel.

Keywords: Spatial Ecological Environment, Outdoor, Elderly, Physical, Psychological, Activities

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INTRODUCTION

China's ageing population is developing rapidly and will become China's primary national condition for a long time (Bai & Lei, 2020; Han et al., 2020). According to the seventh national census in November 2020, China's population aged 60 and above accounted for 18.7% of the total population, and this proportion is still accelerating (NBSC, 2021). Moreover, with the rapid development of cities and the destruction of the ecological environment, the elderly's requirements for the outdoor environment will increase. As a vulnerable group in the city, the elderly's physical and mental health development should be considered in constructing an urban environment. In recent years, building an "age-friendly," "inclusive," and "barrier-free" city has become a high-level development goal for cities (Lui et al., 2009; Wenting et al., 2014; Yifan et al., 2020). Both the world and China are researching the happy lives of the elderly to create a harmonious city for them.

However, many outdoor environments were not designed for elders when they were originally built. China's early environmental design, particularly, ignored the needs of the elderly. Specifically, the impact of ecological factors on the elderly has been less considered, and the importance of trees and biology on the elderly's outdoor activities has not been discussed. Therefore, it is of great significance to explore the impact of urban outdoor ecological environment characteristics on the elderly's outdoor activities.

LITERATURE REVIEW

Elderly

The World Health Organization defines old age as people over 60 (WHO, 2002), while some Western developed countries consider 65 years old the cut-off point. People entering old age will show a decline in physical function, slow metabolism, physiological function, and other characteristics. WHO categorises the population from 60 to 74 years old as the young elderly, while those over 75 years old are solely classified as the elderly. The term "long-lived" refers to people over 90 years old.

In China, Article 2 of the Law on the Protection of the Rights and Interests of the Aged stipulates that the age threshold for the elderly is 60 years old. All citizens of the People's Republic of China who have reached the age of 60 are senior citizens. Therefore, in this study, the age limit for the elderly was 60 years and older.

Ecological Environment and Outdoor Activities

A good spatial-urban ecological environment can improve the physical and mental health of elderly people who do outdoor sports. In recent years, air pollution has brought serious harm to human normal activities and life (Misni et al., 2015). As people are keen on outdoor sports, outdoor sports in an air-polluted

spatial environment will inevitably inhale more pollutants while accelerating breathing, which is detrimental to the elderly (Xu & Lyu, 2022).

In addition, thermal comfort will have an impact on the elderly's outdoor activities. In the context of global climate change, outdoor spaces that provide a pleasant thermal comfort experience for the elderly effectively improve the quality of urban life (Chen & Ng, 2012). Studies have shown that the acceptable thermal comfort range of participants can lead to significant changes in overall park visitor numbers in different seasons, while thermal adaptation characteristics affect individual differences in utilisation within different spaces in different ways. In unshaded areas of the park, visitor numbers increase as temperatures rise during the cool season and decrease during the hot season. However, as temperatures rise, both in the cool and hot seasons, the number of visitors to shady areas increases (Jing & Misni, 2024; Li et al., 2016).

There is a close relationship between the ecological environment and outdoor activities, especially for the elderly. Their physical requirements for the outdoor environment will increase. Therefore, a well-designed ecological environment significantly influences the outdoor activities of the elderly population (Jing & Misni, 2023). Under a good spatial ecological environment, physical and mental health will also improve across sports groups (Xu & Lyu, 2022).

METHODOLOGY

The primary data were collected on site using mixed methods: qualitative observations and quantitative surveys.

Observation

In the early stages, researchers observed the Qingdao's environmental characteristics and experiences, divided the outdoor environmental characteristics into physical environment, psychological environment, and ecological environment, and then wrote a questionnaire.

Questionnaire survey

Questionnaires were distributed to the elderly in Beishan Park during the autumn in October 2022 and the spring in April 2023. This research questionnaire includes 12 basic information questions, 22 five-level quantitative questions, and 4 open-ended questions. The researchers encouraged the elderly to complete the questionnaires by themselves, but some elderly people needed help from the researchers to read aloud due to weak eyesight or a lack of patience. After the elderly answered verbally, the researchers helped record them. Some elderly people repeatedly asked questions, and the researchers were on site and provided the necessary help. The researcher collected all questionnaires upon completion. During the field research process, incomplete survey questionnaires with missing

items were deemed invalid and were not included in the scope of data collection. A total of 130 questionnaires were distributed for this survey, and 123 were recovered. The effective response rate of the questionnaire was 94.62%.

Data analysis

All data were registered and generated using SPSS. PLS-SEM was used to analyse the validity and reliability of the data to verify the relationship between the ecological environment, physical environment, and psychological environment and the outdoor activities of the elderly.

Study Site

This study was conducted in Beishan Park, Shinan District, Qingdao City, Shandong Province, China (Figure 1). Qingdao is a coastal city in China with a four-season temperate climate. According to the seventh Chinese census in 2020, Qingdao's elderly population has surged, with 2.04 million people aged 60 and above accounting for 20.28%.



Figure 1: Location of Beishan Park at Shinan District, Qingdao City, Shandong Province, China (36.07201°N Latitude, 120.41092°E Longitude and an average elevation 27m), surrounded by high density of residential blocks/areas
Source: Googlemaps (2024)

Beishan Park boasts numerous old residential areas, the majority of which date back to the 1980s. Many senior citizens gather in the park for outdoor activities. The aging rate in the residential areas around Beishan Park is 21%; the current aging rate in China is 18.7%, which is much higher than the average. Beishan Park was chosen for this study because it is home to many elderly people.



Figure 2: Spatial distribution of Beishan Park
Source: Authors (2024)

Qingdao Beishan Park is one of the parks formed in the early days of the founding of the People's Republic of China (Figure 2). The government invested in the park in 1990 and continued to renovate in 2001. The park area is about 70,000 square meters. Planting with trees such as Black pine, Cherry blossoms, Albizia julibrissin, Magnolia and other varieties. In March 2002, 18,100 total of trees were planted. In 2004 and 2005, 1,800 and 400 red maples were planted, respectively. The entire park's natural appearance and ecological environment have undergone major changes. Beisha Park has prominent spatial characteristics. The space includes a sports space, a social dancing space, an exercise space, etc. According to the definition of terraces and trees, tall trees naturally form a top interface, shrubs form a vertical interface, and the elderly automatically form a chorus area, and a Tai Chi space. Beishan Forest Park has clear ecological functions and a pleasant environment. Many elderly people are active here (Jing & Misni, 2024).

PLS-SEM ANALYSIS

Beishan Park is a forest park with an excellent ecological environment. This study first conducted behavioural observation and monitoring of the elderly in the park and found that every part of the park was well-utilised at various times. Different seniors will participate in activities at different times. The literature divides the relevant landscape perception elements of outdoor environmental quality into three parts: ecological perception, physical perception, and psychological perception.

The term "ecological perception" primarily describes how elements of the ecological environment, such as trees, water features, biological elements,

and ecological amenities, affect the outside environment of the elderly. Physical perception primarily describes how specific physical amenities, such as benches, restrooms, barrier-free areas, landscape features, etc., affect the senior population's outdoor environment. Psychological perception primarily describes the experiences that senior citizens have in the outdoors as a result of outdoor activities, including psychological safety, communication, happiness, depression, and intergenerational integration. The following presumptions are combined with the observation analysis and research purpose (Figure 3):

- Hyphothesis 1. Physical perception was influenced by ecological perception quality.
- Hyphothesis 2. Psychological perception was influenced by the quality of ecological perception.
- Hyphothesis 3. Comprehensive perception was influenced by the quality of ecological perception.
- Hyphothesis 4. Mental perception was influenced by physical perception.
- Hyphothesis 5. Synthetic perception was influenced by the quality of physical perception.
- Hyphothesis 6. Synthetic perception was influenced by mental perception quality.

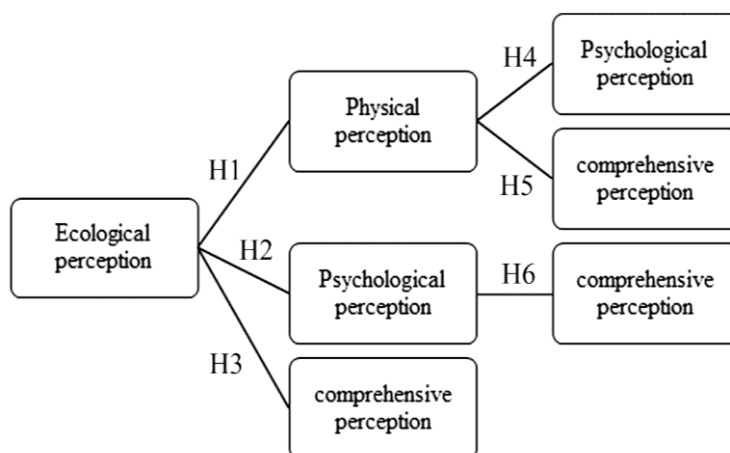


Figure 3: Hypotheses and Research Model
 Source: Authors (2024)

Measurement Model for Evaluation (ECONO)

The primary focus of this study was how the physical, ecological, and psychological environments affect older people's outdoor activities. Figure 4 depicts the study's organisational framework. Trees, ecological infrastructure,

water systems, etc., are the primary components of the ecological environment. Ecological factors were assigned the code ECO, and the corresponding sub-project codes were ECO1–ECO7. The outside amenities and architectural aspects were where the physical environment mostly begins. The associated subproject codes were PHY1–PHY7 in order, while the physical environment was designated as PHY. Emotional exchange and generational relationships among the elderly are fundamental to psychological experience. The associated subproject codes were PSY1–PSY7, and the psychological experience element was assigned the code PSY. SUM was the code assigned to the complete perception problem.

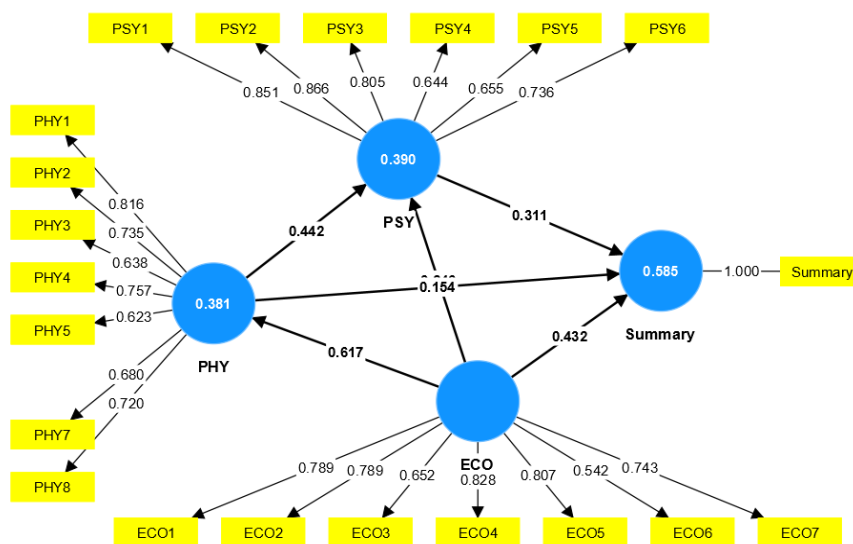


Figure 4: Outer model assessment
Source: Authors (2024)

The measurement model was assessed using confirmatory factor analysis (CFA). Convergence validity was assessed using factor loading, mean-variance extraction (AVE), and composite reliability (CR). Every item had loads larger than 0.5, every AVE value was more significant than 0.5, and every CR value was greater than 0.7, as indicated in Table 1. Furthermore, a CR value significantly higher than 0.7 suggests the reliability of every construct employed in this investigation (Hair, Risher et al., 2019; Hair, Sarstedt et al., 2019).

Table 1: Result of Measurement Model

Items	Loading	Cronbach's alpha	Composite reliability (CR)	Average variance extracted (AVE)
ECO1	0.816			
ECO2	0.821			
ECO3	0.509			
ECO4	0.828			
ECO5	0.658	0.865	0.898	0.561
ECO6	0.807			
ECO7	0.748			
PHY1	0.734			
PHY2	0.639	0.84	0.79	0.511
PHY3	0.771			
PHY4	0.693			
PHY5	0.793			
PHY6	0.703			
PHY7	0.660			
PHY8	0.857			
PSY1	0.647			
PSY2	0.851			
PSY3	0.698	0.872	0.904	0.613
PSY4	0.800			
PSY5	0.822			
PSY6	0.816			
SUM	1			

Source: Authors (2024)

Table 2: Discriminant Validity of Constructs

	ECO	PHY	PSY	SUM
ECO	0.899			
PHY	0.899	0.881		
PSY	0.894	0.881	0.885	
SUM	0.891	0.892	0.885	0.885

Source: Authors (2024)

The criterion developed by Franke and Sarstedt (2019) evaluated the discriminant validity. Table 2 demonstrates that discriminant validity was attained since all of the square roots of the AVE, as indicated by the bolded values on the diagonals, were more significant than the corresponding row and column values.

Evaluation of structural model

Table 3 displays the outcomes of the hypothesis testing. H1 was supported by the results, which indicated a significant association ($\beta = 0.782, p < 0.05$) between ecological and physical perceptions. H2 was supported by a substantial correlation ($\beta = 0.443, p < 0.05$) between ecological and psychological perception. H3 was confirmed by a significant association ($\beta = 0.334, p < 0.05$) between comprehensive and ecological perception. Simultaneously, a substantial positive correlation was found between the fit degree of physical perception ($\beta = 0.439, p < 0.05$) and psychological perception, supporting H4. Comprehensive perception and the fit degree of physical perception ($\beta = 0.305, p < 0.05$) showed a positive correlation, supporting H5. Furthermore, the findings indicated a substantial association ($\beta = 0.335, p < 0.05$) between complete perception and psychological perception.

According to the model, the ecological environment affects the physical environment and psychological environment, and the ecological environment plays a vital role in the comprehensive experience of the elderly's activities.

Table 3: Results of Hypotheses Testing

	Std beta	Std error	T values	P values	
ECO -> PHY	0.782	0.031	25.041	0	supported
ECO -> PSY	0.443	0.074	6.027	0	supported
ECO -> SUM	0.334	0.074	4.518	0	supported
PHY -> PSY	0.439	0.078	5.623	0	supported
PHY -> SUM	0.305	0.072	4.209	0	supported
PSY -> SUM	0.336	0.076	4.392	0	supported
Note: Significant at $p < 0.01$					

Source: Authors (2024)

DISCUSSION

The ecological environment has an important impact on the elderly's outdoor activities, according to the PLS-SEM model. The impact on the ecological environment is mainly reflected in air quality purification, thermal comfort, biodiversity, and other factors. Trees are the most important factor in the park's ecological environment. They can purify the air, improve air quality, and keep the elderly's respiratory system healthy. Trees can also provide shade, lowering outdoor temperatures and improving comfort during hot weather. Parks provide a comfortable shade environment that is very helpful to the elderly. At the same time, more trees attract more creatures, making the biological species here richer and more diverse, and encouraging more elderly people to participate in the interaction with the natural environment.

Beishan Park is built in an old residential area. There are many trees in the park, and the sunlight creates a dappled effect through the shade of the trees. The air is fresh, the climate is comfortable, and there is a lot of biology. This is an excellent place for seniors to visit. The elderly prefer the natural environment; this is a forest park closer to nature. Here, they play chess, Tai Chi, and square dance, care for their grandchildren, lead colourful retirement lives, and enjoy family happiness. The ecological and environmental factors, as well as the characteristics of Qingdao Beishan Park are discussed and analysed below.

Main Arbors

Beishan Park is particularly rich in plants, which carry ecological, structural, and visual functions. By 2005, the park had 33,400 plants from 50 species of trees and shrubs. The ratio of Arbors trees and shrubs is 1:3, and the ratio of evergreen and deciduous trees is 1:1.05. Many trees create an excellent ecological space for the elderly. The whole park is beautiful, with birds singing, as well as flowers and sunshine shuttling in the shade.

Table 4: The Main Arbors Trees in The Beishan Park

No.	Common name	Scientific name	Nos.	Height (m)	DBH (cm)	Canopy width (m)	Seasonal type
1	Locust tree	<i>Styphnolobium japonicum 'Pendula'</i>	600	10-20	15-25	5.0-8.0	Deciduous
2	Acer palmatum	<i>Acer palmatum Thunb. in Murray</i>	400	5	5-10	2.5-3.0	Deciduous
3	Paulownia	<i>Paulownia fortunei (Seem.) Hemsl.</i>	120	15-20	50	8-12	Deciduous
4	Oriental plane	<i>Platanus orientalis L.</i>	100	12-20	40-60	8-12	Deciduous
5	Hackberry	<i>Celtis sinensis Pers</i>	200	9	15-20	3-5	Deciduous
6	Pine tree	<i>Pinus Linn</i>	1000	15-20	30-50	6-12	Evergreen
7	Cypress	<i>Cupressus funebris Endl.</i>	200	10-20	20-40	3-5	Evergreen
8	Oriental cherry	<i>Prunus subg. Cerasus sp.</i>	20	5-10	4-16	3-6	Deciduous
9	Magnolia	<i>Yulania denudata</i>	10	8-15	10-20	4-6	Deciduous
10	Ash tree	<i>Fraxinus chinensis</i>	60	6-12	8-20	4-6	Deciduous
11	Albizia julibrissin	<i>Albizia julibrissin Durazz</i>	300	6-10	12-30	4-8	Deciduous
Total/Mean			3010	18	35	10	Deciduous

Source: Authors (2024)

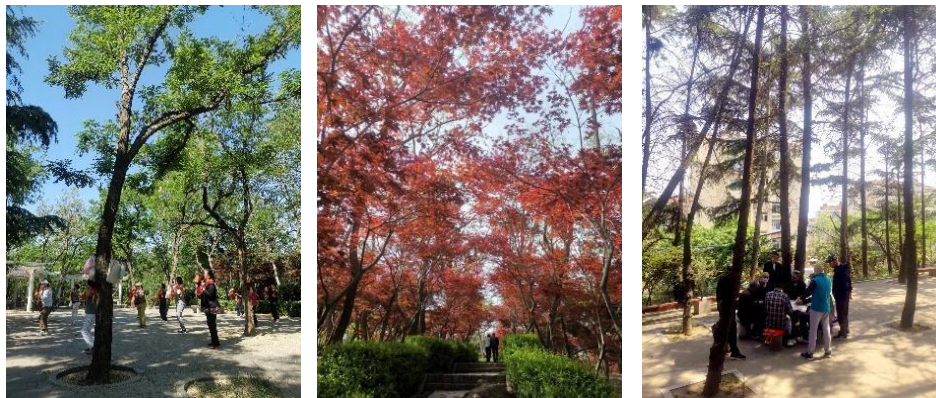


Figure 5: *Styphnolobium japonicum* 'Pendula' (left), *Acer palmatum* Thunb. in Murray (middle), and *Pinus Linn* (right)
Source: Authors (2024)

Due to the large number of trees in Beishan Park, the specific number of each tree was not recorded in this table. However, according to "Qingdao Landscape Annals," recorded in March 2002, the second phase of the greening project started. Dongshan South Slope construction covers an area of 3000 square metres of garden. Landscape woodlands such as *Albizia julibrissin* Durazz., *Yulania denudata* (Desr.) D. L. Fu, and *Acer palmatum* Thunb. in Murray were built, and 18,100 trees were planted. In 2003, Beishan Park planted a red maple forest. In 2004 and 2005, 1,800 and 400 plants of red maple were added. In 2005, the park had 33,400 plants of 50 species of trees and shrubs, and more than 6,400 climbing plants.

The pine trees in Beishan Park are tall and large. Under the big branches are cool and shaded spaces, which provide a roof of leaves for the elderly when the weather is hot. Both the "potential refuge theory" and the "savanna hypothesis" suggest that humans are attracted to tree canopies because they are optimal for survival (Orians, 2022). Later studies have confirmed this preference (Lohr & Pearson-Mims, 2006). For the elderly, shade trees can improve outdoor comfort, reduce glare, and serve as landmarks in outdoor areas (Zeisel, 2007).

The elderly here especially enjoy playing tai chi, or sword dance, under the trees. The tall locust trees and pine trees interlace together to provide a green environment for the elderly, attracting many elderly people and children to play under the trees. Beishan Park boasts a multitude of red maple trees, while the purple hue of the surrounding mountains creates a striking contrast. Others, such as cherry blossoms and magnolia flowers, adjust the colour interest for the park environment and provide ornamental functions for the elderly.

Main shrubs

The shrubs in Beishan Park are mainly used to demarcate areas and boundaries, but some shrubs have no ornamental function. The *Buxus sinica* var. *parvifolia* M. Cheng was artificially pruned to form the region's boundary. The volume of *Photinia serratifolia* (Desf.) Kalkman is large, produced the white flowers in May. Similarly, *Lagerstroemia indica* L., and *Forsythia suspensa* were in bloom season and had bright colours that added aesthetic value to the green space. These shrubs play a good role in the transition spaces between trees and ground cover, and the plant space is well-proportioned and comfortable with high and low levels.

Table 5: The Main Shrubs Trees in The Beishan Park

No.	Common Name	Scientific name	Areas	Height (m)	Canopy Shape	Canopy Width (m)	Seasonal Type
1	Boxwood microphylla	<i>Buxus sinica</i> var. <i>parvifolia</i> M. Cheng	600	2-5	Rectangle	2.5-3	Evergreen
2	Photinia	<i>Photinia serratifolia</i> (Desf.) Kalkman	30	1-3	Round	2-3	Evergreen
3	Hydrangea	<i>Hydrangea macrophylla</i> (Thunb.) Ser.	36	0.5-5	Round	1-1.5	Deciduous
4	Fructus forsythiae	<i>Forsythia suspensa</i>	24	2-3	Dendritic	1-1.5	Deciduous
5	Rose	<i>Rosa centifolia</i> L.	70	1-2	Cluster	1-1.5	Deciduous
6	Pearl plum	<i>Sorbaria sorbifolia</i> (L.) A. Braun	400	3-5	Rectangle	1-1.5	Evergreen

Source: Authors (2024)



Figure 6: *Buxus sinica* var. *parvifolia* M. Cheng (left), *Photinia serratifolia* (Desf.) Kalkman (middle), and *Forsythia suspensa* (right)

Source: Authors (2024)

Main Groundcovers

Beishan Park is especially rich in plants, with a green coverage rate of 85.56%. The entire park’s green space is comfortable. Throughout the day, the park is a mix of sun and shade, with no exposure to the sun. During the survey questionnaire process, it was also found that the number of elderly engaged in activities in the whole park was similar at all times of the day, and the elderly continued to participate in activities during the day. However, after six o'clock in the evening, the number of elderly people significantly decreased, possibly due to the abundance of trees, inadequate lighting, and other factors that made the elderly feel unsafe.

Table 5: The Main Groundcovers Trees in Beishan Park

No.	Common Name	Scientific Name	Height (cm)	Area (m ²)	Seasonal Type
1	Ryegrass	<i>Lolium perenne L.</i>	30-90	940	Evergreen
2	Mint	<i>Mentha haplocalyx Briq.</i>	10-30	120	Evergreen
3	Bluegrass	<i>Poa Linn</i>	30-100	50	Evergreen
4	Iris	<i>Iris tectorum Maxim</i>	30-60	200	Deciduous
5	Magritte	<i>Bellis perennis L.</i>	10-20	250	Deciduous
6	Dandelion	<i>Taraxacum mongolicum</i>	15-50	80	Deciduous

Source: Authors (2024)



Figure 7: Activities of the elderly at different times (8:00am-left and 10:00am-right)

Source: Authors (2024)

The ecological environment of Beishan Park was perfect, and the utilisation of space had been excellent at various periods. The above figure shows the use of different spaces at different periods. Many soft landscapes make the whole park full of nature.

CONCLUSION

A questionnaire survey was conducted in Beishan Park. Generally speaking, the ecological environment here is perfect, with many trees and fresh air. When the weather is hot, the temperature in Beishan Park will be lower than in the surrounding area, which is suitable for the elderly. The ecology here is sound, with more plant and animal species than the surrounding environment. Elders like to come here to interact with various creatures, appreciate flowers and plants, and listen to birdsong. A healthy ecological environment will benefit both the physical environment and the psychological experience. Whether it is sedentary, moderate, or vigorous activity, elders are willing to participate in different activities based on their needs.

For the elderly, a good outdoor environment can meet their activity needs, especially a good ecological environment with suitable temperature and comfort, allowing them to stay outdoors longer. According to the survey results, Beishan Forest Park has obvious spatial characteristics, with green trees and a higher number of activities for the elderly than other surrounding areas. The elderly strongly recognise the ecological environment's impact on outdoor activities. They hope to increase seating facilities under the shade of trees. The scope of activities of the elderly is also related to the location and facilities of the space to a certain extent. Safety, convenience, comfort, diversity, and ecology are the embodiments of a high-quality outdoor environment. In general, the outdoor environment has a direct impact on the elderly's outdoor activities, especially a good ecological environment that can improve the time and quality of activities.

In conclusion, this study explored the influence of environmental characteristics on exercise preferences in the elderly. Despite focusing on the elderly population in Qingdao City, this study holds significant relevance for China and other East Asian countries or regions. Understanding the impact of various environmental factors and the activity preferences of the elderly can help designers produce a better design for outdoor environments suitable for them.

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ETHICAL STATEMENT

The authors declare no conflicts of interest regarding the paper's publication. The participants of this study were agreed to have their scores published in this paper.

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EXPLORING HOW HUMAN NEEDS FULFILLMENT SHAPES THE PERCEPTION OF EXTERNAL CATALYSTS TO ECO- BEHAVIOUR

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Abstract

This study explored the connection between how people perceive the external condition for environmental behaviour [EC] and meeting human needs by drawing upon Maslow's Hierarchy of Needs [HON], Subjective Well-Being [SWB], and Human Interdependence [HI]. Research Questions: (1) Will EC increase if human needs are conveniently met? (2) Can unmet human needs lead to an increase in EC, and if so, which needs do not significantly impact EC? Purpose: This research investigates the variation in EC across the convenience and difficulty of addressing human needs. Approach: Mann-Whitney U test was conducted to measure the variation of EC across convenience and difficulty in addressing 24 human requirements. Findings: The convenience of satisfying 17 human needs led to a significant increase in EC while the other 7 human needs demonstrated no significant effect. The findings suggest that EC has the ability to develop autonomously, regardless of fulfilling human needs.

Keywords: external condition, human needs, subjective well-being, human interdependence with the environment

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INTRODUCTION

This research investigated the statistical interaction between fulfilling human needs and the perception of external conditions of environmental actions by drawing upon existing studies. It aims to broaden the scope of ongoing research concerning positive psychology and Human Interdependence with the Environment [HIE] by concentrating on Human Interdependence [HI], Subjective Well-Being [SWB], and Maslow's Hierarchy of Needs [HON].

HUMAN INTERDEOENDENCE

Recent studies have provided new insights into Human Interdependence [HI], which is a key factor influencing Subjective Well-Being [SWB] over the long run. SWB describes a person's subjective assessment of their levels of happiness, well-being, and life satisfaction by specifically focusing on the dimensions of psychological, emotional, and judgmental. While SWB focuses on evaluations of current well-being, HI is future-focused. The foundation of HI is the idea that an individual's contributions to those around them ultimately determine the improvements in their own well-being. Consequently, a person's SWB benefits from their contributions to others. This promotes the notion that HI is indeed crucial for fostering long-term well-being (Dirzyte & Valatka, 2023; Isham et al., 2022; Garcia et al., 2015; Kjell, 2011).

The characteristics of HI include both internal emotions and external viewpoints. These qualities encompass thought patterns, life experiences, habitual behaviours, involuntary actions, and intentional behaviours that alter the environment and affect a person's sustainable SWB. Generally, HI is defined from two contexts: Human Interdependence with the Environment [HIE] and Human Interdependence with Other Humans [HIH]. Figure 1 illustrates how the two contexts expand into four dimensions.

Within the framework of a more thorough scientific investigation (Abu Bakar et al., 2020a; Abu Bakar et al., 2020b; Abu Bakar et al., 2018; Abu Bakar et al., 2017a; Abu Bakar et al., 2017b), Environmental Behaviour (EB) and External Conditions to Environmental Behaviour (EC) have been proposed as the third and fourth dimensions of HIE. The latter stands as the focus of this research.

EXTERNAL CONDITION TO ENVIRONMENTAL BEHAVIOUR

External Conditions to Environmental Behaviour (EC) focuses on attitudes towards the conveniences of the surrounding environment that can lead to ecologically conscious actions. Some of the traits that constitute EC include a supportive social atmosphere, accommodating facilities and infrastructure, and awareness regarding the cost and accessibility of green products (Abu Bakar et al., 2020a; Abu Bakar et al., 2020b).

HI DIMENSIONS	Human Interdependence with other Humans (HIH)	Human Interdependence with the Environment (HIE)
DIMENSION 1	Personal Empowerment (PE)	Eco-Personality & Lifestyle (PL)
Lifestyles, personality, inner-strength, willpower, wisdom, awareness, and life prospects.	Focus And Resilience, Sense of Control, Self-Determination, Goal Orientation and Self-Improvement	Ecological Mindset, Collectivistic Cultures, Modesty and Moderation in Material Pursuits, and Environmental Mindfulness.
DIMENSION 2	Positive Relationship (PR)	Interaction With Nature (IN)
Intimacy, closeness, familiarity, empathy, affection, voluntary and involuntary interactions.	Affection, Compassion, Forgiveness, Ability to Tolerate Others, Sense of Inclusion and Self-Regulation.	Closeness to Nature, Knowledge of and Empathy Towards Nature, And Health Associated Attributes in Relation to Surroundings.
DIMENSION 3	Organizational Opportunity (OO)	Environmental Behaviour (EB)
Engaging with the surrounding, executing roles or tasks, proving skills and responsibility.	Articulatory and Versatility, Initiatives of Positive Interactions and Cooperative Engagements towards Professional Growth.	Careful and Conscious Decision-Making, Smart Consumerism, Recycling, Energy-Saving Initiatives, and Waste Handling.
DIMENSION 4	Community Movement (CM)	External Condition (EC)
Attitude towards circumstances, interpersonal behaviours with the larger public, etc.	Proactivity, Public Participation, Friendliness, Openness, Respect for Diversity and Sense of Belonging.	Attitudes towards Surroundings Convenience and Encouragements to be Environmentally Responsible

Figure 1: Dimensions of HIH and HIE
 Source: Abu Bakar et al., 2017

EC serves as a driving force behind choices and activities that are conscious of the environment. Besides the surrounding encouragement and convenience, these circumstances also involve beneficial enforcement in the direction of sustainable conduct. EC acknowledges favourable atmospheres, such as personal and professional support, affordability, accessibility, and efficiency, as well as other overall atmospheres that support greener choices. It encourages and enhances HIE by building a strong connection between environmental behaviours and positive outlooks. The enhancement of EC not only improves people's immediate happiness but also contributes towards better SWB over the long run (Abu Bakar et al., 2018; Abu Bakar et al., 2017a; Abu Bakar et al., 2017b) (see Table 1).

Table 1: Definition, Factors, and Indicators of External Conditions

Definition	Factor	Code	Indicators
Contextual and situational factors that influence and hinder individuals to think and act responsibly towards the environment	Surrounding Encouragement	EC1	having family members who support eco-friendly behaviours
		EC2	having a supportive, ethical climate at work
		EC3	having reachable conducive outdoors
		EC4	having a favourable neighbourhood that supports green politics
	Convenience	EC5	recognising accessibility to environmental products
		EC6	recognising affordability of environmental products
	Favourable Reinforcement	EC7	recognising favourable waste handling management
		EC8	recognising conducive surrounding and amenities
		EC9	recognising the efficiency of public transport infrastructure
		EC10	recognising legal enforcement on environmental destruction

HUMAN NEEDS FULFILLMENT AND WELL-BEING

Maslow's Hierarchy of Needs [HON] initially comprised five tiers, which corresponded to various levels on the motivational spectrum (Maslow, 1943). The hierarchy involved two distinct categories: deficiency needs and growth needs. The four most pressing deficient needs were physiological needs, safety needs, love and belonging needs, and esteem needs, while self-actualisation was associated with growth needs. The five-stage HON was later extended to include cognitive needs and aesthetic needs as part of growth needs (Maslow, 1962) and transcendence needs (Maslow, 1970). Figure 2 shows the current eight stages of Maslow's Hierarchy of Needs.

Deficiency needs refer to the need for sustenance that arises from shortages. If left unaddressed, the desire to satisfy these needs will become stronger over time. On the other hand, growth needs are fundamentally driven by psychological fulfilment, which can be met through creative and intellectually satisfying activities. Reaching the transcendence needs—the ultimate level of HON—requires attending to lower-level needs. While people seem to escalate the hierarchy consistently, changes in HON may be brought about by individual situations like marital disputes or career setbacks. In reality, people are prone to bounce between various HON levels rather than to move through it in an upward trajectory.

Maslow (1943) posits that people must first satisfy their basic needs to advance to higher levels of HON. This idea applies to every level of the hierarchy. For example, gratifying Esteem Needs is required before moving on to Cognitive Needs. Maslow (1987) further postulated the idea that satisfying a need is not a black-and-white or final process and that his previous observations could have given the false impression that one need must be met completely before moving on to a higher need. Lower-level needs in HON are usually those that individuals have progressed the fastest towards achieving and most people only have partly completed these needs. Given their dynamic and adaptive nature, human needs enable people to meet several demands at once (Abu Bakar, 2022).

The existing literature has propounded two opposing viewpoints. First, meeting human needs is crucial for achieving SWB. Second, over-satisfying needs might lead to unhappiness. Moreover, those who overcome unfulfilled needs are able to develop a sense of purpose while partly satisfied or unsatisfied needs can bring meaningfulness to life. This study has identified 24 markers of human needs throughout the eight phases of HON (see Figure 3).

	HON	UNDERSTANDING
DEFICIENCY NEEDS	1	Physiological Needs The body's need for balance and consistent levels in different bodily systems is called homeostasis. It is driven by survival instincts like seeking shelter, water, food, warmth, rest, and good health. Until this need is met, all other needs are secondary.
	2	Safety and Security Needs The need for safety and security in one's life and surroundings involve seeking protection from violence, health threats, sickness, and economic pressures in order to thrive in modern societies.
	3	Belonging and Love Needs The need for love and a sense of belonging is fulfilled through supportive and communicative friendships, family, and intimate relationships. Deprivation of these needs can lead to feelings of guilt, loneliness, depression, or low extraversion values.
	4	Esteem Needs The need for self-confidence and recognition is fulfilled through positive feelings of self-worth achieved via accomplishments, appreciation, and recognition. Without meeting this need, one may experience feelings of inferiority.
	5	Cognitive Needs The need for knowledge and understanding is fulfilled by yearning for learning, exploration, discovery, and creation to better understand the world. Failure to fulfil this need may result in confusion and identity crisis.
GROWTH NEEDS	6	Aesthetic Needs The need to appreciate and connect with nature's beauty which involves taking time to immerse oneself in natural surroundings, allowing the sights, sounds, and sensations of the environment to refresh and rejuvenate the mind and body.
	7	Self-Actualization The instinctual need to maximize one's abilities and strive to be the best leading to a feeling of generativity –the desire to vote, contribute, volunteer, nurture and guide others to the well-being and growth of future generations or to outlast oneself.
	8	Transcendence Needs The need to surpass self-centeredness, and assist others in self-fulfilment and unlocking potential, also known as spiritual needs – when fulfilled, results in a sense of integrity, elevating one's existence to a higher plane.

Figure 2: Understanding the Stages of the Hierarchy of Human Needs
 Source: Abu Bakar et al., 2022

STAGES OF HUMAN NEEDS	HON	#	HUMAN NEEDS INDICATORS
Essential Requirements <i>In the absence of them, the living system of mankind is obstructed.</i>	Physiological Needs	HN01	Nutritional and Wholesome Food
		HN02	Access to Medical Care
		HN03	Clean Water (for Drinking and Washing)
		HN04	Clean and Fresh Air
		HN05	Functional and Well-Maintained Lavatory
	Safety & Security Needs	HN06	Sufficient Electrical Supply
		HN07	Affordable Housing and Conveniences
		HN08	Financial Security and Stability
		HN09	Personal Safety and Security
		HN10	Health Insurance
Supplementary Requisites <i>In the absence of them, the living system is not obstructed but lives would be challenging</i>	Belonging & Love Needs	HN11	Work-Life Balance
		HN12	Social Acceptance and Cultural Inclusivity
		HN13	Reliable Communication Network
		HN14	Access to Internet with Reliable Connectivity
Aspired Prospects <i>In the absence of them, the living system is not obstructed and lives would not be too challenging</i>	Esteem Needs	HN15	Primary Education Attainment
		HN16	Secondary Education Attainment
	Cognitive Needs	HN17	Tertiary Education Attainment
		HN18	Employment Prospects and Opportunities
	Aesthetic Needs	HN19	Well-Kept Areas for Recreational Activities
		HN20	Rich Biodiversity of Flora and Fauna
	Self-Actualization	HN21	Rights to Participate in Leadership Selection
		HN22	Freedom of Expression
		HN23	Opportunities Free from Corruption
		HN24	Artistic and Cultural Freedom

Figure 3: Human Needs Indicators
 Source: Abu Bakar et al., 2022

TRANSCENDENCE AND EXTERNAL CONDITION

HON offers an unbiased examination of the factors influencing SWB. Individuals can build their SWB by attending to their fundamental needs. However, it should be noted that the pursuit of HON and SWB is highly individualised with no predetermined approach. This is because one's understanding of human needs may vary depending on their circumstances. While certain individuals discover SWB via creative endeavours, others do so through their connections with surrounding individuals or through their charitable initiatives.

According to Maslow (1970), only 1% of the global population has attained transcendence, which is the highest level of HON. Transcendent individuals find inner peace and satisfaction by helping others and improving society. Some people require the will and ability to form a connection with something greater than themselves to rise beyond their unique identity and challenges (Koltko-rivera, 2015). This selfless state requires elements like knowing one's value and making a positive impact to the world. For some, transcendence is the pursuit of having a sense of being one with everything that exists, including the cosmos, the natural world, or a higher force.

Furthermore, EC describes the fulfilment of transcendence needs, which are characterised by a change in emphasis from one's egocentric pursuits towards a greater responsibility to the natural world. Individuals who score higher on EC are more likely to immerse themselves into encouraging surroundings that will help them succeed in their endeavours. With the support of their physical and social surroundings, these individuals are more inclined to see the big picture, be optimistic about issues outside themselves, and work for a more equitable and sustainable future (Abu Bakar et al., 2020a; Abu Bakar et al., 2020b). They often have a heightened sense of purpose in their everyday activities. Additionally, EC aligns with the concept of transcendence whereby people commit beyond their own interests and wants to effectuate beneficial transformation in the world.

RESEARCH QUESTIONS

This research aims to answer the following questions: (1) Will EC increase if human needs are conveniently met? (2) Can unmet human needs lead to an increase in EC, and if so, which needs do not significantly impact EC?

METHOD

A sample of 4,315 respondents from Malaysia were invited to partake in the survey. An 11-point Likert scale was used to elicit their responses regarding EC. A data screening was conducted followed by the Kolmogorov-Smirnova test. Since the data was not normally distributed, the Mann-Whitney U test was administered to analyse the mean difference of EC between the ease and difficulty of providing 24 human needs.

FINDINGS

The tables below present (i) the mean distribution of EB items, (ii) the Mann-Whitney U test results, and (iii) an interpretation of the statistical results.

Table 2: Mean Distribution of EC Items

Indicators	Code	\bar{x}	$\bar{x}EC$
My family cherish pro-environmental behaviours.	EC1	7.77	7.66
The ethical climate of my workplace is serious about environmental protection.	EC2	7.71	
Conducive outdoors is within my reach.	EC3	7.72	
My neighbourhood is favourable towards environmental behaviours.	EC4	7.76	
Environmental-friendly products are available and accessible.	EC5	7.49	
The prices for environmentally friendly products are affordable.	EC6	7.41	
The waste handling management operates favourably in the neighbourhood.	EC7	7.63	
The civic amenities function favourably in maintaining a conducive environment.	EC8	7.73	
Traffic infrastructure is efficient to encourage the use of public transport.	EC9	7.68	
Legal enforcement is strict on environmental destruction.	EC10	7.72	

Note. Mean Distribution of EB Items (\bar{x}) and Overall Mean of EB ($\bar{x}EC$)

Table 3: Mann-Whitney U Test Results

HUMAN NEEDS (EC)	Difficult			Convenient			U	z	p
	N	$\bar{x}R$	\tilde{x}	N	$\bar{x}R$	\tilde{x}			
Nutritious Food	336	2023.22	7.6	3979	2168.62	7.8	626209.5	-1.928	.054
Medical Treatment	423	2159.92	7.9	3892	2157.79	7.8	822345.5	-.033	.973
Clean Water (For Wash & Drink)	392	2364.97	8.1	3923	2137.32	7.8	687774.5	-3.451	.001
Clean Air	1330	1987.93	7.5	2985	2233.78	7.9	1758827.0	-5.988	.000
Well-Function Toilet	805	2041.60	7.7	3510	2189.70	7.8	1319069.0	-2.940	.003
Adequate Electricity	428	2157.45	7.9	3887	2158.06	7.8	831581.0	-.010	.992
Affordable Houses and Amenities	1114	2262.20	7.9	3201	2121.74	7.7	1666873.5	-3.242	.001
Financial Stability	1861	2105.27	7.7	2454	2197.99	7.9	2185319.0	-2.422	.015
Personal Security	1578	2059.09	7.6	2737	2215.02	7.9	2003417.5	-3.961	.000
Health Assurance	1325	1979.99	7.6	2990	2236.88	7.9	1745012.5	-6.250	.000
Balance in Work and Personal Time	1582	2029.86	7.6	2733	2232.17	7.9	1959088.0	-5.142	.000
Social Tolerance	1310	1998.76	7.5	3005	2227.42	7.9	1759672.0	-5.545	.000
Communication Line	328	2241.13	8.0	3987	2151.16	7.8	626603.0	-1.257	.209
Internet Line	923	2272.86	8.0	3392	2126.75	7.7	1459393.5	-3.160	.002
Primary School Accomplishment	313	2448.11	8.3	4002	2135.31	7.8	535509.0	-4.279	.000
Secondary School Accomplishment	390	2267.12	8.0	3925	2147.16	7.8	722817.0	-1.814	.070
Tertiary School Accomplishment	836	2137.77	7.7	3479	2162.86	7.8	1437313.5	-.523	.601
Job Opportunity	1678	2124.35	7.7	2637	2179.41	7.8	2155985.0	-1.416	.157
Well-Maintained Recreational Park	1430	1954.05	7.5	2885	2259.09	7.9	1771121.5	-7.573	.000
Diversity of Flora and Fauna	1453	1944.42	7.5	2862	2266.43	7.9	1768917.0	-8.026	.000
Rights to Choose Leaders	1823	2002.98	7.5	2492	2271.41	8.0	1988849.5	-6.993	.000
Freedom of Speech	1957	2041.87	7.6	2358	2254.38	7.9	2080030.5	-5.580	.000
Corruption Free Opportunities	2247	2118.46	7.7	2068	2200.97	7.9	2234545.0	-2.174	.030
Freedom to Express Arts & Diversity	1531	1961.12	7.5	2784	2266.27	7.9	1829730.5	-7.700	.000

Note. Mean Rank of $\bar{x}\Sigma EC$ across Difficult and Convenient; **Bold** shows higher mean rank.

Table 3 shows that EC had a significantly greater mean when 13 human needs were fulfilled with ease and 4 human needs were fulfilled with difficulty.

Table 4: Mann-Whitney U Test Results Interpretation

	HUMAN NEEDS (EC)	INTERPRETATION
Physiological Needs	Nutritional and Wholesome Food	Those who claimed convenient had greater mean rank (N = 3979, $\bar{x}R = 2168.62$) than those who claimed difficult (N = 336, $\bar{x}R = 2023.22$), but the difference was not statistically significant (U = 626209.5, p = .054).
	Access to Medical Care	Those who claimed difficult had greater mean rank (N = 423, $\bar{x}R = 2159.92$) than those who claimed convenient (N = 3892, $\bar{x}R = 2157.79$), but the difference was not statistically significant (U = 822345.5, p = .973).
	Clean Water (for Drinking and Washing)	Those who claimed difficult had greater mean rank (N = 392, $\bar{x}R = 2364.97$) than those who claimed convenient (N = 3923, $\bar{x}R = 2137.32$). A statistically significant difference was found (U = 687774.5, p = .000).
	Clean and Fresh Air	Those who claimed convenient had greater mean rank (N = 1330, $\bar{x}R = 2233.78$) than those who claimed difficult (N = 1330, $\bar{x}R = 1987.93$). A statistically significant difference was found (U = 1758827.0, p = .000).
	Functional and Well-Maintained Lavatory	Those who claimed convenient had greater mean rank (N = 3510, $\bar{x}R = 2189.70$) than those who claimed difficult (N = 805, $\bar{x}R = 2041.60$). A statistically significant difference was found (U = 1319069.0, p = .003).
Safety and Security Needs	Sufficient Electrical Supply	Those who claimed convenient had greater mean rank (N = 3887, $\bar{x}R = 2158.06$) than those who claimed difficult (N = 428, $\bar{x}R = 2157.45$), but the difference was not statistically significant (U = 831581.0, p = .992).
	Affordable Housing and Conveniences	Those who claimed difficult had greater mean rank (N = 1114, $\bar{x}R = 2262.20$) than those who claimed convenient (N = 3201, $\bar{x}R = 2121.74$). A statistically significant difference was found (U = 1666873.5, p = .001).
	Financial Security and Stability	Those who claimed convenient had greater mean rank (N = 2454, $\bar{x}R = 2197.99$) than those who claimed difficult (N = 1861, $\bar{x}R = 2105.27$). A statistically significant difference was found (U = 2185319.0, p = .015).
	Personal Safety and Security	Those who claimed convenient had greater mean rank (N = 2737, $\bar{x}R = 2215.02$) than those who claimed difficult (N = 1578, $\bar{x}R = 2059.09$). A statistically significant difference was found (U = 2003417.5, p = .000).
	Health Insurance	Those who claimed convenient had greater mean rank (N = 2990, $\bar{x}R = 2236.88$) than those who claimed difficult (N = 1325, $\bar{x}R = 1979.99$). A statistically significant difference was found (U = 1745012.5, p = .000).
Belonging and Love Needs	Work-Family Balance	Those who claimed convenient had greater mean rank (N = 2733, $\bar{x}R = 2232.17$) than those who claimed difficult (N = 1582, $\bar{x}R = 2029.86$). A statistically significant difference was found (U = 1959088.0, p = .000).
	Social Acceptance and Cultural Inclusivity	Those who claimed convenient had greater mean rank (N = 3005, $\bar{x}R = 2227.42$) than those who claimed difficult (N = 1310, $\bar{x}R = 1998.76$). A statistically significant difference was found (U = 1759672.0, p = .000).
	Reliable Communication Network	Those who claimed difficult had greater mean rank (N = 328, $\bar{x}R = 2241.13$) than those who claimed convenient (N = 3987, $\bar{x}R = 2151.16$), but the difference was not statistically significant (U = 626603.0, p = .209).
	Access to Internet with Reliable Connectivity	Those who claimed difficult had greater mean rank (N = 923, $\bar{x}R = 2272.86$) than those who claimed convenient (N = 3392, $\bar{x}R = 2126.75$). A statistically significant difference was found (U = 1459393.5, p = .002).
Esteem Needs	Primary Education Attainment	Those who claimed difficult had greater mean rank (N = 313, $\bar{x}R = 2448.11$) than those who claimed convenient (N = 4002, $\bar{x}R = 2135.31$). A statistically significant difference was found (U = 535509.0, p = .000).
	Secondary Education Attainment	Those who claimed difficult had greater mean rank (N = 390, $\bar{x}R = 2267.12$) than those who claimed convenient (N = 3925, $\bar{x}R = 2147.16$), but the difference was not statistically significant (U = 722817.0, p = .070).
Cognitive Needs	Tertiary Education Attainment	Those who claimed convenient had greater mean rank (N = 3479, $\bar{x}R = 2162.86$) than those who claimed difficult (N = 836, $\bar{x}R = 2137.77$), but the difference was not statistically significant (U = 1437313.5, p = .601).
	Employment Prospects and Opportunities	Those who claimed convenient had greater mean rank (N = 2637, $\bar{x}R = 2179.41$) than those who claimed difficult (N = 1678, $\bar{x}R = 2124.35$), but the difference was not statistically significant (U = 2155985.0, p = .157).

Note. Result Interpretation of Mann-Whitney U Test; Bold & Highlighted shows statistically significant output.

Table 4: Mann-Whitney U Test Results Interpretation (continued)

	HUMAN NEEDS (EC)	INTERPRETATION
Aesthetic Needs	Well-Kept Areas for Recreational Activities	Those who claimed convenient had greater mean rank (N = 2885, $\bar{x}R = 2259.09$) than those who claimed difficult (N = 1430, $\bar{x}R = 1954.05$). A statistically significant difference was found (U = 1771121.5, p = .000).
	Rich Biodiversity of Flora and Fauna	Those who claimed convenient had greater mean rank (N = 2862, $\bar{x}R = 2266.43$) than those who claimed difficult (N = 1453, $\bar{x}R = 1944.42$). A statistically significant difference was found (U = 1768917.0, p = .000).
Self-Actualisation Needs	Rights to Participate in Leadership Selection	Those who claimed convenient had greater mean rank (N = 2492, $\bar{x}R = 2271.41$) than those who claimed difficult (N = 1823, $\bar{x}R = 2002.98$). A statistically significant difference was found (U = 1988849.5, p = .000).
	Freedom of Expression	Those who claimed convenient had greater mean rank (N = 2358, $\bar{x}R = 2254.38$) than those who claimed difficult (N = 1957, $\bar{x}R = 2041.87$). A statistically significant difference was found (U = 2080030.5, p = .000).
	Opportunities Free from Corruption	Those who claimed convenient had greater mean rank (N = 2068, $\bar{x}R = 2200.97$) than those who claimed difficult (N = 2247, $\bar{x}R = 2118.46$). A statistically significant difference was found (U = 2234545.0, p = .030).
	Artistic and Cultural Freedom	Those who claimed convenient had greater mean rank (N = 2784, $\bar{x}R = 2266.27$) than those who claimed difficult (N = 1531, $\bar{x}R = 1961.12$). A statistically significant difference was found (U = 1829730.5, p = .000).

Note. Result Interpretation of Mann-Whitney U Test; Bold & Highlighted shows statistically significant output.

Table 5: Summary of Findings

Statistically Significant Difference Established (p < .000)		Difference Did Not Reach Significance
Condition 1:	Condition 2:	Condition 3:
EC Increase with Difficulty	EC Increase with Convenient	Neither Change EC
The difficulty to meet human needs increases EC, or EC is greater with difficulty to meet human needs.	The convenience to meet human needs increases EC, or EC is greater with the convenience to meet human needs.	Neither convenience nor difficulty to meet human needs increases EC, or EC does not change with the convenience nor difficulty to meet human needs.

	HON	No. Human Needs	Findings/Condition
DEFICIENCY NEEDS	Biological & Physiological Needs	1 Nutritional and Wholesome Food	Condition 3
		2 Access to Medical Care	Condition 3
		3 Clean Water (for Drinking and Washing)	Condition 1
		4 Clean and Fresh Air	Condition 2
		5 Functional and Well-Maintained Lavatory	Condition 2
	Safety & Security Needs	6 Sufficient Electrical Supply	Condition 3
		7 Affordable Housing and Conveniences	Condition 1
		8 Financial Security and Stability	Condition 2
		9 Personal Safety and Security	Condition 2
		10 Health Insurance	Condition 2
	Belonging and Love Needs	11 Work-Life Balance	Condition 2
		12 Social Acceptance and Cultural Inclusivity	Condition 2
		13 Reliable Communication Network	Condition 3
		14 Access to Internet with Reliable Connectivity	Condition 1
	Esteem Needs	15 Primary Education Attainment	Condition 1
		16 Secondary Education Attainment	Condition 3
GROWTH NEEDS	Cognitive Needs	17 Tertiary Education Attainment	Condition 3
		18 Employment Prospects and Opportunities	Condition 3
	Aesthetic Needs	19 Well-Kept Areas for Recreational Activities	Condition 2
		20 Rich Biodiversity of Flora and Fauna	Condition 2
	Self-Actualisation	21 Rights to Participate in Leadership Selection	Condition 2
		22 Freedom of Expression	Condition 2
		23 Opportunities Free from Corruption	Condition 2
		24 Artistic and Cultural Freedom	Condition 2

The mean distribution of EC items, ranging from 7.41 to 7.77, suggested that Malaysian respondents had a highly favourable sentiment towards EC (see Table 2). The respondents were asked to determine whether meeting human needs was convenient or difficult. Between 50% to 75% of them said that meeting all 24 demands was convenient (see Table 3).

The Mann-Whitney-U test examined the average fluctuation of means for all EC items between two points (convenience and difficulties). The results indicated that EC increased when almost half of the human needs were convenient to satisfy. These human needs are clean and fresh air, functional and well-maintained lavatory, financial security and stability, personal safety and security, health insurance, work-life balance, social acceptance and cultural inclusivity, well-kept areas for recreational activities, rich biodiversity of flora and fauna, rights to participate in leadership selection, freedom of expression, opportunities free from corruption, and artistic and cultural freedom. The ease with which these human needs can be met is likely to increase the external conditions influencing environmental behaviour.

The results also revealed that EC increased when four human needs were difficult to satisfy: clean water, affordable housing and conveniences, access to internet with reliable connectivity, and primary education attainment. Furthermore, EC was unaffected by the convenience or difficulty to fulfil certain human requirements, namely (i) nutritional and wholesome food, (ii) access to medical care, (iii) sufficient electrical supply, (iv) reliable communication network, (v) secondary education and (vi) tertiary education accomplishment, and (vii) employment prospects and opportunities.

DISCUSSION AND CONCLUSION

This study found that the convenience or difficulty of addressing human needs might influence the External Conditions to Environmental Behaviour. Among the crucial factors include clean air, functioning lavatories, financial stability, safety, health insurance, work-life balance, social acceptance, recreational areas, biodiversity, government involvement, freedom of speech, corruption-free opportunities, and cultural freedom. These factors are favourable when they are satisfied, demonstrating that a supportive atmosphere promotes sustainability. Nevertheless, factors like nutritional food, medical care, electricity supply, communication networks, and educational achievements, including employment opportunities, appear to have less direct impact. This suggests that while these factors are essential for overall well-being, they may not directly increase or decrease EC. In conclusion, External Conditions to Environmental Behaviour may vary across diverse human needs, highlighting the intricate interplay between the external catalysts to environmental behaviour and the availability of essential necessities.

Furthermore, the external conditions that encourage eco actions can be positively impacted by the difficulty of satisfying specific human wants. The following capture some of these reasons:

- **Clean Water (for Drinking and Washing):**
Water shortages and pollution are environmental challenges that might become more apparent when people face difficulties in obtaining clean water. People and communities who are dealing with water scarcity are more likely to save water and support sustainable water management programs, that aim to make water available to everyone while also protecting the environment.
- **Affordable Housing and Conveniences:**
Having Affordable housing and basic utilities might be a prominent challenge, but when faced with such difficulties, communities can become more resilient and inventive. Sustainable living techniques, such as energy efficiency and waste reduction, may help residents in underprivileged regions make the most of limited resources by reducing housing-related expenditures and improving living conditions.
- **Access to the Internet with Reliable Connectivity:**
Local involvement and grassroots initiatives in environmental education and action may be bolstered by limited internet access. Local networks and face-to-face communication can help communities overcome digital gaps, thus strengthening links and empowering collective action for environmental protection and advocacy.
- **Primary Education Attainment:**
Local efforts and community-led educational programs that focus on sustainability and environmental awareness might emerge when primary education targets are unmet. Problems in underprivileged areas schools could inspire new ways of teaching about the environment and provide local kids with the necessary tools to become environmental champions.

Collectively, the challenge of addressing these basic necessities highlights preexisting socioeconomic gaps while simultaneously inspiring environmentally conscious actions and solutions spearheaded by the community. Resilience, sustainable development, and environmental justice and fairness may be advanced on local and global levels by tackling these issues. While these obstacles are substantial, they also provide chances for groundbreaking environmental action and beneficial ecological effects.

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**QUANTIFYING THE COOLING EFFECT FOR URBAN PARK
MICROCLIMATE: AN ANALYSIS OF *PELTOPHORUM
PTEROCARPUM* SPECIES IN KLCC PARK, KUALA LUMPUR,
MALAYSIA**

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Abstract

Many cities worldwide are concerned with the urban heat island (UHI) effect. Rising temperatures negatively impact urban microclimates. However, vegetation can help to mitigate this effect. A particular tree species, *Peltophorum pterocarpum* (Yellow Flame) is the subject of this study's preliminary inquiry into its cooling effects. This study used a particular technique and statistical analysis to examine the unique cooling ability of *Peltophorum pterocarpum* in the urban park setting. This study will estimate the *Peltophorum pterocarpum* species' overall cooling effect by considering density and surface. It has led to a correlation coefficient of [0.75], signifying the magnitude and direction of the association between *Peltophorum pterocarpum* density and surface temperature. The species exhibits provided substantial shade coverage and resulting in a notable reduction in temperature. The outcomes of this research are expected to provide valuable insights for urban microclimate management, particularly in the context of parks and similar environments. By quantifying the cooling effect of *Peltophorum pterocarpum*, this study contributed evidence-based guidelines for urban planners and landscape designers, facilitating informed decision-making regarding vegetation selection and integration. Implementing these findings can effectively alleviate the urban heat island (UHI) effect, enhancing the liveability and sustainability of urban areas.

Keywords: Cooling, Urban Park microclimate, Urban Heat Island (UHI), *Peltophorum pterocarpum*

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INTRODUCTION

The urban heat island effect, characterized by elevated temperatures are more prominent in urban areas compared to surrounding rural regions and has become a growing concern in cities worldwide. Resulting in adverse impacts on human health, energy consumption, and overall urban comfort have propelled the exploration of strategies to mitigate this effect. Among these strategies, the cooling effect of vegetation has emerged as a promising solution, offering multiple benefits for urban microclimates. KLCC Park, situated in the heart of Kuala Lumpur, Malaysia, is a renowned urban green space known for its aesthetic beauty and recreational value. However, the specific contributions of vegetation, particularly tree species, in reducing this park's urban heat island (UHI) effect still need to be explored. Hence, this research aims to quantify the cooling impact of vegetation on the urban microclimate of KLCC Park, with a specific focus on analysing the *Peltophorum pterocarpum* species. *Peltophorum pterocarpum* was chosen because of its prominence in KLCC Park and its potential as a significant contributor for temperature reduction. Thus, this study focuses into the cooling capabilities of *Peltophorum pterocarpum*, thoroughly examining surface temperatures in both paved and turfed areas beneath its canopy. This investigation also considers factors such as tree density and surface coverage to gauge the efficacy of *Peltophorum pterocarpum* in reducing the urban heat island effect within the area of KLCC Park. This study involved a quantitative assessment of its cooling influence. The study will provide insights into the tree species' effectiveness in alleviating the urban heat island effect and enhancing the microclimate conditions within KLCC Park. Understanding the cooling effect of *Peltophorum pterocarpum* and its specific contributions to the urban microclimate of KLCC Park holds substantial practical implications. It can provide evidence-based guidance for urban planners and landscape architects in optimizing the selection and placement of tree species within the park to enhance its cooling potential. Additionally, the findings from this research can contribute to a broader urban microclimate management strategy, aiding in the development of sustainable and climate-resilient cities. A thorough literature analysis will synthesize existing knowledge on the cooling effect of vegetation on urban microclimates, the particular significance of tree species, and the methodology used to quantify this effect to meet study objectives. This research will involve field measures, including surface temperature monitoring, to determine the cooling effect of *Peltophorum pterocarpum* trees for KLCC Park. Through this study, it will be possible to understand how *Peltophorum pterocarpum* cooling capacity and its effect on the urban microclimate of KLCC Park. Ultimately, the findings will add to the knowledge of managing urban microclimates and offer helpful information for sustainable urban planning and design.

Urban Microclimate and Urban Heat Island (UHI)

Urban microclimate refers to the localized climatic conditions within urban areas that differ from the surrounding rural environment (Priya, U. K and Senthil, R., 2021; Wong, N. H., et al. 2021). It resulted from various interactions between urban structures, land use, and atmospheric processes. Urban microclimates often exhibit distinct characteristics, including elevated temperatures, altered wind patterns, and modified humidity levels (Abdullah, S., et al. 2021). The Urban Heat Island (UHI) phenomenon arises from sunlight that the earth's surface cannot absorb due to urban areas comprising skyscrapers, concrete structures, and paved roads (Yang, L., et al. 2016). The previous study done by Kim, S. W., and Brown, R. D. (2021) mentioned that lack of space for heat absorption by the earth's surface results in elevated temperatures during both day and night, causing the released thermal heat to intensify in urban areas during the night. In Kuala Lumpur, the city centre registers a temperature of 32°C, while the outskirts in Titiwangsa report 26°C (Isa, N. A., Wan Mohd, W. M. N., and Salleh, S. A., 2017). This clearly signals the presence of the Urban Heat Island effect within urban areas. This phenomenon is attributed to various factors, including the prevalence of glass-covered building structures incapable of absorbing the existing heat. For instance, the KLCC Tower, constructed with glass facades, substantially exacerbates most of the UHI effect in Kuala Lumpur (Elsayed I.S., 2012a; Malaysian Meteorological Department, 2023). According to Elsayed I.S., (2012a, 2012b), the diminishing presence of greenery in Kuala Lumpur's urban areas impedes the city's heat absorption process, primarily due to the scarcity of vegetation and shade. Green plants and trees are vital in urban environments as they indirectly contribute to lowering local temperatures from 21°C to 18°C, thereby mitigating the UHI effect (Elsayed I. S., 2006.; Mitchell, 1953, 1961). Efforts to mitigate UHI effects involve various strategies, including promoting green infrastructure, implementing cool roofing and pavement technologies, and urban planning policies that encourage sustainable development practices (Brown, Robert., 2011; Soydan, O., 2020). Vegetation, including trees and green spaces, is vital in mitigating UHI by providing shade, evaporative cooling, and reducing heat absorption. By understanding the dynamics of urban microclimate and UHI is crucial for developing effective strategies to combat the adverse impacts of excessive urban warming. This knowledge formed the backdrop for the investigation into the cooling effects of *Peltophorum pterocarpum* in KLCC Park, Kuala Lumpur.

The Role of Vegetation in Cooling Effect

Vegetation, including trees, shrubs, and green spaces, served as a natural climate regulator in urban environments. These green elements play a crucial role in mitigating the adverse effects of urbanization, particularly the UHI effect. Their

contributions to urban cooling can be attributed to several key mechanisms: (i) shade and temperature reduction- one of the most apparent cooling effects of vegetation is the provision of shade (Elsayed, I. S., 2012b; Lindberg, F., & Grimmond, C. S. B., 2011; Akbari, H., Pomerantz, M., & Taha, H. 2001). Previous study by Akbari H., et al. (1992) and Shahidan, Mohd. F., et al. (2010) stated the trees and canopy cover create sheltered areas that reduce direct exposure to solar radiation, leading to cooler surface temperatures. In densely populated urban areas, these shades can significantly lower ambient temperatures during hot summer months, making outdoor spaces more comfortable for residents, (ii) transpiration and evaporative cooling- vegetation, through a process called transpiration, releases water vapor into the atmosphere (Morabito, M, et al. 2021; Jiao, M, et al. 2021). This evapotranspiration process cooled the surrounding air and surfaces. As plants draw water from the soil and release it into the atmosphere, they effectively dissipate heat and reduce the local temperature. This cooling effect is particularly noticeable during periods of high temperatures and can counteract the heat generated by urban activities (Yao, L., Sun, S., Song, C., Wang, Y. and Xu, Y., 2022) and (iii) urban planning and green infrastructure- Urban planners and policymakers increasingly recognize the importance of green infrastructure, such as urban parks, green roofs, and street trees, in urban cooling strategies (Lindberg, F., & Grimmond, C. S. B., 2011). Integrating vegetation into urban planning and design can help to create a more sustainable and liveable cities while addressing the challenges posed by urban warming. Understanding the multifaceted role of vegetation in urban cooling is essential for developing effective strategies to combat the UHI effect and enhance the quality of urban environments. This knowledge focuses on the significance of analysing the cooling effects of *Peltophorum pterocarpum* in KLCC Park, Kuala Lumpur, as it contributed to the broader understanding of urban green infrastructure's impact on microclimates and human comfort.

***Peltophorum pterocarpum*: Specific Cooling Effect**

Peltophorum pterocarpum, commonly known as Yellow Flame tree, is a tropical tree species native to regions in Southeast Asia, including countries like India, Sri Lanka, Malaysia, and Indonesia. While it is primarily valued for its ornamental qualities, this tree species also has some specific cooling effects, which can be beneficial for the environment and urban areas. Details about the specific cooling effect of *Peltophorum pterocarpum*: (i) shade production- the tree's broad canopy and dense foliage create a substantial area of shade underneath it. This shade helps in reducing the temperature of the surrounding environment by blocking direct sunlight and preventing solar radiation from heating the ground (ii) temperature reduction- the shade cast by the Yellow Flame tree can lead to a significant reduction in ambient temperature. According to a

study done by Edward F. and Dennis G. (2011), in urban areas, where heat-absorbing surfaces like concrete and asphalt do contribute to higher temperatures (UHI effect), the presence of these trees can counteract the heat buildup and create microclimates with lower temperatures, (iii) cooling of surfaces. Based on previous study done by Li, Y. C., et al. (2019), stated that the shade provided by the Yellow Flame tree extends not only to the air but also to the surfaces beneath it. This includes the ground and any nearby buildings or structures. By preventing these surfaces from absorbing excessive heat, the trees helped maintain lower temperatures in its immediate surroundings, and (v) urban heat island mitigation- In urban planning, *Peltophorum pterocarpum* trees are often used as part of strategies to mitigate the urban heat island effect (Jain, B., Pancholi and Jain, R., 2011). Introducing greenery and shade in urban environments they help reduce the overall temperature differential between urban and rural areas. In summary, the cooling effect of *Peltophorum pterocarpum* is primarily due to its shade production, transpiration, and ability to reduce surface temperatures. These specific cooling mechanisms make it a valuable addition to urban landscapes, contributing to local temperature reduction and enhancing the overall comfort of outdoor spaces.



Figure 1: Sample chosen for field measurement: *Peltophorum pterocarpum*
Source: Author, 2022

DESIGN & METHODS

This research utilizes an exploratory methodology to gather data through observation and case studies. The selection of *Peltophorum pterocarpum* was noted within two specific areas, turfing and pavement, covering 100 square meters (10 meters x 10 meters). Quantitative data was collected at various times over three days to assess surface temperature variations visually.

Context of the Study

This research has selected KLCC Park as its focal site for the following reasons: its central location and urban green space- nestled in the core of Kuala Lumpur. KLCC Park is an ideal hub for executing various fieldwork methodologies, conducting surveys, making observations, and collating essential data. The study of KLCC Park presents an opportunity to delve into the crucial role of urban green spaces within a bustling cityscape. This exploration encompasses the impact of such spaces on the urban populace's well-being, their roles in biodiversity preservation, fostering environmental sustainability, and promoting community engagement.

Data Measurement: Environmental Climate Data

This study's focus is solely on environmental climate data, namely one (1) variable out of five (5) variables that influence the microclimate in urban open spaces, which is surface temperature. Variables concerning canopy transparency rate (Daylight luminance), such as the flow of absorbed heat (thermal) by tree canopies, humidity, air temperature and wind speed, are not included in this study as they have minimal impact on the ambient temperature in the surrounding areas (Sharmin, M., et al. 2023; Liu, H., et al. 2023). The primary goal of the study is to concentrate more on the microclimate factors (surface temperature) to quantifying the cooling effect in grassy and turfed areas beneath the canopy. The categories of data to be collected are surface temperatures for two (2) study spots. The environmental climate data collection procedure was done for eight (8) hours, from 9:00 am until 5:30 pm, with a 30-minute interval for each study spot. Each day represented eighteen (18) data readings taken for the two (2) study areas. The selection of months for fieldwork was based on the analysis of Kuala Lumpur's Annual Climate Data. This study area was systematically observed separately for a total of 3 days: in May 2023 (1 day), July 2023 (1 day), and September 2023 (1 day). According to the data by Malaysian Meteorological Department (MET Malaysia, 2023), climate change make July the hottest month in 2023. Consequently, 54 sets (18 readings per day x 3 days) of data were collected for the measured study parameters in each study spot. The selection of study spots with *Peltophorum pterocarpum* trees covered an area of 100 square meters (10 meters x 10 meters). Spot 1 and Spot 2 were densely planted vegetation comprised of eight (8) tree stems within an area of 100m², with

canopies exceeding 4.5 meters. All gathered data will subsequently undergo analysis. Relationships between each microclimate factor (surface temperature) of the *Peltophorum pterocarpum* trees at each study spot were tabulated into charts and graphs using Microsoft Excel and statistically analysed using the Statistical Package for the Social Sciences (SPSS) software. This study used appropriate tools (instruments) to facilitate data collection at the study site, ensuring efficient and accurate results. Some of the supportive tools used include: (i) FLUKE Thermal Imager to measure surface temperatures ($^{\circ}\text{C}$) and captured temperature images for specific areas. This tool can display thermal profiles and the recorded surface temperatures and (ii) OAKLON TemTestr to measure surface temperatures ($^{\circ}\text{C}$), and it allowed for close measurement of any object. The procedure for measuring the surface temperature measurements within the tree canopies were taken using the OAKLON TemTestr. This device was positioned beneath the tree canopy on the pavement and turf surfaces. The device was placed 1 meter below the canopy and 1 meter away from the designated research surface area.

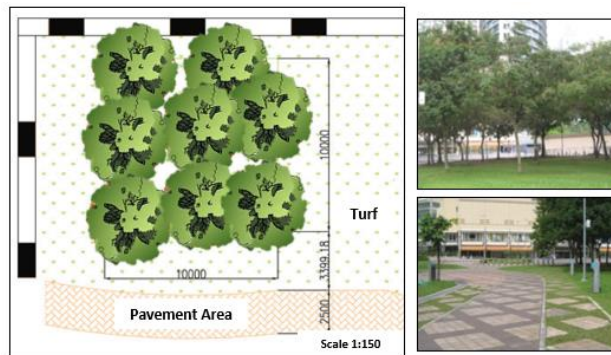


Figure 2: Spot (1) refers to dense vegetation beneath the grassy canopy surface
 Source: Author, 2023

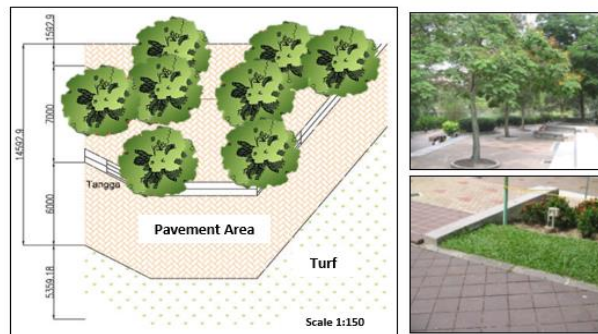


Figure 3: Spot (2) refers to dense vegetation beneath the pavement canopy surface
 Source: Author, 2023

FINDINGS & ANALYSIS

The findings summarized that surface temperature data collected from Spot (1) with a turf canopy and Spot (2) with a pavement canopy over three days (March, May, and July 2023). The results revealed distinct temperature trends between the two sites. Specifically, Spot (1) within the turf canopy exhibited the lowest temperatures at 9:00am, 9:30am, and 2:00pm. In contrast, Spot (2) in the pavement canopy depicted the highest temperatures between 2:30pm and 3:30pm. The lowest surface temperature of 25.0°C and 25.5°C was recorded between 9:00 and 9:30 in the morning in both the turf canopy area (Spot 1) and the pavement canopy area (Spot 2). The peak surface temperature reached at Spot 1 occurred at 2:00 - 2:30pm, measuring 30.5°C. Meanwhile, the highest temperature of 32.5°C was recorded at 2:30 in the afternoon in the pavement canopy area (Spot 2). Spot 1 exhibit surface temperature fluctuations throughout the day, reaching its peak around 2:00 - 2:30pm. Conversely, Spot 2 generally maintains slightly higher temperatures and reached its peak around 3:00 - 3:30pm. There was an increase of temperature at the pavement canopy area (Spot 2) of average 32.3°C at 2:30 in the afternoon, rising from 28.5°C to 33.0°C. In contrast, in the turf canopy area (Spot 1), the surface temperature with an average of 28.2°C from May, July and September 2023 at 2:30 in the afternoon. Throughout the three-day observation and surface temperature measurements, the average surface temperature analysis between 9:00 in the morning and at 5:30 in the evening at the turf canopy area (Spot 1) was lower, at 27.0°C, compared to the surface temperature at the pavement canopy area (Spot 2) at 30.0°C, showing a difference of 3.0°C. Across all time intervals, Spot 2 consistently exhibit slightly higher average surface temperatures in comparison to Spot 1. Moreover, while both locations displayed temperature fluctuations, Spot 2 notably registered higher temperatures, particularly during the midday period. The surface temperature analysis for Spot 1 revealed a gradual rise in temperatures from May, recorded at 27.7°C, to July, showing a slight increase to 28.2°C, followed by a relatively stable surface temperature in September, recorded at 28.1°C. Conversely, Spot 2 exhibited a distinct surface temperature pattern, displaying a substantial increase in temperatures from May, marked at 28.4°C, to July, recording a peak of 29.3°C, before experiencing a slight decline in September to 28.8°C. Based on Figure 4, the average temperature recorded for Spot 1 across all time intervals was 27.7°C, while for Spot 2, it was slightly higher at 28.4°C.

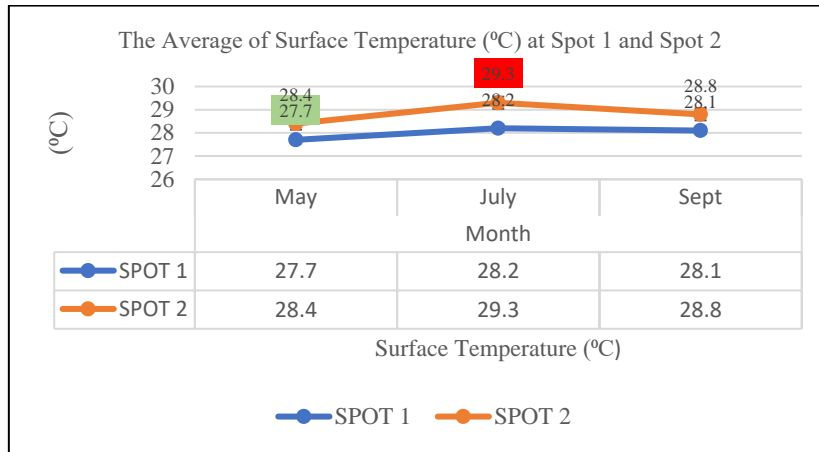


Figure 4: The Average of Surface Temperature (°C) at Spot 1 and Spot 2
 Source: Author, 2023

These observations underlined varying surface temperature fluctuations across the months for both Spot 1 and Spot 2, showcasing distinct changes in surface temperature trends between the different periods and different covered or shaded. When compared, the surface temperature variances between Spot 1 and Spot 2 across different months revealed consistent differences. In May, Spot 2 displayed temperatures approximately 2.54% higher than Spot 1, recording 28.4°C compared to Spot 1's 27.7°C. This trend continued up until July, where Spot 2 registered surface temperatures approximately 3.90% higher than Spot 1, with readings of 29.3°C and 28.2°C, respectively. Similarly, in September, Spot 2 maintained temperature around 2.50% higher than Spot 1, recording 28.8°C compared to Spot 1's 28.1°C. These percentage differences consistently indicated higher surface temperatures in Spot 2 compared to Spot 1 across the observed months. Across all analyses, Spot 2 consistently demonstrated higher surface temperatures than Spot 1, exhibiting noticeable fluctuations in May, July, and September. Notably, July is the warmest month for both Spot 1 and Spot 2. The result of the correlation coefficient between a *Peltophorum pterocarpum* density (X) of 8 and surface temperatures (Y) of 27.7°C, 28.2°C, and 28.1°C was calculated to determine their relationship, resulting in a correlation coefficient of [0.75], indicating the strength and direction of the relationship between *Peltophorum pterocarpum* density and surface temperature. This suggested that higher tree density at this fixed value correlates significantly with higher surface temperatures within the dataset, implying a consistent association between the two variables.

DISCUSSION

After assessing the influence of *Peltophorum pterocarpum* species on the urban microclimate of KLCC Park. The data collected unveiled a compelling association between these plants and temperature regulation, emphasized their potential significance in combating urban heat island effects. Based on the analysis and findings, the results indicated that:

- a) Difference of surface between Spot 1 and Spot 2: Consistently across the recorded months, Spot 2, designated as the pavement area, consistently demonstrated slightly elevated temperatures compared to Spot 1, which represented the turf area. The nature of the turf area (Spot 1) and pavement area (Spot 2) likely contributed to the observed temperature differences, with pavement surfaces typically absorbing more heat than turf surfaces. This finding showed that it can be attributed to the inherent properties of these surfaces. Pavement surfaces have a higher capacity to absorb and retain heat when compared to turf surfaces due to their composition and thermal properties. The previous study conducted by Shamsaei, M.; Carter, A.; Vaillancourt, M. A (2022), highlighted that pavement, being darker and having lower albedo, tend to absorb more solar radiation and heat, leading to higher surface temperatures in urban areas. In addition, research by Hachem et al. (2016) in the journal *Landscape and Urban Planning* also discusses how surface materials, particularly pavements with higher thermal conductivity, contributed significantly to increased urban heat island effects due to their heat-absorbing nature.

- b) Tree density: The consistent *Peltophorum pterocarpum* tree density set at 8 displayed a noticeable trend where surface temperatures tend to consistently rise. This observation underlined the significant influence of constant tree density on surface temperatures, primarily attributed to shading effects and enhanced evapotranspiration. A previous study done by Dina and Lin (2023) stated the vegetation successfully lowered air temperature (T_a) and minimized exposure to solar radiation on pavement concrete, thereby alleviating outdoor heat stress. Hence, maintaining a specific tree density can impact surface temperatures by reducing direct exposure to sunlight through increased shading. This shading mechanism mitigates the absorption of solar radiation, subsequently contributing to lower surface temperatures within shaded areas. Sharmin, M., Tjoelker and M.G., Pfautsch, S. (2023), highlighted the role of increasing tree density in urban spaces, emphasizing how trees' shading properties effectively reduce direct solar radiation, consequently lowering surface temperatures. Additionally, Abdi, B., Hami, A., Zarehaghi, D. (2020) and Streiling, S. (2003) accentuate the impact of higher tree density on surface

temperature reduction, interpreted how increased shading and enhanced evapotranspiration processes led to greater cooling effects. These studies collectively support the notion that maintaining higher tree density can effectively contribute to cooler surface temperatures by leveraging shading effects and intensified moisture loss through transpiration and evaporation, thereby shaping a more favourable microclimate.

CONCLUSION

To comprehensively address the challenges posed by urban heat islands, it becomes evident that specific recommendations for further study are necessary. While the selected variables, surface temperature, aligns with the primary goal of quantifying the cooling effect in grassy and turfed areas beneath the canopy, excluding other pertinent variables restricts the study's overall comprehensiveness. Future research endeavours should adopt a more inclusive approach, delving into additional microclimate factors to offer a more holistic understanding of cooling dynamics in urban open spaces. The initial focus should concentrate on detailed research into the nuanced impacts of diverse tree species on microclimate regulation, identifying those that excel in optimal shading and evapotranspiration. Simultaneously, the importance of sustained, long-term monitoring becomes apparent, evaluating how changes in tree density and surface materials affect microclimates across varying seasons. Integrating tree planting and surface material selection into urban planning strategies is important for establishing more resilient and thermally comfortable urban environments. Concurrently, efforts should be directed towards exploring methods to engage communities in tree-planting initiatives and elevate awareness about the heat mitigation benefits of vegetation. In conclusion, sustained investigation into specific tree species, ongoing monitoring, innovative urban planning, and proactive community involvement hold significant promise in developing effective strategies to counteract the urban heat island effects and foster sustainable, habitable urban spaces.

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BIOPHILIC WORKSPACES: A COMPARATIVE STUDY OF VISUAL ATTRIBUTES IN GOVERNMENT INDOOR OFFICE ENVIRONMENTS IN PUTRAJAYA, MALAYSIA

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Abstract

The paper examines the visual features of biophilic design patterns in indoor workspaces in government office buildings in Putrajaya. It aims to highlight and identify the biophilic elements in these workspaces. The perceived perception of biophilic design elements is recorded based on inventory lists using the author's expertise—the comfort and health of building occupants, mainly indoors, need to be considered. Visual benefits from interacting with nature, directly and indirectly, are abundant, including improving mood, thus contributing to enhanced focus and concentration. Based on the observation conducted on the indoor workspaces in the government offices in Putrajaya, Malaysia, the prevalent elements identified are the usage of natural lighting and diffused light entering from windows, especially in the cellular offices, which indirectly provides an external view outside the office. The presence of natural elements, such as potted plants and flowers, pictures of nature, botanical elements at the door, building panels, and pillars, can be seen. Biophilic design in indoor working spaces must be encouraged to cater to office users' physical and mental well-being, thus improving their performance at work.

Keywords: Biophilia, Biophilic Design Attributes, Government Office Malaysia

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INTRODUCTION

Biophilic design integrates natural elements into the built environment, aiming to connect humans and nature, benefiting physical and mental well-being. Biophilic design can be implemented in various human environments, including indoor workspaces. Working long hours indoors could impact the mental and physical health of office occupants. Biophilic design can also be categorised as an artificial environment mimicking nature, providing similar positive effects. Applying biophilic design to working spaces can help reduce the pressure and stress of working indoors as they restore concentration, improve focus, and provide healing through sustained engagement and interactions. The therapeutic essence of nature has been proven in various studies (Khozaei et al., 2022; Hartig & Staats, 2006; McNeel, 2021; Shosha, 2021; Yassein & Ebrahiem, 2018). Nature in the built environment contributes to the users' safety, comfort and health and the long-term use of the buildings, which is one of the approaches to sustainable design practices (Aduwo & Akinwole, 2020).

LITERATURE REVIEW

Biophilic Elements and Dimension

Human well-being is highly influenced by its physical surroundings. This can also be applied to indoor spaces such as offices. The optimal surroundings necessary for a human's mental and physical survival need to be comprised of a multisensorial nature. The exposure to nature enhances healing, improves moods, and elevates focus and concentration with a sense of calm and liberation. Office settings with natural lighting, natural ventilation, and other environmental features improve worker performance, lower stress, and increase motivation. Contact with nature has been linked to cognitive functioning on tasks requiring concentration and memory (Ibrahim et al., 2021; Kellert et al., 2008). The sensory, mental, physiological, spiritual, and physical benefits of engagement with the natural environment are imperative for improving human well-being. Features that need to be examined and identified on-site are based on Stephen Kellert's Biophilic Design Principles. Kellert, in 2008, formulated dimensions and their attributes.

Dimension of Biophilic Design and its Attributes (Kellert, 2008):

- A. Environmental Features: 1) Color, 2) Water, 3) Air, 4) Sunlight, 5) Plants, 6) Animals, 7) Natural materials, 8) Views and Vistas, 9) facade greening, 10) Geology and landscape, 11) Habitats and ecosystems, 12) Fire.
- B. Natural Shapes and Forms: 1) Botanical motifs, 2) Tree and columnar supports, 3) Animal (mainly vertebrate) motifs, 4) Shells and spirals, 5)

- Egg, oval and tubular forms, 6) Arches, vaults, domes, 7) Shapes resisting straight lines and right angles, 8) Simulation of natural features, 9) Biomorphy, 10) Geomorphology, 11) Biomimicry
- C. Natural Patterns and Processes: 1) Sensory Variability, 2) Information Richness, 3) Age, change and the patina of time, 4) Growth and efflorescence, 5) Central focal points, 6) Patterned wholes, 7) Bounded spaces, 8) Transitional spaces, 9) Linked series and chains, 10) Integration of parts to wholes, 11) Complementary contrasts, 12) Dynamic balance and tension, 13) Fractals, 14) Hierarchically organised ratios and scales
- D. Light and Space: 1) Natural light, 2) Filtered and diffuse light, 3) Light and shadow, 4) Reflected light, 5) Light pools, 6) Warm light, 7) Light as shape and form, 8) Spaciousness, 9) Spatial variability, 10) Space as shape and form, 11) Spatial harmony, 12) Inside-outside spaces
- E. Place-Based Relationships: 1) Geographic connection to place, 2) Historic connection to place, 3) Ecological connection to place, 4) Cultural connection to place, 5) Indigenous materials, 6) Landscape orientation, 7) Landscape features that define building form, 8) Landscape ecology, 9) Integration of culture and ecology, 10) Spirit of place, 11) Avoiding Placelessness
- F. Evolved Human-Nature Relationships: 1) Prospect and Refuge, 2) Order and complexity, 3) Curiosity and enticement, 4) Change and metamorphosis, 5) Security and protection, 6) Mastery and control, 7) Affection and attachment, 8) Attraction and beauty, 9) Exploration and discovery, 10) Information and cognition, 11) Fear and awe, 12) Reverence and spirituality.

RESEARCH METHODOLOGY

This paper examines the biophilic design features in indoor workspaces and their physical design environment. Firstly, a desk study is conducted to study the site selection, the criteria of biophilic design in workplaces, and the method used to carry out the research. The elements of biophilic design that will be identified are adapted from Kellert's "Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life" (2008). The site selected is the government office workspaces in Putrajaya. The workspaces selected for the study are namely the Ministry of Science, Technology and Innovation (MOSTI) in Precinct 1, Palace of Justice and Perbadanan Putrajaya in Precinct 3, Ministry of Agriculture and Food Industry (MAFI) in Precinct 4, and Ministry of Tourism, Arts and Culture in Precinct 5. The method used in this study is a structured observational study where the researcher carefully observes the visual characteristics of the workspaces based on Kellert's work and relies upon the knowledge gathered from literature reviews. No intervention or amendment is made to the workspaces. The

qualitative method was used. Data analysis is done by comparison; in this context, biophilic elements from different workspaces have the same characteristics. From the results, the existing biophilic elements are presented and discussed.

ANALYSIS AND DISCUSSION

Findings from the data collection revealed that the indoor offices among the government buildings in Putrajaya are mostly comprised of environmental features, natural shapes and forms, as well as light and space. The most dominant biophilic design elements from the environmental features are sunlight, colour and indoor plants. The most prevalent elements for the natural shapes and forms are the botanical motifs, mainly leaves and natural abstract patterns on the doors and pillars, as well as arches, vaults, and domes, which can be seen in the hallway. These are primarily visible in the shared common spaces such as the lounge, waiting area, and walkway.

The cellular offices have natural lighting from the windows, whereas the open-plan offices are mostly occupied with typical bright wall colour selection and cool colour partitions. The counter service area mostly consists of botanical motifs on the pillars and furniture. Ample natural lighting is also needed in open-floor cubicle offices to allow clearer thinking and reduce movement, thus improving the workers' productivity.

Generally, the offices are occupied with potted plants and plants in the planter box that are mostly artificial for easy maintenance. There are also potted plants that are either provided by the organisation or brought to the office by the occupants. There is also an abundance of pictures and images of nature, such as flowers, oceans, and forests, mounted on the wall, giving the users an indirect experience of nature. The usage of wooden finishes for the door and ornamental patterns not only improves the visual characteristics of the office buildings but also provides the image of a professional working ethos for public servants.

The indoor workspace of the government offices lacks attributes of natural patterns and processes, place-based relationships, and evolved human-nature relationships based on the biophilic design attributes. There is no visible indication of an ecological, historical or geographical connection to the indoor office, possibly due to the nature of the focus-oriented space rather than a space of healing or a space for the community. There is also minimal to no application of natural elements such as water elements and natural materials, and façade greening is highly visible among the office buildings. This condition might be prevalent due to high maintenance and a lack of awareness of how these elements could positively affect office occupants.

The number of indoor plants is also limited in the open-plan cubicle offices. Maximising the application of plants, whether in the shapes, forms, or mimicry of vegetation, can be applied to the wall as there are limited spaces to

include the plants. More consideration of these elements is needed to improve the visual aspects of the office, as suggested by Lottrup et al. (2013). It is noted that most indoor areas do not possess sensorial characteristics such as tactile, olfactory, and auditory senses. Interior designers or planners need to explore these attributes for future indoor workspaces, especially in the government sector.

1. Palace of Justice (PoJ)

In general, the indoor office in the Palace of Justice utilises the soft nude colours as wall finishing, which could bring a sense of calm to the occupants. Pictures of the natural environment can be seen throughout the indoor spaces. Botanical flower motifs can be seen around the indoor area of the building. The biophilic design elements of 'integration of part to wholes' are present based on the colour selection of furniture, which creates a sense of spatial harmony in the compound. The use of arches can be seen in the hallway of the building, which gives off organic and fluid design characteristics.

Based on the observation, the cubicle workstations generally possess little to no application of biophilic design apart from the colour selection and artificial indoor plants. However, the employees must make optimal use of their immediate working stations. Some workspaces apply biophilic design by placing artificial or small indoor plants in their workspaces. The counter workspace, where most of the support group employees are located, has botanical motifs visible on the counter area with a strong colour selection, which can improve the mood of the workspace compared to the rest of the working spaces in the building. Indoor plants are mostly artificial; however, still provide an aesthetic function in the room. In the cellular office, sunlight enters the indoors through the window, providing a sense of serenity and energising for office users. Views and vistas can be obtained through windows, where vegetation from outside can be seen.

To maximise the impact of biophilic design on the employees, the employees may include small potted plants or place the imagery of natural environments on their work desks or immediate workspaces. Interior designers of the workstation need to consider the implementation of good colour on the cubicle, floor and the walls in the indoor office to provide a spirit of working or liveability, as the downside of indoor open floor working spaces is little to no availability of windows and natural ventilation that can improve their working conditions.



Figure 1: Biophilic Design Elements identified in working spaces in the Palace of Justice

2. Ministry of Science, Technology and Innovation

Office spaces in the Ministry of Science, Technology and Innovation building provide private office rooms with ample natural lighting and curtain shades. The artificial indoor plants can also be seen in the corner of the room. However, the open floor workspaces lack the application of environmental features that could affect the occupants' performance at work, such as water elements, access to direct sunlight, windows, natural ventilation, and natural materials. The application of biophilic design such as organic forms, arches, and botanical motifs, including environmental features such as plants, are mostly present outside the working premises such as the big halls, hallways, lounge and lobby area, which cannot directly provide a connection to nature for the working employees. Some parts of the open-floor office have windows that provide a wide outside view, but some are enclosed in the middle of the building despite the lack of physical biophilic attributes.

Open-floor cubicle offices cater to social interactions among office occupants. The natural elements of biophilic elements such as water, where they allocate an aquarium, indoor living plants and an external view of nature are present in the indoor working area. The enclosed part of the workspaces, such as the cubicle, provides the occupants with a sense of privacy and security and encourages concentration. The lack of natural features in the designated work area must be improved.

Visual biophilic features such as images of landscapes, scenes, and natural forms can be applied to the walls or desks to increase the direct connection with nature and improve the mood, thus reducing the employees' stress. The colour selection of walls can be changed to cool colours instead of warm colours to elevate positive moods for office occupants.



Figure 2: The present biophilic design attributes in the Ministry of Science, Technology and Innovation

3. Ministry of Tourism, Arts and Culture

In the Ministry of Tourism, Arts and Culture building, the office layout area is divided into rather typical settings in which private offices are placed in the outer part of the floor plan while open floor offices are placed at the centre of the building. In the private office, the provision of the windows allows natural lighting to enter the workspace, providing a sense of calm and focus. Indoor plants are also present in the room, suggesting the need for beauty and colour vibrancy in a workspace. In an open-place cubicle workspace, the use of bright colours for the walls and partition provides a sense of repetition and monotonousness; thus, the application of a variety of biophilic elements is crucial to increase work performance.

The spatial harmony and integration of parts to the whole can be felt and seen in the counter area. The visual biophilic design characteristics identified in the office buildings are mostly in the same colour palette: the warm earth tone such as brown, beige and green. The repetitive elements, such as organic forms and botanical motifs, bring a sense of security to users and the space occupants. In general, indirect natural elements such as pictures, artificial plants as decorations, and floral motifs on doors provide visual experiences for the users.

Visual biophilic design characteristics identified in the workstations, such as warm earth tones and visible imagery of natural environments, such as pictures of scenery, water elements and sculptures, provide a sense of spirit to the office employees. Improvement in physical or direct connection towards nature needs to be highlighted, such as the application of green walls or small-scale water elements that could improve the work motivations for the employees.

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Figure 3: The visual attributes of biophilic design identified in the government office in the Ministry of Tourism, Arts and Culture

4. Perbadanan Putrajaya

The most prominent visual characteristic of biophilic design in Perbadanan Putrajaya is the application of the natural environment inside and outside the building. There are outdoor landscapes with colourful water features and soft landscapes outside the building, as well as a view of the lake and surrounding area with available windows. However, it can mostly be enjoyed by private office employees. Pictures with nature images can be seen on the private office wall. The use of wooden wall finishes resembles tree bark colours, providing a warm tone to the room that could give a sense of concentration. Multiple work desks encourage social interaction that makes workers productive. In the counter service area, the application of cool colours resembling water and sky with botanical motifs and suitable lighting provides a sense of relaxation for the occupants. In the open plan offices, the usage of moss green colour for the partition that resembles leaf colours provides a sense of calm. The imagery of abstract paintings that resemble nature, ample outside view with wide windows and abundant natural lighting encourages the feeling of extension from the outside into inside spaces. These elements could improve mood and mental focus for the occupants.

Restoring mental health and improving employee productivity are important as they are interrelated. Providing sensorial connectivity with nature by emphasising visual characteristics such as green walls, potted plants, or water elements indoors, especially near or at immediate workstations, can elevate concentration and improve the moods of the employees. Too many natural elements in the offices could create an uncomfortable working environment; thus, an optimal volume is required.



Figure 4: Visual biophilic design characteristics exhibited by the Perbadanan Putrajaya office.

5. Ministry of Agriculture and Food Industry

The cellular office in the Ministry of Agriculture and Food Industry has operable windows with blinds that allow the sunlight to come in. The application of huge wallpaper with greenery mounted on the wall of the open-plan cubicle office is also identified. The partition of the cubicle with a cool colour selection provides a sense of calm and reduces the stress of the office occupants. In the indoor workspaces, the images of nature and potted plants are present, stimulating and reducing the office occupants' stress. The botanical motifs, such as leaves in the window panel of the cellular office, are implemented. Some parts of the indoor workspace have huge windows where the office occupants are able to see and enjoy the scenery, especially from the high-rise buildings. In general, the visual biophilic design elements are visible in the immediate working spaces, especially in private cell offices, such as the application of botanical motifs, for example, the leaf motifs, tree trunk motifs, and flower motifs. Biophilic design elements such as real potted plants, artificial plants, and water elements are also present in the lounge and hallways, which could bring a sense of calm to the employees who are walking by the area. Aquatic animals, such as bee shrimp in the aquarium or arapaima sp. in large aquariums, have attractive visual features that can be implemented in the working area.

Due to a high number of occupants in an open plan floor workspace, the interior designers need to maximise or optimise the connection to nature; visually could act as a direct experience with nature, could improve and restore the mental health of office occupants as the view towards nature outside, the provision of sunlight or daylighting is limited. The brief interaction with nature, whether indirect exposure to it, such as by its colour, mimicry, or derivation, is important to humans, even if it is in a small amount

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Figure 5: Ministry of Agriculture and Food Industry workspaces displayed a strong embodiment of biophilic design applications.

CONCLUSION

Based on the observation, it can be noted that natural elements can be utilised through indirect experiences of nature such as pictures, colour selections and artificial implementations that could provide almost similar effects to the actual natural environment. Integrating biophilic elements into indoor workspaces allows the occupants to become adaptable to their surroundings while managing stress and long hours of working at the office. The application of biophilic design and biophilic interior architecture in government offices needs to be celebrated and promoted in indoor workspaces, which evidently have many positive impacts on office occupants. These elements not only provide aesthetic functions but also improve the mood and reduce stress so that the occupants can perform better at work. The robust lifestyle and pressured workloads in the government sector have made the indoor environment hostile towards its occupants. Office designs in the public sector are direly lacking natural and sensorial implementation from the biophilic design, which could mainly be rooted in cost, maintenance issues and space considerations that do not cater to human factors. Comfort and health should be the main factor in designing human spaces.

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ANALYSIS OF THE END-USER RESPONSES TOWARDS BIOPHILIC DESIGN IMPLEMENTATION IN MALAYSIAN PRIVATE HOSPITALS

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Abstract

Hospitals are the central place to get treatment, especially during the COVID-19 pandemic that badly hit the world. Significantly, hospitals need a healing environment promoting health and well-being. One initiative is integrating biophilic design as done by international hospital building design to maximise the human-nature relationship in a hospital environment. Hence, the positive impacts of green hospitals enable biophilic design to be applied in Malaysia. Therefore, this study aims to identify the successful implementation of biophilic design for space planning in Malaysian green hospitals. A questionnaire survey method with two hundred respondents was conducted, and the questionnaire survey data were analysed using Statistical Package for Social Science (SPSS). From the analysis of the end-user responses, ten biophilic design elements have been discovered to help improve the health and well-being of the hospital end users, including patients, staff and visitors. These research findings further demonstrate the potential of biophilic design to be implemented in Malaysian private hospital designs to enhance the healing environment supporting the medical health care system.

Keywords: biophilic design, private hospital, healing environment, Malaysia

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INTRODUCTION

Biophilic design is a concept established by Edward O. Wilson in 1984 that comes from the term biophilia, which refers to the relationship with nature. He emphasised the concept of people and nature relationships through his *Biophilia* book (Krcmova, 2009). His encouragement to connect with nature and green elements has guided a better building design. Nowadays, many green buildings with biophilic designs have been developed by designers to connect humans with nature even though the country is progressing and technology is becoming more sophisticated (Mohd Ariffin & Gad, 2017; Shamri et al., 2022).

Based on the study by White et. Al (2019) states that people must spend at least 120 minutes interacting with nature weekly. Human connection with nature is essential to increase health and well-being. By integrating biophilic design into building design, people could have positive impacts even on the building. Biophilic design helps lower blood pressure, reduce stress, increase the feeling of tranquillity and much more (Browning et al., 2014). Applying biophilic design to hospital building design could enhance the healing environment. It should be utilised within the hospital building's internal compound and spaces. Research by Ulrich in 1980 has proven that the hospital building with natural design speeds up patients' recovery and healing process (El Messeidy, 2019). It is essential to design a hospital with a biophilic design for occupants to connect with nature.

PROBLEM STATEMENT

As Malaysia is developing, the use of modern technology and machines in the construction of hospital buildings has grown. Designing hospitals without considering human nature's relationship has taken away the healing benefits of human health care (Lydia, 2019). Khoo Teck Puat Hospital in Singapore (Cheok & Chan, 2017) and Ostra Hospital in Sweden (El-Messeidy, 2019) are successful green hospitals that have implemented biophilic design concepts to increase human-nature connection. The biophilic buildings in Malaysia can only be found covering the shophouse (Bahauddin et al., 2019&2021) and office building design (Ibrahim et al., 2021) (Hui & Bahauddin, 2019). Since no biophilic hospital has been built in Malaysia, this study places a notable gap in both knowledge and practice to fill up the lack of study on the biophilic design implementation in Malaysian hospitals.

Malaysia and 192 other countries are working towards achieving the 2030 Agenda for Sustainable Development. The 2030 Agenda consists of more than 200 indicators, 17 Goals and 169 Targets to benefit the environment and humankind. Goal 3 of the SDGs emphasizes ensuring people's healthy lives and well-being at all ages. Besides that, SDGs Goal 11 focuses on developing sustainable cities and communities. In line with the national agenda such as the

2030 Agenda, Shared Prosperity Vision 2030 and Twelfth Malaysia Plan, this highlights the significance of improving the current hospital design to create a prosperous, inclusive and sustainable Malaysia. In addition, the condition of the hospital, which has become the focus since the COVID-19 pandemic hit, has caused the hospital's healing environment to be improved. Quarantine patients in hospitals and workers working overtime caused a lack of interaction with nature. This affected hospital occupants' mental and physical health (Muller et al., 2020). Therefore, a study on a biophilic design approach to enhance the hospital healing environment is needed, thus enhancing the significance of this research.

LITERATURE REVIEW

Biophilia to Biophilic Design

Biophilic design comes from the term biophilia. Biophilia has different meanings according to the views of researchers and their field of study. The *Dictionary of Environment and Ecology Fifth Edition* in 2004 defines the meaning through two words, bio and philia. Bio means living organism, and philia means attraction to something. The term biophilia was also popularized by a psychoanalyst named Erich Fromm in his book *The Anatomy of Human Destructiveness* in 1973 (Moghaddami, 2019). He introduces the concept of biophilia while elaborating on the differences between nature and 11 human beings. Biophilia means the innate feeling of human beings connecting with nature (Sayuti, 2016).

Besides that, Edward O. Wilson describes biophilia as a natural tendency to concentrate on life and life processes (Krcmarova, 2009). Biophilia has a physiological relationship with nature and contains the genetic basis of its meaning. He established and popularised a hypothesis about biophilia in 1984 through his book *Biophilia*. The hypothesis is about the concept of humans' relationship with nature and some biotic forms.

The word biophilia inspired the existence of biophilic design, a concept of integrating nature and the built environment. In the 21st century, the concept of biophilic design began to enter the field of architecture and building development (Zhong et al., 2021). In a book titled *Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life*, Kellert et al. (2011) elaborated on the positive impacts of natural systems, processes and constructed landscapes built in the buildings remain essential to human health, well-being and performance.

Healing Environment

Healing is an overall process of recovering mind, body and spirit, resulting in a beneficial change and movement towards self-realization no matter the absence or presence of disease (Dubose et al., 2016). In the meantime, a *healing environment* can be defined as physical and nonphysical environments intended

to aid recovery. As opposed to cure, which is linked to health conditions, healing seems more closely related to spirituality and mental state. A concept used to describe medical facilities is the environment of healing. An excellent healing environment in which it helps in balancing between artificial consumption and nature design (Kamali & Abbas, 2012). In order to achieve the optimum healing environment, four categories must be addressed: internal, interpersonal, behavioural and external, as shown in Figure 1 below.

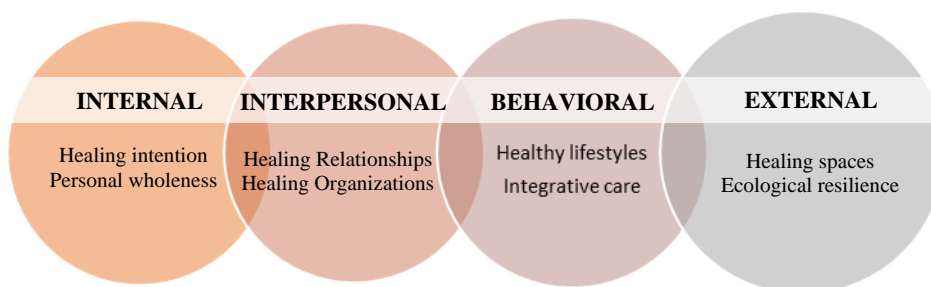


Figure 1: The optimal healing environment
Source: Reproduce illustration from Sakallaris et al., 2015

Being surrounded by those four categories in a hospital environment could improve healing and patient health. A healing environment should be comfortable, promote human health, and provide a sense of tranquillity for its occupants. The suitable architectural layout of a therapeutic setting would indirectly influence the outcomes for the occupants, including shorter hospital stays, happier patients and much more (Huisman et al., 2012). Hospitals must be designed well since the healing environment affects people's health.

Biophilic Design Advantages Towards Human Health and Wellbeing

Compared to its financial advantages and contribution to the structure, the biophilic design undoubtedly has numerous favourable effects on people's psychological, spiritual, mental, and bodily moods. Among them are stress reduction, quicker recovery, focus recovery, enhanced wellbeing, and declining crime rates (Moghaddami, 2019). According to Salingaros (2015), in order to have a positive influence on human health, biophilic design, also referred to as a bottom-up approach, is required. An experiment conducted at the hospitals by Salingaros and Mehaffy (2015) provides proof of this. According to the trial, patient rooms with windows overlooking greenery may improve the healing environment and lessen patient discomfort. This is beneficial and advised for those using pain medication. Humans who spend most of their lives in developed environments can benefit mentally and physically from sensory interaction with nature (Aduwo et al., 2021). Numerous studies from various organizations

depicted how biophilic design affects healing. In addition to architecture, scientifically verified disciplines like neurology and endocrinology have responded to the link between biophilic design and healing, health, and wellbeing. The benefits of biophilic design patterns to stress cognitive performance, emotion, mood, and preferences are illustrated in Table 1.

Table 1: The Advantages of Biophilic Design

NO	BIOPHILIC DESIGN PATTERNS	STRESS REDUCTION	COGNITIVE PERFORMANCE	EMOTION, MOOD AND PREFERENCES	
1	Nature in the space	Visual connection with nature	Lowered blood pressure and heart rate	Improved mental engagement/ attentiveness	Positively impact attitude and overall happiness
2		Non-visual connection with nature	Reduced systolic, blood pressure and stress hormone	Positively impact cognitive performance	Perceived improvements in mental health and tranquillity
3		Non-rhythmic sensory stimuli	Positively impact heart race, systolic, blood pressure and sympathetic nervous system activity	Observed and quantified behavioural measures of attention and exploration	
4		Thermal and airflow variability	Positively impacted comfort, well-being and productivity	Positively impacted concentration,	Improved perception of temporal and spatial pleasure
5		Presence of water	Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure	Improved concentration and memory restoration, Enhanced perception and phycological responsiveness	Observed preferences and positive emotional responses
6		Dynamic and diffuse light	Positively impacted circadian system functioning, Increased visual comfort		
7		Connection with natural system			Enhanced positive health responses, Shifted perception of environment
8	Natural analogues	Biomorphic forms and patterns			Observed view preference
9		Material connection with nature		Decreased diastolic blood pressure, Improved creative performance	Improved comfort
10		Complexity and order	Positively impacted perceptual and		Observed view preference

NO	BIOPHILIC DESIGN PATTERNS	STRESS REDUCTION	COGNITIVE PERFORMANCE	EMOTION, MOOD AND PREFERENCES	
		physiological stress responses			
11	Nature of the space	Prospect	Reduced stress	Reduced boredom, irritation and fatigue	Improved comfort and perceived safety
12		Refuge		Improved concentration, attention and perception of study	
13		Mystery			Induced strong pleasure response
14		Risk/peril			Resulted in strong dopamine or pleasure responses

Source: Reproduce table from Browning et al, 2014.

METHODOLOGY

This study used a quantitative data collection method. A questionnaire survey using a random sampling method was conducted for data collection. Guided by a literature review, two hundred respondents were involved in this study. These respondents were staff, outpatients, and visitors visiting the hospital. Due to limited inpatient access and strict ward access granted by the hospital administration, the sample only focused on the outpatients in the general hospital areas, including the clinic, pharmacy area, cafeteria and hospital lobby. Significantly, there are six green hospitals in Malaysia. Among the six hospitals, the Pantai Hospital Laguna Merbok was selected as the case study for this research.

To fulfil the study, reliable information about how hospital users perceive the application of biophilic design and how they interact with natural elements within the hospital was acquired. The data collection included two ways of reaching out to hospital end users. A direct approach to scanning for QR codes and posters was used to gain attention from all hospital end users. The data collection included two ways of reaching out to hospital end users. This includes a direct approach to the end users for QR code scanning and through survey posters placed at several strategic and allowable areas within the Pantai Hospital Laguna Merbok (see Figure 2). In particular, this research has undergone the UiTM Research Ethics Committee approval and further getting consent from the hospital administration before proceeding with the questionnaire survey.



Figure 2: Location of Poster Inside the Hospital
 Source: Architect of Pantai Hospital Laguna Merbok

RESULTS AND DISCUSSION

The questionnaire survey was analysed using Statistical Package for Social Science (SPSS). The data analysed from SPSS were referred to the Percentage of Consensus of Agreement analysis. It is to identify the successful implementation of biophilic design elements for space planning. The percentage value that considered as consensus through the Percentage of Consensus of Agreement (PoCoA) had been reached was set at either 66.7%, 75%, 80% or 100% (Ayob et al., 2022). Therefore, the Percentage of Consensus of Agreement (PoCoA) determines the Cut-off Point Percentage for the questionnaire survey data. The cut-off point percentage used and applicable to this study is 75%. Table 2 below shows the respondents' selection criteria for biophilic design for private Malaysian hospitals. Overall, this questionnaire survey obtained positive feedback from the respondents.

Table 2: The Respondent Selection Criteria for Biophilic Design for Malaysian Private Hospital

	Strongly Disagree	Disagree	Neither Disagree or Agree	Agree	Strongly Agree
Current design is good for healing	Not available	4%	19.5%	51%	25.5%
Application of natural elements	Not available	Not available	1%	12.5%	86.5%
Prospects	Not available	Not available	Not available	3%	97%

	Strongly Disagree	Disagree	Neither Disagree or Agree	Agree	Strongly Agree
Refuge	Not available	Not available	Not available	3.5%	96.5%
Complexity and order design	Not available	Not available	Not available	4.5%	95.5%
Shape and form that suitable for the healing environment	Not available	Not available	5%	6.5%	93%
Natural colours	Not available	Not available	Not available	13.5%	86.5%
Plants or landscape design	Not available	Not available	1%	15.5%	83.5%
Cultural and ecological	Not available	Not available	3.5%	14.5%	82%
Natural light	Not available	Not available	6%	15%	79%
Image of nature	Not available	1.5%	5%	15%	78.5%
Water features	2.5%	2%	6%	13.5%	76%
Natural materials	Not available	1%	13%	47.5%	16%
Pets	6%	8.5%	45%	11%	29.5%

Source: Author

Most of the respondents in this questionnaire survey are females between eighteen and thirty years old. The observations made while collecting data show that the eighteen- to thirty-year-old group is more proficient in using gadgets and QR scan code applications. Most older people do not have a QR code scanning application and lack the experience to answer forms online. Table 2 shows the respondent selection criteria for biophilic design in Pantai Hospital Laguna Merbok. There are ten biophilic design elements that most respondents strongly agree to be applied to hospital design, which includes prospects, refuge, complexity and order design, shape and form that are suitable for the healing environment, natural colours, plants or landscape design, cultural and ecological, natural lighting, image of nature and water features element. The ranking of elements indicates the contribution to the successful implementation of biophilic design. The main elements that help hospital users heal are prospects. This means that the design of the hospital has a long-term benefit. It is essential to insert this biophilic design element into hospital design to enhance the healing environment. The element that least assists in healing is incorporating the pet's area. As depicted in Table 2, most respondents neither agree nor disagree with having pets in the hospital building area. This is because the application of this element was

never found in any hospital design. However, some prefer it to be applied, considering that interaction with animals has many positive effects. Implementation of this element in hospital design is not crucial in designing a hospital. Significantly the hospital occupants generally strongly agree if the hospital building design applies biophilic design elements.

All biophilic design elements with a percentage higher than 75% in this questionnaire survey are the successful implementation of the biophilic design elements in the hospital. The respondents also suggested some improvements for future hospital design that highlight space planning, outdoor plants and the hospital's colours. It indicates that these top three elements play an essential role in healing. Besides that, there are also suggestions to improve the hospitals' water features elements, universal design, maintenance, sound elements, view and much more. The minor elements demanded by hospital users to be improved in future hospital designs are linked to materials and the aromatic smell inside the building.

CONCLUSION AND RECOMMENDATION

Biophilic design is a concept that can be enhanced and utilized in Malaysian hospital building design. It is a concept that has been introduced previously in hospital design abroad, and it can gain recognition in Malaysia. This study's findings discovered that ten biophilic design elements are suitable for integration into private hospitals in Malaysia based on the hospital end users' response. The biophilic design elements with 75% and above responses are successfully implemented and could be utilized by designers to build a biophilic hospital in the future. The biophilic design elements are prospects, refuge, complexity and order design, shape and form suitable for a healing environment, natural colours, plants or landscape design, cultural and ecological, natural light, the image of nature and water features. The elements, natural materials, and pets scored less than 75%, indicating their low capability to promote health and well-being and enhance the healing environment. Nevertheless, hospital users will need the benefits of biophilic design and elements that enhance the healing environment within the Malaysian private hospital design. Biophilic design has proven to improve the healing environment in hospitals and has many positive impacts on hospital users' health and well-being.

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EXAMINING RECYCLABLE ITEMS COLLECTION: INSIGHTS FROM MATERIAL RECOVERY COLLECTION FACILITY AND COMMUNITY RECYCLING CENTRE

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Abstract

For city administrations, urban waste management is a crucial issue since it has an impact on public health and environmental sustainability. Reducing the amount of waste that is dumped in landfills and protecting the environment requires efficient recycling programs. This study aims to evaluate the collection of recyclable items from two distinct types of recycling centres, namely, Material Recovery Collection Facilities (MRCFs) and Community Recycling Centres (CRCs). Meanwhile, it also aims to evaluate the quantity of recyclable materials that are collected from two distinct types of recycling centres. This study utilised raw secondary data provided by KDEB Waste Management Sdn. Bhd. A statistical analysis was subsequently conducted to provide insights into the composition of recyclable items at each recycling facility. From the analysis, it is shown that the MRCFs have gathered 97.29% of recyclable items, leaving the CRCs with the remaining 2.71% in total. This highlights the value of a specialised and well-coordinated strategy for managing numerous types of recyclable waste, which enhances the overall sustainability and effectiveness of the recycling program. Therefore, this study recommends that data collection activities at each recycling centre continue with some improvements, as this could aid in future analysis of recycling patterns and trends.

Keywords: Recyclable, Material Recovery Collection Facility (MRCFs), Community Recycling Centre (CFCs), KDEB, Waste Management

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INTRODUCTION

The quantification of municipal solid waste (MSW) in Malaysia has grown increasingly intricate, mirroring challenges observed in other developing countries (Kasavan et al., 2020). This complexity is fuelled by factors such as burgeoning populations, rapid urbanisation, and shifts in lifestyle, which collectively strain solid waste management systems (Yusof et al., 2019). Malaysia generates a considerable amount of waste daily, with an average of 1.17 kg per person, ranking third in the ASEAN region. Singapore leads at 3.763 kg per capita, followed by Brunei at 1.4 kg per capita (UNEP, 2017). Government statistics indicate a troubling upward trend in household waste production. The total amount of waste increased from 36,500 tons per day in 2015 to 38,150 tons per day in 2018 (SWCorp, 2020).

According to Mohd Rodzi et al. (2019), the most common form of disposal is landfilling, with very little waste being recycled (17.5%) or burned (26.5%) at home. The management of MSW presents a multifaceted challenge, with household waste contributing significantly to the composition of landfills, wherein recyclable materials constitute up to 80% of the waste stream (Shakil et al., 2023). This reliance on landfills, a predominant waste disposal method, poses considerable environmental risks, including methane emissions and leachate contamination (Chuah et al., 2023).

The pressing issue of domestic waste management has garnered attention, particularly in Selangor State, Malaysia, which stands out as the highest producer of domestic waste, with its capital city, Shah Alam, contributing significantly to this statistic (Bazrbachi et al., 2023). Statistical data highlights a discernible upward trend in solid waste generation within Selangor, escalating from 2,765,149 metric tonnes in 2018 to 3,010,831 metric tonnes in 2021 (Statistik Siri Masa MyKPKT, 2022).

Despite this surge, there is a noteworthy positive development in recycling practices among the populace, as evidenced by the increase in the recycling rate in the State of Selangor, reaching 2,602,940.62 tons in 2023, compared to just 219,920.68 tons in 2020 (Dewan Negeri Selangor, 2024). Additionally, the national recycling rate in 2023 increased to 35.38% compared to the target of 35%, with the total volume of recycled goods reaching 4.933 million metric tons. This rate is aligned with the target recycling rate set in the Twelfth Malaysia Plan, which aims for a recycling rate of 40% by the year 2025 (Syazana, 2023). The importance of recycling as a keystone of this paradigm is highlighted by the realisation of the necessity of sustainable waste management, which includes the collection, transportation, recycling, and disposal of waste without compromising environmental integrity or future well-being.

In 2016, the Selangor State Government appointed KDEBWM as the PMC to manage the solid waste collection and public cleansing services throughout Selangor. Consistent with the principles that are outlined in Malaysia's National Cleanliness Policy and the United Nations Sustainable Development Goals (SDGs), KDEBWM is actively advancing recycling programs and advocating for the reduction of single-use plastics as integral components of a circular economy framework (KDEB Waste Management, 2024). The rationale for these initiatives stems from the need to protect the environment and promote sustainable practices.

Recycling initiatives aim to preserve the environment by reducing the amount of waste that is disposed of in sanitary landfills. For instance, materials such as cans, papers, and bottles can be recycled and reused, which can help prevent environmental degradation and contribute to a more sustainable ecosystem. KDEBWM currently operates two types of recycling centres, i.e., the Material Recovery Collection Facilities (MRCFs) and Community Recycling Centres (CRCs).

Thus, this paper aims to evaluate the collection of recyclable items from two distinct types of recycling centres, namely, the Material Recovery Collection Facilities (MRCFs) and the Community Recycling Centres (CRCs) in Selangor; which are operated by KDEB Waste Management Sdn. Bhd. (KDEBWM), a Project Management Company (PMC) wholly owned by the State Government of Selangor. To ensure the quality of the secondary data retrieved, the data was meticulously acquired from recycling centres under the supervision of KDEBWM.

RESEARCH METHODOLOGY

Study Area

This study focuses on five (5) recycling centres that have been established by KDEBWM, which are strategically located in several regions in Selangor to play a role in effective waste management and recycling processes, as depicted in **Figure 1**.

KDEBWM has established five recycling centres located in Jalan Korporat in Meru, Klang; Bandar Bukit Puchong in Subang Jaya; Bukit Changgang in Kuala Langat; Cyberjaya; and PPR HICOM. Among these, the centres in Jalan Korporat, Bandar Bukit Puchong, and Bukit Changgang are large-scale facilities designated as MRCFs.

These facilities serve as collection centres where no processing of recyclables occurs. The primary source of recyclables in MRCFs is the KDEBWM garbage compactors, which employ a process known as tailgate recycling. This process involves general workers separating recyclables at the tailgate of the garbage compactors.

On the other hand, the recycling centres in Cyberjaya and PPR HICOM are classified as CRCs. The CRCs in Cyberjaya operate as a buy-back centre, where the public can sell their recyclable materials. The source of recyclables for this centre primarily comes from the public in Cyberjaya and nearby areas. The CRCs in PPR HICOM, however, is a drop-off type centre, where the public can drop off their recyclable materials for collection.



Figure 1: Location of five (5) recycling centres operated by KDEB Waste Management Sdn. Bhd.
(Source: Google Maps, 2024)

Description of Secondary Data

This study concentrates on the raw data of recyclable items collected from the five (5) recycling centres operated by KDEBWM in collaboration with several recycling partners, which include both MRCFs and CRCs. The data provided includes recycling centre types, locations, hours of operation, types of recyclables, and the total amount of recyclables collected annually.

MRCFs, such as those located in Jalan Korporat, Bandar Bukit Puchong, and Bukit Changgang, primarily serve as collection points where recyclable materials are gathered and subsequently sold to off-takers. These materials are then repurposed as raw materials for the production of new items. On the other hand, CRCs, such as the ones in Cyberjaya and PPR HICOM, function differently. These centres operate based on a buy-back and drop-off

concept. This means that the public can sell their recyclable materials at these centres or drop off their recyclables for collection.

These recycling centres are strategically situated across various municipalities, including Majlis Bandaraya Subang Jaya (MBSJ), Majlis Bandaraya Diraja Klang (MBDK), Majlis Perbandaran Kuala Langat (MPKL), Majlis Perbandaran Sepang (MPSp), and Majlis Bandaraya Shah Alam (MBSA), to facilitate easy access for the community and promote sustainable waste management practices. Regarding the operational hours, MRCFs are open six days a week, while CRCs operate 24 hours a day, every day.

All these recycling centres accept a similar range of recyclable items, including plastic, paper, scrap metal, aluminium, copper, coils, e-waste and used cooking oil. However, glass and fabric are only accepted at the Cyberjaya recycling centre. The total amount of recyclable items collected will be analysed and detailed further in the results and discussion section.

Data Analysis

The raw data provided was systematically reorganised and tabulated first using Microsoft Excel due to some missing and insufficient values. Those missing values were due to the non-availability of data provided which include (i) different types of recyclables items at each recycling centre, and (ii) different operational years. As a result, part of the data could not be shown. Only significant and required data were statistically analysed further. Most of the values and numbers from the data were converted into percentages and visualised using bar graphs and pie charts for easier comprehension.

RESULTS AND DISCUSSION

The summarised data of the recyclable items that have been gathered by five (5) recycling centres located in Selangor is shown in **Table 1**.

Table 1: Summarised data from KDEBWM for each recycling centre.

Recycling Centre Types		Material Recovery Collection Facilities (MRCFs)			Community Recycling Centres (CRCs)	
Location		Bukit Puchong	Jalan Korporat	Bukit Changgang	Cyberjaya	PPR Hicom
YEAR	2021	1,799,633.00	1,895,719.50	Not Available	Not Available	Not Available
	2022	2,214,559.00	1,793,386.72	Not Available	46,076.01	Not Available
	2023	1,921,772.62	1,916,889.94	710,415.32	125,206.46	1526.00
Total (kg)		5,935,964.62	5,605,996.16	710,415.32	171,282.47	1,526.00
Recyclables Item		Plastic, paper, scrap metal, aluminium, copper, coil, e-waste, oil, glass and fabric.				

As illustrated in **Table 1**, the total amount of recyclable items was only recorded in 2023. This occurred because the Bukit Changgang, Cyberjaya, and PPR Hicom recycling centres commenced operations at a later date by KDEBWM, in comparison to the Bukit Puchong and Jalan Korporat recycling centres.

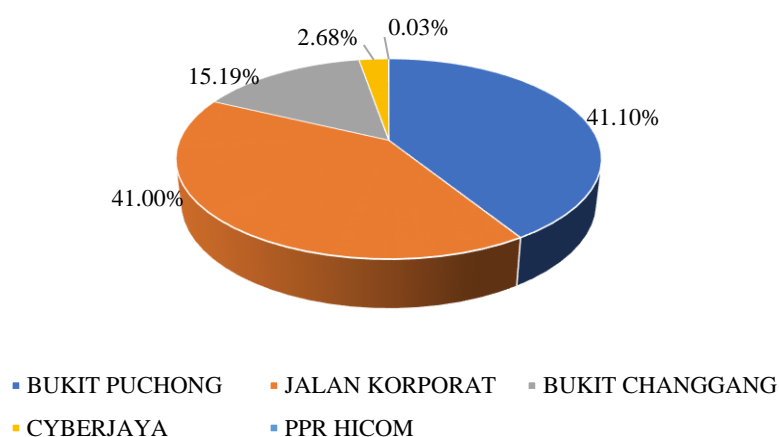


Figure 2: Total collection in year 2023 by percentages.

The descriptive data revealed significant disparities in the volume of recyclables handled by each centre, with MRCFs processing a notably higher percentage compared to CRCs.

This distribution may suggest that MRCFs play a crucial role in handling large-scale recycling volumes, which could point to their more extensive resources, accessibility, or established infrastructure. MRCFs extract valuable recyclables from complex waste streams, with their net present values and environmental impacts varying based on factors such as waste composition, fixed capital costs, and waste tipping fees, which influence profitability (Olafasakin et al., 2023). Plus, the application of optimisation models and advanced sorting technologies may improve the operational efficiency of MRCFs. Although individuals' separation may still be necessary for some materials, mechanical separation operations in MRFs enhance the quality of recyclable materials and reduce unwanted substances (Chang et al., 2005).

In contrast, CRCs, such as those in Cyberjaya and PPR Hicom, contribute minimal percentages, suggesting limitations in facility size, accessibility, or community participation rates. This contribution may be influenced by several challenges, including but not limited to seasonal and geographical variations and public perception and participation, as noted in prior

studies. Due to regional and temporal factors, the amount of waste collected at CRCs might vary substantially. As an example, statistics from Denmark showed that waste collection varied seasonally, with recyclable materials rising over time. Seasonal patterns, which are primarily influenced by visitor numbers, have an impact on the waste collected at community recycling centres. For effective planning and resource allocation, it is crucial to recognise these patterns (Edjabou et al., 2019).

Next, factors related to public perception and participation play a role. A sociological survey conducted in Italy found that the main drivers of CRC usage are respect for the environment and community engagement. Participation is also encouraged by financial incentives, such as shopping vouchers or waste fee reductions (De Feo & Polito, 2015). These factors, however, are based solely on prior studies and not on the descriptive analysis conducted in this study, which presents a research gap for further investigation into the underlying causes of the disparities between MRCFs and CRCs.

Figure 2 depicts the percentage of each recycling centre in the year of 2023. The Bukit Puchong and Jalan Korporat recycling centres each recorded approximately 41% of the recyclable items. In contrast, the Bukit Changgang recycling centre recorded only 15.19%. Meanwhile, at CRCs, the Cyberjaya and PPR Hicom centres recorded smaller amounts, at 2.68% and 0.03%, respectively. To be exact, MRCFs have gathered 97.29% of recyclable items, leaving CRCs with the remaining 2.71% in total, as illustrated in **Figure 3**.

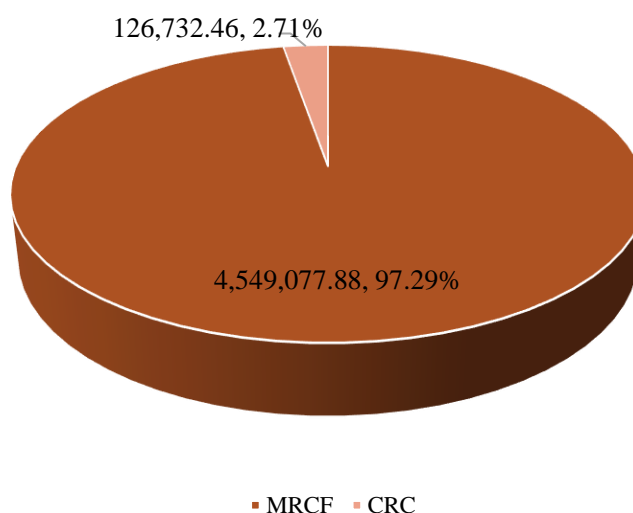


Figure 3: Total Collection by Different Types of Recycling Centres in 2023

Analysis of waste collection data as illustrated in **Figure 4** reveals a distinct division of labour between the Material Recovery Collection Facilities (MRCFs) and the Community Recycling Centres (CRCs). MRCFs are predominantly responsible for collecting the bulk of recyclable waste, including plastic (99.6%, equivalent to 2,875,536.60kg), paper (93.5%, equivalent to 906,470.83kg), and scrap metal (98.8%, equivalent to 621,830.05kg). In contrast, CRCs exclusively manage fabric (100%, equivalent to 2,741.00kg) and glass (100%, equivalent to 26,720.00kg) waste streams. A slightly balanced distribution is observed in the collection of oil (76.5% by MRCFs, equivalent to 11,032.65kg; 23.5% by CRCs, equivalent to 3,382.79 kg) and e-waste (40.4% by MRCFs, equivalent to 7,913.20 kg; 59.6% by CRCs, equivalent to 11,697.17 kg). Additionally, MRCFs are solely responsible for collecting coil (100%, equivalent to 53,663.00kg) and copper (100%, equivalent to 320.00kg) waste. While MRCFs collect the majority of aluminium waste (99%, equivalent to 72,311.55kg), CRCs contribute a minor portion (1%, equivalent to 709.78 kg). These findings, which comprise both quantitative and proportional data, emphasise the distinct responsibilities of each type of recycling facility in the waste management system and their collaborative efforts in handling a broad range of recyclable items.

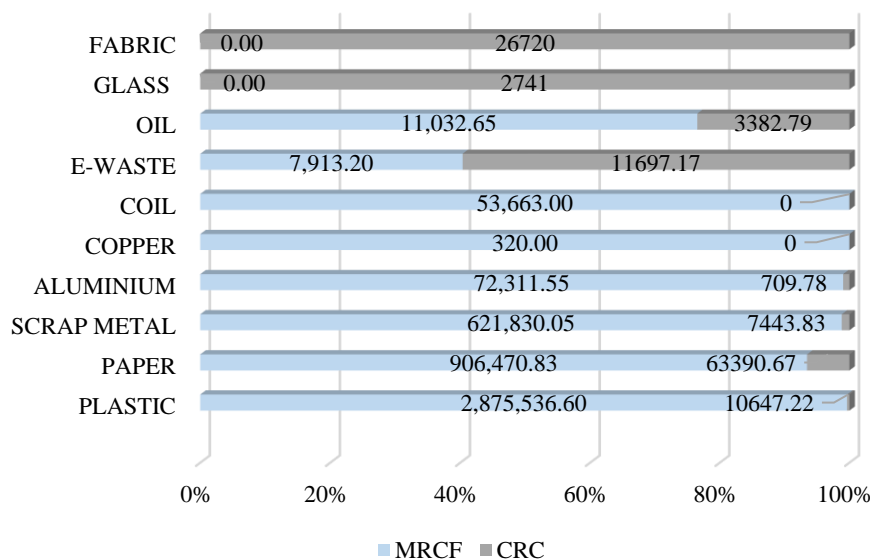


Figure 4: Total amount of recyclable items by categories for both types of recycling centres in 2023.

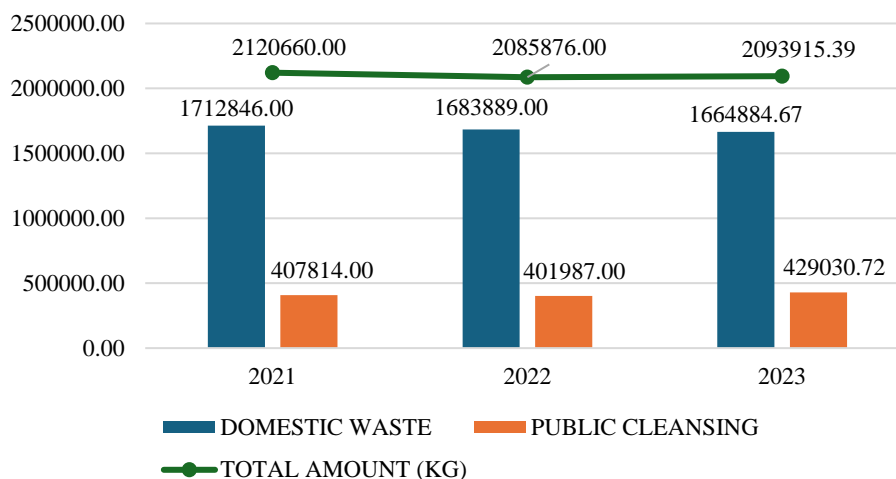


Figure 5: Solid waste generated in Selangor from year 2021 until 2023

In addition, the graph in **Figure 5** illustrates the annual quantity of solid waste generated in Selangor from 2021 to 2023. This waste is categorised into domestic waste and public cleansing waste, with the total amount also indicated. Domestic waste consistently constituted the largest proportion, exhibiting a minor decline from 1.7 million tonnes in 2021 to 1.6 million tonnes in 2023. Public cleansing waste remained relatively stable, averaging around 400,000 tonnes annually. Overall, the total solid waste generated experienced slight fluctuations, starting at 2.1 million tonnes in 2021, dipping marginally in 2022, and then reaching just under 2.1 million tonnes in 2023.

This additional information regarding solid waste generated in Selangor is crucial for understanding the dynamics of the recycling system in the future. In order to enhance recycling initiatives and tackle waste management issues, an array of strategies that foster greater public involvement and make the most of current facilities must be adopted. Based on current research, preliminary recommendations identify a number of strategies that can be used to improve recycling practices and recycling system efficiency.

Firstly, an educational initiative has been successful in improving recycling-related public awareness and behaviour. As an example, accessible recycling facilities were shown to be a significant obstacle in a pilot recycling campaign that raised awareness and participation (Chase et al., 2009). Furthermore, competitive development techniques combined with cost-effective educational interventions can significantly impact recycling and

environmental practices, producing a high impact at a low cost (Popescu et al., 2020).

In addition, enhancing the reach of recycling facilities and placing drop-off locations in more strategic areas promotes broader involvement within the community. Making recycling facilities more convenient, such as placing them near residential areas or buildings, can greatly increase recycling rates (Siu & Xiao, 2016; DiGiacomo et al., 2017).

Besides that, continuous monitoring and analysis of waste generation patterns can help refine recycling initiatives and highlight areas that need further attention. For instance, Azri et al. (2022) applied the within-cluster pattern identification (WCPI) approach in this country, employing geotagged images and k-means clustering to optimise recycling bin placement. This method aims to reduce litter and lower carbon emissions by promoting recycling through improved bin location strategies. These preliminary recommendations offer an initial basis to improve recycling facilities and participation, and they might also act as an outline for future studies on the most effective sustainable waste management strategies.

CONCLUSION

Based on the statistical data analysis, the total quantity of recyclable items that have been recorded at the three facilities under the Material Recovery Collection Facilities (MRCFs) in 2023 is significantly higher than the amount recorded at the two facilities under the Community Recycling Centres (CRCs). In comparison, CRCs only collected 126,732.46 kg of recyclables, while MRCFs recorded 4,549,077.88 kg. These disparities imply that MRCFs have a crucial role in managing high recycling volumes, most likely as a result of their greater infrastructure, accessibility, and resource availability. CRCs, on the other hand, deal with difficulties including public perception, facility constraints, and fluctuating seasonal and regional factors that affect participation rates.

Hence, this study suggests that in order to address these problems, data collection at each recycling location should be continued with improvements. Notably, an understanding of community recycling trends and patterns would be assisted by these improvements. In addition, future studies might focus on filling up the gaps found in this study, namely, in addressing the fundamental causes of the disparities between MRCFs and CRCs. This study can provide a preliminary basis for future research that aims at optimising recycling infrastructure and improving public engagement.

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HOSPITAL FIRE ACTION PLAN COMPONENTS AND CHECKLIST IN SELANGOR, MALAYSIA

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Abstract

Hospital fire safety is a major concern when designing them, therefore they are considered a critical facility. Hospitals contain various people with different conditions, which requires a special focus on fire safety. Many fire accidents have happened in Malaysian hospitals, which led to the investigation of why it happens and how to act when it occurs. The research aims to study the hospital's fire action plan and determine the major elements of this topic while providing a fire action plan checklist. The methodology used for this research is qualitative research using semi-structured interviews with four participants. The qualitative analysis, thematic analysis was used to present the themes of the fire action plan using NVIVO software. The findings of this study provided 6 themes for the fire action plan such as communication, firefighting systems and design, immediate actions and activation, monitoring and control planning, and roles training and awareness and 5 themes for the fire action plan checklist such as complying with hospital design and regulation standards, continuity of operation, defined roles and responsibilities, fire training, inspection and maintenance of the hospital. A clear plan must be taught to all staff so that the casualties are minimum.

Keywords: Fire Action Plan, Thematic Analysis, Hospital, Checklist, Fire Safety, and NVIVO Software

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INTRODUCTION

The majority of the established infrastructure in a healthcare environment is made up of hospital structures, which are crucial to a nation's ability to offer healthcare services. The majority of hospital structures are made to endure for numerous years and offer many patients "temporary" housing and functional operations (Kodur et al., 2020). Over the past few years, there have been numerous fire accidents all over the globe, understanding the properties of combustible materials, the causes of fire, and the high-risk areas for ignition and the safety plan in facilities is of the utmost importance given that these incidents have resulted in significant losses in terms of both life and property (Hamida & Hassanain, 2019). Fire hazards in facilities are those that could start accidentally or on purpose and endanger people's lives, the structure itself, and their belongings. Stakeholders are becoming more and more worried about this (Ebekozi et al., 2021). Immediately after a fire starts in a hospital, evacuation and firefighting efforts must be made. As a result, an essential of hospital fire safety is the fire department coverage for hospitals (Liu et al., 2023).

Since the early 20th century, fire safety has been researched and has undergone significant scientific advancement, particularly as a result of significant losses brought on by sporadic but catastrophic fires (Ornstein et al., 2007). One of the main considerations of many governments is fire safety, particularly in light of the numerous fire tragedies that have occurred recently in healthcare institutions (Agus Salim et al., 2023). Therefore, Codes and standards have been created to articulate this issue, such as the International Fire Code and the National Fire Protection Association. To assure safety from fire in the hospital the term fire safety comes to light, the component of fire safety can be taken from the codes and standards, for this research will focus on fire action plan in hospitals, due to the spread of fire and having casualties in such incidents it creates a question of what is wrong and what is happening that when fire occurs there are high losses in property and people.

LITERATURE REVIEW

Hospitals are the focal point of the nation's healthcare system, and they are in charge of delivering 24/7 medical treatment every day of the week. Any type of interruption to medical operations and operations makes the health system vulnerable (Fazel et al., 2022). Bakar (2006), stated that in the event of a building fire, the most important factor in building fire protection is human life as the greatest risk is to the users, while fire protection for structures can be identified, the need for sufficient means of egress is a vague science that can differ based on the type of occupancy, operation, and type of building, The primary concern is to guarantee the life safety of building residents.

Chow (2001), finds that there should be at least three components of a fire safety plan such as maintenance plan, a staff training plan, and a Fire action

plan. Also, he suggested an additional plan called the fire prevention plan. As stated by Chow the fire action plan is a part of the fire safety plan, the purpose of the Fire Action Plan is to provide all occupants with clear instructions on emergency protocols and other issues that are crucial to supporting fire protection and evacuations in emergencies within facilities, the majority of these things are likely to be in position, but the plan needs to make note of a few clauses that deal with how each service is going to execute them (The University of Edinburgh, 2023). NHS England (2013), stated that action plans for responding to fire emergencies should be created for every level of the organization and the areas it oversees. Della-Giustina (2014), Planning for emergencies is crucial to preventing catastrophic losses to individuals, assets, and facility functions. A well-thought-out emergency plan can make the difference between minor incidents turning into major ones. Along with the regular circumstances, each organization will have some inherent risks that should be taken into account during emergency preparedness.

Chow (2001), stated that to handle the total responsibility of the property and daily safety management, a fire safety manager should be hired. The management ought to have some experience fighting fires because they are expected to be capable of guiding the firemen to the afflicted area, the fire action plan according to Chow includes clearly outlined steps to be taken in the event of a fire, the fire action plan ought to contain steps such as contact the fire brigade, gather people and direct them to secure locations, fight the fire, help the fire brigade, and a roll call is conducted at the assembly location for particular structures like schools or karaoke.

NHS England (2013), stated that the emergency action plan especially is for the ward, department, and space, also, the detailed local fire emergency action plan includes the steps to be done when the fire is discovered, the steps to be done when the alarm is heard, precise information on how to evacuate, all the exit locations and the equipment needed for evacuation, and firefighting gear location. Also, the guide recommends details that need to be presented, such as plans of the property, the arrangement of vital equipment, and details on the fire and safety systems, services, and environmental systems, as well as the hazardous items. It will be necessary to create fire emergency action plans to guarantee that, in the case of a fire, the facility and its personnel act in a way that ensures the security of all concerned parties and achieve the goals of reducing service interruption, and environmental and building damage.

According to Bakar (2006), Chow (2001), NHS England (2013), The Centers for Disease Control and Prevention (2023), The University of Edinburgh (2023), and University of Strathclyde (2023), the fire emergency plan emphasizes key actions such as triggering alarms, evacuating without using elevators, and only allowing trained staff to fight fires. It highlights the importance of clear roles in contacting emergency services, shutting down critical equipment, and handling

high-risk areas like chemical storage. Proper evacuation procedures for disabled people, visitors, and at-risk individuals are crucial, with designated fire marshals and wardens overseeing the process. Escape routes, assembly points, and communication with emergency services must be well-documented. The plan also includes contingency measures for system failures and procedures for re-entry or alternatives if re-entry is not possible.

RESEARCH METHODOLOGY

Qualitative approach will be used to conduct the research. The research will depend on gathering data from conducting interviews with fire experts and specialists and gather the data from them. The data gathered will be arranged to create a checklist for assessing the fire action plan in hospitals.

For conducting this research, collecting data from conducting interviews with fire experts and specialists to investigate what is the most important component of fire action plan in hospitals. The strategy for this research will be a qualitative method strategy, the method contains interview approaches for primary data.

Primary data

The design of the interview questions will be dependent on the research objectives, the questions that will be asked are used to able to answer the research questions, and the questions will be open-ended to allow room for conversation in the interview and help both the interviewee and interviewer to ask and mention every detail that help fulfilling the research objective. The research questions will be divided into different sections, each of which will be to answer a specific topic. The interview questions are split to three parts, Part one: introductory questions, these will be asked to identify the interviewee's, Part two: key questions, will be used to obtain data related fire action plan, and Part three: key questions, will be used to obtain data related Fire Action Plan checklist.

ANALYSIS AND DISCUSSION

The research aims to find the essential components of fire action plan, and establishing a fire action plan checklist. This leads to the use of thematic analysis for the data collected, NVIVO software was used for the analysis process from creating codes, themes, and to presenting the results. This section will present the data collected, the analysis method, and the discussion of the data in relation to literature. The data analysis will follow the thematic analysis six-phase method mentioned (Byrne, 2022). The interview has been conducted with four participants.

Respondents Background Information

This part represents the background information about the people who participated in the interview. Table 1 represents the background information of each individual.

Table 1: Interview participant personal information

Participant number	Workplace	Educational level	Years of experience	position
1	UKM Specialist Children's Hospital	Master	6-10	Hospital emergency manager
2	Pantai health group	Degree	11-15	Safety Officer for Health Group
3	Fire and Rescue Department of Malaysia	Ph.D.	20-25	Head of Fire Safety Approval
4	Hospital Cyberjaya	Degree	16-20	Hospital Fire Safety Officer

From Table 1 we can see that participant 1, 2, and 4 currently work in a hospital and are responsible for its safety, participant 3 currently works for the Malaysian National Fire and Rescue Department under the government. All participants have degrees, also all participants have 10+ years of experience except Participant 1 who has 6-10 years of experience.

Fire Action Plan Components

This part is focused on the components of the fire safety action plan for hospital, the question focuses on the action to be done also the plan required to be implemented before the fire or after it occurs. The interview questions and answers are put into NVIVO software to generate the codes. For this part, there were 6 themes generated.

Theme 1: Communication

This theme represents the internal and external communication for the hospital in case of fire incidents. This theme has 2 codes representing the participant's actions and hospital implementation of this theme.

Contact BOMBA. This code is one of the first actions to be done by the hospital team, as the team is required to inform the fire department of the incidents in case the alert system does not work. Participant 3 stated *“The staff need to have proper communication to call BOMBA.”* Also, participant 1 stated *“Whatever alarm that triggered inside our fire control room, it will automatically be detected through them. So, they will call us saying that they receive a... is there any fire in your building. So, they will call BOMBA and send.”*

Having knowledge and details of the emergency contacts. The importance of detailed information on the emergency contacts as the hospital needs to know which is the closest BOMBA and hospital. Participant 1 stated *“Then you need to know all the emergency contacts around your facility. So you need to know where is the nearest BOMBA, where is the nearest police station, where is the nearest other hospital.”* The standards and guidelines and researchers have discussed that hospitals must have a communication plan for their facility. International standards such as NFPA 99 (2020), discussed that one of the hospital's main topics of fire prevention is Information technology and communication systems. Also, Della-Giustina (2014), stated that to achieve the goals of the program the hospital must communicate with the community fire department. NHS England (2013), found that one of the elements that must be in the action plan is alerting the fire and rescue services if needed. Agus Salim et al. (2023), found in their research one of the issues is ineffective internal and external digital communication networks

Theme 2: Firefighting System and Design

This theme has 4 codes representing. Firstly, fire alarm. This element in the plan is vital due to its role in alerting. Participant 1 stated *“If there's a fire we immediately my staff that stationed inside the fire control room will notice an alarm Yeah.”*

Passive and active firefighting system. Participant 3 explained that the first method of firefighting is through the passive system *“First by using a passive. Passive, right? Passive, yeah. We need to... We need... to make sure all the passive system in terms of the structure, in terms of building, in terms of material are not support the fire ignition.”* In addition, Participant 1 stated that there must be knowledge of the available firefighting systems within the hospital. *“The knowledge of the firefighting system available inside the hospital. you need to know also the okay the firefighting system available if it's actually the active system.”*

Special requirement for disabled. Participant 3 mentioned hospitals have special requirements for design, he stated *“Sometimes... the deaf person, the blind. They have to use, they, they, and we call it, you know, in hospital building, and one of the special requirements is a light. Lighting alarm.”*

Reduce fire load. Participant 3 stated *“In terms of the compliance to the regulation to prevent the fire ignition in hospital building so our fire load in hospital building must be reduced fire load.”* The participants have mentioned different areas of design and fire systems that are implemented in their hospitals, 2021 IBC (2020), stated that one of the requirements for hospitals is to have a fire alarm system. 2021 IFC (2020), states that a layout plan must contain Manual fire alarm boxes. In addition to that, NHS England (2013), and University of Strathclyde (2023), stated that, in the event of a fire one of the first activities is to

raise the alarm. Moving to one of the most important firefighting elements is the Passive and active firefighting systems. The participants mentioned that their hospitals have different types of fire suppression systems. The previous literature mentioned that no hospital is authorized for operation if it doesn't contain passive and active firefighting design. 2021 IBC (2020), stated that hospital facilities must have a passive design, such as Smoke barriers, Corridors must be continued and separated, and means of egress. NHS England (2013), stated that the action plan must contain the location of acceptable zones of absolute and partial safety. Bakar (2006), Fire Protection: passive and active are important in terms of reducing fire risk and hazard, also he studied the passive design, however, issues arise when these systems are neglected. Agus Salim et al. (2023), found in their research one of the issues is insufficient care of "active" fire suppression systems. Due to its functionality, hospitals have a lot of people with special needs, Participant Three stated that there must be aiding design for blind and deaf. 2021 IFC (2020), stated that the plan must have life strategy Protocols for evacuating residents, especially those who require assistance. Also, Hassanain et al. (2017), stated that the fire active system must have Emergency lighting One of the building design restrictions is the fire load in the hospital, The UBBL of 1984, mandates that all buildings construction materials must possess the required level of fire resistance. Also, 2021 IFC (2020), provided data on the Interior finish material and furnish. Agus Salim et al. (2023), found in their research that Combustible materials and electrical problems were found to be the primary causes of fire.

Theme 3: Immediate Action and Activation

This theme represents the actual action done when a fire occurs. It has 5 codes.

Immediate notification of fire through the fire alarm. This code represents having stationed staff watching if any alarm is activated. Participant 1 stated that "We need that if there's a fire, there's a fire We immediately my staff that stationed inside the fire control room will notice an alarm."

Hospital staff are the first to respond. Participant 1 stated "*So we are the first respond.*"

In addition to that, participant 3 stated "The staff need to have proper knowledge. If they have to also help."

Determining major and minor disasters. Participant 1 stated "*What is the criteria of major disaster? What is the criteria of minor disaster? how are you gonna plan?*"

Activating the evacuation plan. Participant 3 stated "*Yeah, it's evacuation. Okay, they need to focus on evacuation. Okay. Action Plan is about evacuation.*"

Confinement and compartment. Participant 3 focused on the confinement part. He stated "*Confine. You confine the compartment. You close*

the door. You close everything to confine the fire.” The participants have mentioned different actions, researchers have highly focused on alerting the hospital as fast as possible. NHS England (2013) and University of Strathclyde (2023), stated that In the event of a fire one of the first activities is to raise the alarm. Following the actions of the staff, participants one and three stated that the staff are the first line of defence against fire, Della-Giustina (2014), stated that the fire program must prepare staff members for activity in an emergency. 2021 IFC (2020), states that a description of particular staff activities such as the steps for a defend-and place tactic. In addition. When alerting the hospital, the staff must be able to recognize the severity of the incident, Della-Giustina (2014), stated that a well-thought-out emergency plan can make the difference between minor incidents turning into major ones. On the other hand, Ong and Suleiman (2015a), found one of the errors and issues found in these fire incidents Ineffective post-fire disaster management. In addition. After all the actions have been done from alerting to ensuring the type of emergency, the staff immediately execute the evacuation. The participant stated that the action plan revolves around the evacuation. Liu et al. (2023), stated that immediately after a fire starts in a hospital, evacuation and firefighting efforts must be made. In addition, 2021 IFC (2020), also stated that the plan must provide the exact processes for evacuating. Kodur et al. (2020), state that there must be control for those who may be subjected and their possessions to fire. However, some of the evacuation is from one ward to the others on the same floor, Kodur et al. (2020), stated that the research found compartmentation and structural integrity are the final lines of defense. Also, NHS England (2013), required that the fire safety manual have information on any compartmentation space.

Theme 4: Monitoring and Control

This theme represents actions done during the hospital's daily operation.

Staff are always stationed in the fire control room. Participant 1 stated “If there's a fire, my staff that stationed inside the fire control room.” Rahardjo and Prihanton (2020), stated that to ensure that the facility is always operational there must be sufficient supervision performed, also, Nugroho et al. (2020), stated that fire safety management must have monitoring of the fire safety systems and reactive monitoring.

Theme 5: Planning and Roles

Hospital roles and plans must be clear and determined in advance.

Contingency plan. Participant 1 stated that his hospital considered it as a section in the emergency response plan, he stated “*you will have your contingency plan.*”

Emergency response plan. Participant 1 stated *“The highest level is emergency response plan. This is the structure that we read here. So this plan is actually the entire plan for everything.”*

Emergency response team. Participant 3 stated *“Emergency response team actually has one team will activate if any happen disaster in hospital.”* To have an effective action plan there must be clear roles and plans established in the hospital. According to the University of Edinburgh (2023), the fire action plan must cover certain topics, one of them being the Contingency plan in case any system fails. Moving to the emergency response plan, this plan represents the structure of fire response. NHS England (2013), stated that the plan must contain the quick dispatch of the Fire Response Unit. Also, participants mentioned the emergency response team. NHS England (2013), stated that the fire structure must have a fire response team.

Theme 6: Training and Awareness

The hospital staff must be aware of the action they must apply. Having awareness and training. Participant 4 stated *“So we have OKK, so we have awareness, two times we do the tabletop, we do the fire drill. So, all the staff must know.”* Standards and old research focused on the role of training in providing better responses when a fire occurs. Senin et al. (2022), stated that the absence of knowledge of space design arrangement, inadequate experience in training, and fire safety, and a shortage of understanding of facility fire safety all contribute to delays in responding to fires. Also, Agus Salim et al. (2023), found that one of the obstacles is insufficient training for staff. Therefore, Della-Giustina (2014), stated in his book that there should be proper Instruction and training for all personnel. Also, NHS England (2013), stated that fire safety management must guarantee a proper fire safety training. Moreover, Abhishek Shastri et al. (2018), found one of the management assessment tools for health and safety is utilizing education and training to raise knowledge of fire safety and emergencies. Ebenehi et al. (2017), stated that to prevent fire-related damage, various actions must be taken, such as teaching staff, and practicing fire drills. Ong and Suleiman (2015b), stated that one of the fire safety management activities is the fire drills. NHS England (2013), stated that all fire action plans must be routinely practiced, whether through table workouts, walkthroughs, fire drills, or other suitable methods.

Fire Action Plan Checklist

The participant responses provide 5 themes.

Theme 1: Complying With Hospital Design and Regulation Standards

This theme represents all the spaces and designs for fire safety.

Fire certificate and compliance schedule. In Malaysia, the hospitals must annually renew their fire certificate, Participant 1 stated *“In Malaysia, you need to renew your fire certificate every year.”*

Escape back lift. Participant 3 stated *“They have what we call an escape backlift. Others building they don't have except in hospital building.”*

HIRARC. Participant 1 stated *“HIRARC is more about risk assessment.”*

Refuge area. Participant 3 stated *“In hospital, they have a refuge area.”*

Layout plan with details. Participant 4 stated *“The layout plan. So all the walls or the surfaces make a layout plan. Where do you want to go if fire happen?”*

Mimic diagram. Participant 3 stated *“And mimic diagram. You need to have mimic diagram. Where the fire exit, where the fire protection system, the mimic diagram in hospitals, it's very important.”*

Panic button with exact fire location. Participant 4 stated *“Okay, so one button to activate the committee. So we have a specific button to activate.”*

Alarms with lighting for disabled people. As a requirement, Participant 3 stated *“Because the people, if they have any disability, they can't hear it. They can't hear the sound. They just see it. Yeah, you just see the lighting.”*

Compartment. Related to the design of the hospital, participant 3 stated *“You confine the compartment. You close the door. You close everything to confine the fire.”*

Fire reset door. Participant 4 stated *“The fire-reset door. All the fire-reset doors must close so to protect the people.”*

Smoke ventilation design. Participant 3 stated *“For example in hospital ward, they need to ventilate the smoke.”*

Reduce fire load. Participant 3 stated *“So our fire load in hospital building must be reduced fire load, the load must be non-combustible.”*

The escape path is wide and clear. Participant 4 stated *“The corridor. All the corridors must be free. From the any blockage.”* Regarding complying with design and structure, this theme has various components, Bakar (2006), found that passive fire protection is important in reducing fire risk. Also, research found compartmentation and structural integrity are the final lines of defence (Kodur et al., 2020). NHS England (2013), required that the fire safety manual have information on any compartmentation space. This is in line with Participant 3 statement that hospitals having compartmentation. Other hospital designs are related to the spaces that protect the patients during incidents as stated by participants 1 and 3, such as fire lifts, refuge areas, and reducing fire load. The University of Edinburgh (2023), stated that the fire plan must contain Temporary refuge areas and Lifts, also mentioned by Bakar (2006), the active fire protection systems consist of having a fire lift. The UBBL of 1984, mandates that all

buildings possess a minimal level of structural integrity. When it comes to compliance with regulations and standards the participant mentioned it with high importance. Hamida & Hassanain (2019), stated that being aware of the fire systems to evaluate and sustain the full compliance of the buildings to the standards. Della-Giustina (2014), stated that the fire safety management program must ensure compliance with regulations. Participants One and Two mentioned that it is recommended to share plans with the local authorities. Abhishek Shastri et al. (2018), stated that hospital administration must conceive and regularly enforce operational criteria and must never diverge from safety regulations outlined by authorities. Also, Participants One and Three mentioned that all their training and activity are documented for future reference. NHS England (2013), requires a manual that has documentation of fire action plan practice. Moreover, Ong and Suleiman (2015b), found one of the issues that hospitals face are related to documentation. Ensuring the proper functionality of the hospital fire systems. Nugroho et al. (2022), stated that all used equipment should also undergo routine maintenance. However, Agus Salim et al. (2023), found that Malaysian public hospital accidents are due to lacking maintenance plans, receiving poor maintenance, and inadequate fire safety equipment maintenance.

Theme 2: Continuity of Operation

Hospital facilities are very different from any other facility when it comes to fire safety, the continuity of the hospital operation of providing care is vital. Participant 1 stated *“If you lost your emergency department today, you need to have your backup plan. You always have a continuous plan.”* In addition, participant 4 mentioned that his hospital has a continuity plan *“So we must send patients to the nearest hospital. Let’s say a fire happen in level two the nearest hospital we send patients to the Hospital Putrajaya.”* The standards have discussed this area as a part of the fire protocol, NHS England (2013), stated that the fire protocol must have a plan for continuity of care. Moreover, Della-Giustina (2014), states that resources both internal and external are ascertained for business continuity.

Theme 3: Defined Roles and Responsibilities

Participant 4 mentioned that the roles safety are not limited to the fire safety staff *“So maybe we can add on the security guard. The security guard must work.”* Participant 1 stated *“We do have a... so called procedure for every people inside the ERT team, they know what to do, and they train for it.”* According to 2021 IFC. (2020), stated that the plan must provide the exact processes for evacuating patients. NHS England (2013), stated that the staff must know the required actions, such as sounding the alarm. The Centers for Disease Control and Prevention (2023), developed a fire emergency plan where each floor has a monitor whose tasks are to verify that every individual has left. The traffic

controller mentioned by Kodur et al. (2020), states that there must be control for those who may be subjected and their possessions to fire.

Theme 4: Fire Training

Participant 1 stated “*Meaning that in a year you need to have a fire training how many times a fire training we also have a schedule to do the fire evacuation so it's a thing that we schedule early of the year throughout the year.*” This topic must be checked and confirmed that the hospital staff undergo training. Ebenehi et al. (2017), stated that to prevent fire-related damage, various actions must be taken, such as teaching staff, and practicing fire drills. Ong and Suleiman (2015b), stated that one of the fire safety management activities is the fire drills.

Theme 5: Inspection and Maintenance of the Hospital System

This theme focuses on the maintenance and inspection of these spaces also other materials. This theme has 5 codes. Firstly, kitchen engineering system inspection. Participant 2 stated “*kitchen engineering system must be inspected.*” Secondly, electric system inspection. Various reports mentioned the most common cause of fire is the faulty electric system, participant 2 stated it as one of the most important checked elements “*electrical system inspection.*” Thirdly, hazardous materials and special equipment inspection. Due to the nature of the operation, hospitals become more prone to fire incidents, participant 2 stated “*hazardous materials inspection.*” Fourthly, inspections of fire systems and maintenance. Participant 2 stated “*Yes, based on fire safety checklist in term of checking on fire active and passive system.*” Fifthly, medical gases inspection. Participant 2 stated that through his inspections of the hospitals, the medical gases are always on the inspection checklist “*The medical gas inspection.*” According to DellaGiustina (2014), stated that every kitchen must have a Class K fire extinguisher. Regarding the electrical systems, NFPA 99 (2020), discussed in depth one of the main topics in fire protection is the electrical systems and equipment. Also, DellaGiustina (2014), stated that there must be a Class C fire extinguisher for electrical systems and equipment. Moving to hazardous materials, the literature has rated hospital buildings as high-risk buildings due to containing hazardous materials, various researchers have stated that one of the most common issues creating fire is related to hazardous materials, Abhishek Shastri et al. (2018), Agus Salim et al. (2023), and Ong and Suleiman (2015a) stated that one of the causes of fire occurrences is related to materials. Finally, regarding medical gas inspection, several standards have considered this topic, Sahebi et al. (2021), stated that hospitals are facilities under fire risk due to medical gases and combustible chemicals, therefore, NHS England (2013), stated the hospital's fire protocol must address various issues, such as medical gases.

CONCLUSION

This research aims to find a method to minimize the fire incident outcome, by studying the fire safety of hospitals, and by coming up with a checklist for the components that could help in this matter. The research has contributed to the topic of hospital fire safety using a qualitative research method by using open-ended interview questions. This study helped in developing a fire action plan checklist, also providing data on the components of fire action plan for hospitals. The findings of this study can provide the concerned parties with this topic of having comprehensive data on fire action plan.

The objective to investigate the fire action plan components, two methods have been used, collecting data from previous research and standards and conducting interviews with fire safety specialists. The outcome of the data collected from the interviews and the analysis chapter of the data taken from the interviews provided us with six themes for the fire action plan such as (1) communication (2) firefighting systems and design (3) immediate actions and activation (4) monitoring and control (5) planning and roles (6) training and awareness.

The other objective is to develop a checklist that can be implemented in hospitals, which ensures the fire action plan is efficient in case of fire events. The checklist has been developed from the respondents' answers in addition to data from the literature. The main themes in the checklist are (1) complying with hospital design and regulation standards (2) continuity of operation (3) defined roles and responsibilities (4) fire training (5) inspection and maintenance of the hospital. See Figure 1 for the developed checklist.

Criteria		Response		
		Yes	No	Comment
Complying With Hospital Design And Regulation Standards	Fire certificate and compliance schedule			
	Escape back lift.			
	Having HIRARC			
	Refuge area			
	Layout plan with details			
	Mimic diagram			
	Panic button with exact fire location			
	Alarms with lighting for disabled people			
	Compartment			
	Fire reset door			
	Smoke ventilation design			
	Reduce fire load			
	The escape path is wide and clear			
	Continuity Of Operation	The continuity plan effective		
Defined Roles And Responsibilities	Firefighting team and search and rescue team.			
	Emergency manager			
	Evacuation officer.			
	Maintenance team			
	Sweeper			
	Traffic controller			
	Historian			
	Safety officer			
Fire Training	Fire drill			
	Monitoring of training			
	Staff educated on fire			
Inspection And Maintenance Of The Hospital System	Kitchen engineering system inspection			
	Electric system inspection			
	Hazardous materials and special equipment inspection			
	Inspections of fire systems and maintenance.			
	Medical gases inspection			
	Fire suppression gear is accessible			

Figure 1: Fire Action Plan Checklist

Source: Author Findings

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URBAN PARK DESIGN FOR MENTAL HEALTH RESTORATION VIA DIFFERENT AGES IN MALAYSIA

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Abstract

Mental health is commonly faced by urban dwellers due to urbanisation. Nature is therapeutic, especially for urbanites, and can help with mental health issues. However, little is known about the park characteristics in the restorative setting that could restore mental health for different ages. In order to address these limitations, the purpose of this study is to examine the association between park characteristics and mental health restoration, as well as the age differences among urban park users. Hence, the objective of this study is to analyse the preference of park characteristics for mental health restoration that interact by age moderator by urban dwellers in the urban park. This study employed a mixed method study using a survey (n=382) and semi-structured interviews (n=40) within the two urban parks in Kuala Lumpur: Perdana Botanical Park and Titiwangsa Lake Park. The result showed that the prospects dimension is a significant indicator of mental health restoration. The survey data was analysed using Partial Least Squares Structural Equation Modelling (PLS SEM) and thematic analysis for semi-structured interviews. Nevertheless, this study contains certain constraints when the statistics exhibited age bias due to the higher level of activity and responsiveness exhibited by young people towards this investigation. Notably, this finding can aid landscape architects and urban designers in enhancing the quality of life in urban areas and in planning park designs that cater to users' demands.

Keywords: Perceived Sensory Dimension, Mental health restoration, Park characteristic, Restorative environment, Urban Park

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INTRODUCTION

Rapid urbanisation is thought to have negative effects on mental health and lead to an increase in depression, anxiety disorders, and schizophrenia among urban residents (Lederbogen et al., 2011). According to the Ministry of Health Malaysia, 28.8% of urban adults in Malaysia experience mental health problems, with Kuala Lumpur having the greatest prevalence at 39.8% (Institute for Public Health, 2015; Malaysian Healthcare Performance Unit, 2017; Subramaniam, 2016). Research also indicates that 70% of urban employees encounter work-related stress, whereas 12.3% of impoverished individuals in Selangor experience depression (Dahlgren, 2006; Mallow, 2016; Tan & Yadav, 2013).

A rising number of studies have investigated how utilisation and design of the natural environment can affect the mental health and well-being of city residents in response to the escalating mental health issues in urban settings (Nejade et al., 2022; Raman et al., 2021). However, little research and documentation is describing the precise urban parks' design that enhances the efficacy and restorative experience. In addition, the Malaysian open space planning and standards (National Landscape Guidelines Edition 2 (2008) only prioritise the creation and preservation of aesthetically pleasing landscapes to enhance people's quality of life rather than focusing on mental health restoration. Planners and park designers often overlook demographic patterns, leisure choices, behaviours, and attitudes, overlooking the demands of users such as the elderly, crippled, and juveniles (Maryanti et al., 2016). Such limitation hence halts the leading to visitor dissatisfaction (Mak & Jim, 2019). Therefore, it is a challenge for city planners and landscape architects to design an urban environment that matches the public's preferences, especially in restoring stress (Peschardt & Stigsdotter, 2013; Velarde et al., 2007).

Furthermore, Xiong et al. (2020) found that mental health issues are prevalent among females, young adults, and low-income urban residents. Yet, the lack of study on this issue has created uncertainty regarding whether natural environments truly provide healing experiences for these particular groups of individuals, and which park features are significant and helpful for improving their mental well-being. Therefore, this study is to examine the association between park characteristics and mental health restoration, as well as age differences among urban park users. In correspondence, the objectives of this study are to analyse the preference of park characteristics for mental health restoration that interact with age as the moderator by urban dwellers in the urban park.

LITERATURE REVIEW

Nature as a restorative environment for urban stressors

Urbanism has been contributing to stress-related *(issues/ problems/ concerns) in urban dwellers. Demographic factors such as ethnicity, marital status, age,

gender, education level, financial constraints, presence of chronic or psychiatric illnesses, and a lack of regular exercise are substantially associated with depression among urban dwellers (Kader Maideen et al., 2014; Leong Bin Abdullah et al., 2021; Tan & Yadav, 2013). Since the city has become a widespread migration, urban policy and guidelines for open space to be accessible for people's health and well-being have been established in the urban area.

Several studies have employed different techniques to compare responses to various landscapes. People with mental fatigue find natural sites to be the most restorative rather than the built environment. Studies have introduced a preference for restorative environments among young adults to be of various types such as forests, lakesides, and blue (Du et al., 2022; Li et al., 2023). These are all idyllic places for 'getting away' to get some rest rather than in the built environment.

Even though several types of restorative environments exist, many people in urban contexts may find no option to get into those places, as argued by Kaplan, (1995). It is also hard to find forest parks in an urban area nowadays due to land degradation in the urban city. Furthermore, Hadavi et al. (2015) argue that a natural environment is often limited in urban cities. Thus, the urban park provided by the authorities is the easiest to access and the most cost-effective, whereby the urban dwellers can find physiological and psychological restoration.

Urban parks as a restorative environment

Studies have shown that many people visit the parks to find peace, a quiet environment, a place where they are able to relax and recover from stress (Chiesura, 2004; Nor Akmar & Aziz, 2012; Pálsdóttir et al., 2018). According to the study, walking in parks lowers saline cortisol levels, diastolic blood pressure, and mood disturbances compared to city areas (Abdul Aziz et al., 2021; Mokhtar et al., 2018). Other study demonstrates that visitors acknowledge the benefits of pocket parks as crucial for the well-being, enhancing both their mental and physical health (Hashim et al, 2019). The result was also consistent with a study by China which stated that urban parks relieved stress and attentional levels (Wang et al., 2016).

The study also supports that urban park positively affects stress relief even on short-term visits (Mokhtar et al., 2018). Passive interaction with the environment interacts with the settings without being heavily engaged and creates a sense of relaxation, mainly by watching people (Memari et al., 2017). Thus, the study showed that the characteristics of the restorative environment were able to relieve stress and psychological comfort.

Park characteristics relates to restoration experience

Further studies assert that park characteristics or components contributed to the restoration experience. In public open spaces, natural elements such as trees,

greenery, water features, and being away from traffic make it easier for people to relax (Villagra-Islas & Alves, 2016). These park characteristics were mostly listed in the perceived sensory dimension (PSD) model developed by Grahn and Stigsdotter, (2010) that described the attributes of the urban park environment, including nature, rich in species, refuge, prospect, social, serene, space and culture.

The study by Grahn and Stigsdotter (2010) indicated that those who had reported experiencing stress exhibited a stronger preference towards urban parks that offered a combination of natural, refuge, and spaces that are rich in species. In another study, Peschardt (2014) shows that people with an average stress level tend to have a preference for social and serene dimensions, while stressed individuals are shown to derive the highest level of restorative experience from environments that encompass elements of nature, social interactions, and serenity. Moreover, in Malaysia a study showed that PSD influences perceived restorativeness, improving the restoration experience, and correlating landscape characteristics among university students (Malekinezhad et al., 2020).

However, little research is done to determine the relationship between PSD, restorative experience in urban parks and age differences. Therefore, the aim of this study is to to examine the association between park characteristics and mental health restoration, as well as age differences among urban park users. This study suggests the following hypothesis (refer Figure 1):

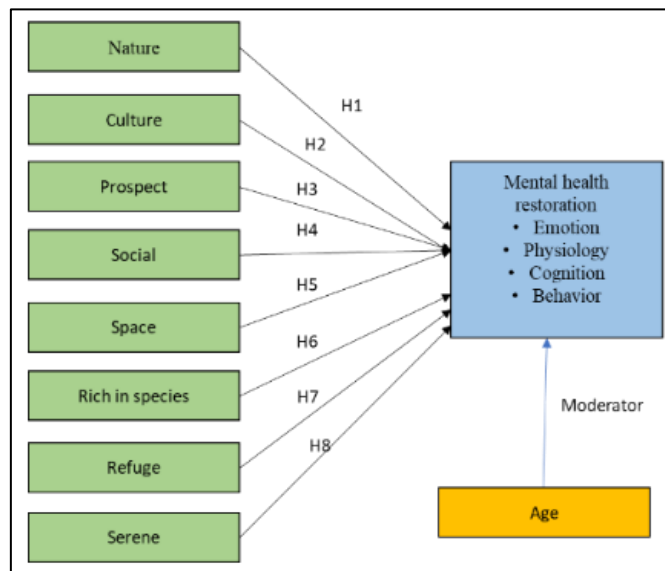


Figure. 1: Research framework of Perceived Sensory Dimensions and mental health restoration via age differences.

Source: Stigsdotter, (2010) and Han, (2003)

METHODOLOGY

The mixed method research design is primarily used in this study. Accordingly, a survey and an interview based on a case study were conducted. The data was collected sequentially on January 2021 until the end of February 2021. An adult (18 years of age or older) from Kuala Lumpur's city was chosen for this study using a simple random sampling. The G*power calculator determined a minimal sample size of 160 with a medium effect size of 0.15, power 0.95, and a +/- 5% margin of error using eight predictors for this study. To ensure accurate responses, the respondent was approached at the park's main entrance before they left.

Kuala Lumpur is one of the most densely populated states in Malaysia, according to the Department of Statistics Malaysia (2016). Hence, due to Kuala Lumpur's high population two parks have been selected for this study, they are Perdana Botanical Park (PBP) and Titiwangsa Lake Park (TLP). The selection of the case study was based on its adherence to the size criteria outlined in the Department of Town and Planning Malaysia's (2011) hierarchy of open space, which recommends urban parks to be between 40 and 100 hectares. According to Grahn and Stigsdotter (2010), larger urban spaces were chosen to showcase more park characters. Additionally, the urban park needs to fall within Kuala Lumpur City Hall's purview in order to receive the same care and maintenance.

A survey questionnaire was employed to ascertain the PSDs' preferences for mental health restoration. The questionnaire was divided into five components. Correspondingly, the findings of this study were limited to three areas: (1) respondent profile, which includes the respondent's age disparities; (2) preferences of the perceived sensory dimension, which addresses the eight PSD aspects with 48 items that are adopted from Grahn and Stigsdotter, (2010); and (3) mental health restoration of park visitors that is adopted from Han, (2018). Partial Least Square Equation Modelling (PLS-SEM) was utilised in this study to analyse the PSDs effect on mental health restoration via the age difference.

In this study, a semi-structured interview methodology was employed to comprehensively elicit the perspectives of park users regarding several aspects that were related to their engagement at the urban park. The interview question is (Q1) "Can you describe the park characteristics that you find restorative in this urban park?" Participants' responses were facilitated by a list of park characteristics probes, which included "wild and natural" (Nature), "quiet and peaceful" (Serene), "prospective" (Prospect), "safe and enclosed" (Refuge), "social" (Social), "feeling of spaciousness and freedom" (Space), "cultural" (Culture), and "rich in species" (animal and plant diversity). In contrast, restorative encompassed mood, focus, behaviour, and physiology.

The interview data were analysed using thematic analysis by employing Saldana's (2013) thematic coding methodology. The interviews transcription was

coding with the PSDs dimension (Nature, Serene, Culture, Social, Rich in Species, Prospect, Refuge, and Space).

RESULT AND DISCUSSION

Initially, 400 park visitors volunteered to complete the survey and 40 visitors volunteered to be interviewed. However, 18 questions were disqualified following the screening procedure since their responses were not completed.

Table 1. Demographic results of the urban park users

Variable	Item		Perdana Botanical n (%)	Titiwangsa Lake n (%)	Total n (%)
Age	Young adult	18- 25 years	135 (60.8)	67 (41.9)	202 (52.9)
		26 - 30 years	30 (13.5)	44 (27.5)	74 (19.4)
		31 - 35 years	20 (9)	23 (14.4)	43 (11.3)
	Middle adult	36 - 40 years	6 (2.7)	14 (8.8)	20 (5.2)
		41 - 45 years	9 (4.1)	8 (5.0)	17 (4.5)
		46 - 50 years	3 (1.4)	3 (1.9)	6 (1.6)
	Older adult	51 - 55 years	2 (0.9)	0	2 (0.5)
		56 - 60 years	8 (3.6)	1 (0.6)	9 (2.4)
		61 - 65 years	6 (2.7)	0	6 (1.6)
		66 - 70 years	1 (0.5)	0	1 (0.3)
	70 years above	2 (0.9)	0	2 (0.5)	

The results in Table 2 reveal that the interaction is not supported for Culture, Nature, Refuge, Social, Rich in Species, Space, and Serene; the exception being Prospect ($\beta = -0.574$, $t=1.879$, $p = 0.060$). Thus, Table 2 shows that age is a significant moderator to the relationship between preference of park characteristics and mental health restoration.

Later, the results were explored using the simple slope analysis. Figure 2 shows that the mental health restoration is higher for young adults at higher Prospect. In contrast, plotting shows that higher prospect has resulted in lower mental health restoration for older adults. This indicates a significant negative relationship ($\beta = -0.376$) between rich in species and mental health restoration that is moderated by the age difference.

Table 2. Relationship Between the Preference of Park Characteristics and Restorative Experience with Age as Moderator

Relationship	Std beta	Std error	t value	pValues	Decision	R ²	f ²
age*na -> MHR	-0.352	0.361	0.975	0.330	Not support	0.255	0.003
age*cl -> MHR	0.331	0.391	0.846	0.398	Not support		0.002
age*ps -> MHR	-0.574	0.306	1.879	0.060	Support		0.015
age*sc -> MHR	-0.160	0.428	0.374	0.709	Not support		0.000
age*sp -> MHR	0.405	0.515	0.786	0.432	Not support		0.003
age*ric -> MHR	0.043	0.242	0.179	0.858	Not support		0.000
age*re -> MHR	-0.149	0.449	0.333	0.739	Not support		0.000
age*se -> MHR	-0.081	0.285	0.284	0.776	Not support		0.000

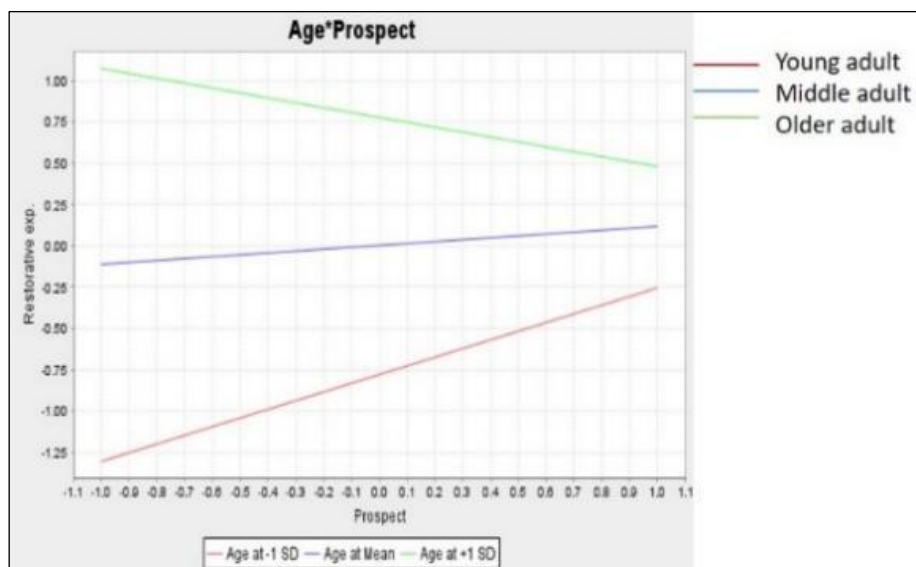


Figure 2. Plotting Graph for Age Difference

One possible interpretation for young adults, related to the prospect dimension and mental health restoration, was to have a vista over the surroundings. Several young adults felt a sense of release from work stress; they

felt more positive vibes and were energetic, relaxed, and happy after doing physical activities on the open and flat surface of the urban park:

I prefer to come to this park because the outdoor environment has more fresh air than the indoor gym. I feel happy, healthy and release my work stress after doing high-intensity training and Tabata here. The flat pavement looks functional and safe for me to do high-intensity training and Tabata workout activities. (Interviewee 1, 27 years old, PBP)

I usually work out here because the place is prominent, surrounded by nature and not crowded with people. This place preferred me to come here to do activities and release my stress. (Interviewee 10, 23 years old, PBP)

After running, I will do a fitness test or play badminton at the Astaka. I feel fresh, positive for the whole day, relaxed and happy after doing those activities. (Interviewee 28, 30 years old, TLP)

A group interview among younger adults in TLP also found that they preferred to sit on the grass under shaded trees or at or at sheltered places after jogging and running to relax and chat (social activity). As they were still students, they met at the urban park to relax, clear their thoughts, and refresh themselves, even if they were tired:

We usually jog, run or play football on the field. After that, we sat on the grass lawn under shaded trees or at the Astaka with shaded roofs. We can chat since this is the only time to meet up because most are busy studying at different universities. Meeting up, doing activities, and chatting together makes us feel happy and fresh, although we are sweating and tired. We don't think any problems, feel relaxed, happy and fresh. (Interviewee 33, group of young adults, 22 years old, TLP)

The grassy surface also provides a space for young adults to socialise and hold picnic activities. A group of young adults did mention that the grass lawn under the shaded trees and near the toilet facilities is their favourite place to sit for picnic activities:

Our usual picnic activity was at the open lawn, under the shady tree and near the public toilet. It's easy for us to go to the toilet. I feel happy and energized after doing the activity, the natural setting, and the fresh air in this park. (Interviewee 5, group of young adults, 23 years old, PBP)

The result contrasted with that of a middle-aged adult who felt relieved from stress whenever he watched his children playing freely and fearlessly on the grassy field and have vista over the surrounding area:

My job is an indefinite time since I am self-employed. I always feel tired and stressed. So, I'll bring my family to the park when I have time. I can see my children do anything they want and move freely without obstruction on this lawn. I prefer the lawn because it is spacious and free. It is also next to the playground and has many shaded trees. I feel released and very calm (Interviewee 22, middle adult, 38 years old, TLP)

For another interviewee, engaging in a physical activity on the grassy lawn in the urban park while socialising with family members brings mental health benefits:

My favourite place is an open space or lawn where I can play badminton with my family. I feel healthier, fit and released from stress at the same time. I can see and enjoy the natural scenery and fresh air. (Interviewee 9, middle adult, 39 years old, PBP)

For older adults, a prospect is unnecessary since they are mainly motivated to come to the park for walks and to enjoy nature:

I came here just brisk walking, taking pictures of nature, and socialising with my friends. (Interviewee 4, older adult, 63 years old, PBP)

I just do fast walking for exercise under the shaded walkway. While walking, I can stop to take a picture of nature. (Interviewee 6, older adult, 63 years old, PBP)

This study has discovered that age difference influences the relationship between preference for park characteristics and restoration experience. For young and middle-aged individuals, the prospect dimension is the most significant predictor for mental health restoration. Thus, most of them prefer the open space such as a lawn or pavement that has been provided with safety to carry out their activities. A study has demonstrated that youths are most likely to visit the park for sports, to walk or to ride their bicycles if the facilities and amenities are present (Zainol & Au-Yong, 2016). Hence, a place with facilities and amenities for them to participate in sports and physical activities, and for socialising, safety is essential in the design of a restorative urban park.

The interview results further reveal that young adults are more psychologically restored when they are carrying out physical activities and

socialising with their friends. Among the preferred activities include picnic, yoga, Tabata, badminton, or high-intensity training on a flat and spacious pavement or lawn. They have also mentioned that holding activities together with friends is related to the restoration experience as they can appreciate nature while carrying out the activity. This result had been predicted since the study Malaysians enjoy social and physical activity in neighbourhood parks (Malek & Nashar, 2018). Areas with grassy surface are needed for them to do sports and physical activities as well as to socialise with each other safely (Kim & Jin, 2018). These physical activities can restore the younger adults' mental health (Ashish Sharma et al., 2006).

Middle-aged adults restored their mental health when they carried out physical activities and socialised with their family members. They also prefer activities such as cycling, jogging, badminton, and bringing their children to play on the lawn. As mentioned by several older adults in the interview, the prospect dimension is insignificant for them since they usually do lower impact activities such as walking within the natural setting of the urban parks for their mental health restoration. Correspondingly, many studies have proven the restorative experience of adults' walking in green spaces (Coventry et al., 2019; Li et al., 2019; Zuniga-Teran et al., 2019).

This finding is expected since Twedt et al. (2019) have mentioned that an exciting social setting might be potentially restorative for young adults compared to older people who love a quiet environment. This also supported by the findings that a lower rate of mental illness is predicted for city dwellers who regularly use green places for physical activities and relaxation rather than the gym or the streets. However, the results from this research appeared to contradict with previous studies where young adults were reported to have perceived lower restoration potential in the urban park during their visit, as studied by White et al. (2013) and Berto (2007).

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ETHICAL STATEMENT

This research is dedicated to upholding the greatest ethical standards, assuring respect, fairness, and responsibility throughout the project. Approval to undertake this research has been granted by the Landscape and Recreation Development Department of the Kuala Lumpur City Hall. Consent was individually acquired from those who participated. This was accomplished by engaging and interviewing potential participants chosen among urban park users, who were subsequently informed about the research objectives. They were advised that their participation was voluntary, that their personal contact information would be protected, and that they could withdraw from the study at any time. The

research findings also ensure integrity, honesty, transparency, and the absence of manipulation or bias.

CONCLUSION

This study explores the link between park characteristics and mental health restoration, as well as age differences among urban park users. Findings discovered that young and middle-aged adults were more likely to perceive mental health restoration in the prospect dimension. Therefore, the findings of this research that may contribute to the design of future urban park development that is inviting and desirable to all users, especially for physiological and psychological restoration.

However, this study has several limitations that could be investigated in greater depth in future research. The data were biased according to age. This was because young adults were more active and willing to respond to this research. A future study should examine the topic from the perspective of adolescents since this study is restricted to assessing adult preferences.

The findings of this research have significant implications for the implementation of landscape architecture and urban design in urban parks. Additionally, these results could be beneficial for parks and public spaces with similar characteristics in other Malaysian cities or nations with comparable circumstances.

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